AL-FARABI KAZAKH NATIONAL UNIVERSITY

INFORMATION
about publication activity
FACULTY OF INFORMATION TECHNOLOGY

№	Наименование публикации	Выходные данные (doi статьи)	Аннотация статьи	Ссылка для цитирования (Ф.И.О., название статьи, название, номер и/или выпуск, том журнала, страницы, doi статьи)
1.	Intelligent System for Assessing the Socio-economic Situation in the Region	doi.org/10.1007/978-3-030-88113-9_35	This article analyzes the problems of monitoring and managing the socio-economic situation. The analysis of the socio-economic situation involves the determination of the quantitative characteristics of the dynamic series, the trend of growth, decline or stabilization, the identification of causal factors, in specific territories and for different groups. The criterion of fuzzy controllability was obtained to solve the problem of forecasting and controlling the socio-economic situation. A mathematical model and algorithm for solving the task of monitoring and managing the socio-economic situation based on interval mathematics and their software implementation are described. The social effect will be expressed in improving the safety of people's lives. As a result, it will be possible to carry out preventive measures in the necessary territories.	Jomartova S., Mazakov T., Mukhaev D., Mazakova A., Tolegen G. (2021) Intelligent System for Assessing the Socio-economic Situation in the Region. In: Wojtkiewicz K., Treur J., Pimenidis E., Maleszka M. (eds) Advances in Computational Collective Intelligence. ICCCI 2021. Communications in Computer and Information Science, vol 1463. Springer, Cham. https://doi.org/10.1007/978-3-030-88113-9_35
2.	The stability interval of the set of linear system	DOI: 10.24425/ijet.2021.135958	The article considers the problem of stability of interval-defined linear systems based on the Hurwitz and LienardShipar interval criteria. Krylov, Leverier, and LeverierDanilevsky algorithms are implemented for automated construction and analysis of the interval	Talgat Mazakov, Waldemar Wójcik, Sholpan Jomartova, Nurgul Karymsakova, Gulzat Ziyatbekova, and Aisulu Tursynbai

			characteristic polynomial. The interval mathematics library was used while developing the software. The stability of the dynamic system described by linear ordinary differential equations is determined and based on the properties of the eigenvalues of the interval characteristic polynomial. On the basis of numerical calculations, the authors compare several methods of constructing the characteristic polynomial. The developed software that implements the introduced interval arithmetic operations can be used in the study of dynamic properties of automatic control systems, energy, economic and other non-linear systems.	The Stability Interval of the Set of Linear System INTL JOURNAL OF ELECTRONICS AND TELECOMMUNICATIONS, 2021, VOL. 67, NO. 2, PP. 155-161 Manuscript received August 17, 2020; revised April, 2021 DOI: 10.24425/ijet.2021.135958
3.	Mathematical modeling forecasting of consequences of damage breakthrough	DOI 10.32014/2020.2518-170X.111	The article is devoted to the development of a mathematical model for preventing a breakthrough of a dam and predict its possible consequences. In this work, the task of developing a single integrated approach to ensuring the safe operation of hydraulic structures, based on the notification of interested bodies in real time, was solved. A mathematical model of the state of the reservoir is developed, on the basis of which a hardware-software complex for operational notification of interested organizations (akimats) and local emergency departments is implemented. A mathematical model of predicting the consequences of a dam break is proposed. An algorithm for calculating the maximum level of the breakout wave has been formulated, taking into account many parameters of the hydraulic structures. The convergence of the developed algorithm in the form of a theorem has been proved. This method has a large practical focus, compared with existing formulas. The Java language implements a hardware-software complex (PAC) for predicting the effects of a dam break, consisting of the following modules: 1) a module for receiving and transmitting current information about the water level, humidity and temperature on the crest of the dam; 2) a module for processing constant and operational information about the threat of dam breakthrough (server); 3) a module for predicting the effects of a dam break. Based on the solution of the model problem, the effectiveness of the developed hardware-software complex is shown. The practical basis for the model task was the events that took place in Kyzylagash village of Almaty region of the Republic of Kazakhstan. © National	T. Zh. Mazakov, P. Kisala, Sh. A. Jomartova, G. Z. Ziyatbekova, N. T. Karymsakova MATHEMATICAL MODELING FORECASTING OF CONSEQUENCES OF DAMAGE BREAKTHROUGH N E W S OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN SERIES OF GEOLOGY AND TECHNICAL SCIENCES ISSN 2224-5278 Volume 5, Number 443 (2020), 116 – 124 https://doi.org/10.32014/2020.2518-170X.111

			Academy of Sciences of the Republic of Kazakhstan, 2020.	
4.	Automated system for monitoring the threat of waterworks breakout		The article is devoted to the creation of an automated system for monitoring the water level in reservoirs to prevent the breakthrough of weirs and dams. The paper offers hardware and software for monitoring the reservoir occupancy with prompt notification of interested organizations (local administrations) and local emergency departments. The article developed an automated system for monitoring the water level in a reservoir, which allows to get real-time information about the relative humidity and air temperature, the distance from the dam crest to the water surface in the reservoir. Based on the information received, the system allows to estimate the forecast time of increasing the volume of water level from the current to the critical level and inform the population about the state of the reservoir.	Mazakov T., Jomartova S., Ziyatbekova G., Aliaskar M. Automated system for monitoring the threat of waterworks breakout Journal of Theoretical and Applied Information Technology 98, 15, PP 3176 - 3189 August 2020
5.	METHODS of EXTRACTING ELECTROCARDIOGRAMS from ELECTRONIC SIGNALS and IMAGES in the PYTHON ENVIRONMENT	DOI 10.29354/diag/126398	High-quality signal processing of an electrocardiogram (ECG) is an urgent problem in present day diagnostics for revealing dangerous signs of cardiovascular diseases and arrhythmias in patients. The used methods and programs of signal analysis and classification work with the arrays of points for mathematical modeling that must be extracted from an image or recording of an electrocardiogram. The aim of this work is developing a method of extracting images of ECG signals into a one-dimensional array. An algorithm is proposed based on sequential color processing operations and improving the image quality, masking and building a one-dimensional array of points using Python tools and libraries with open access. The results of testing samples from the ECG database and comparing images before and after processing show that the signal extraction accuracy is approximately 95 %. In addition, the presented application design is simple and easy to use. The proposed program for analyzing and processing the ECG data has a great potential in the future for the development of more complex software applications for automatic analyzing the data and determining arrhythmias or other pathologies.	Zholmagambetova, Bakhytgul, Talgat Mazakov, Sholpan Jomartova, Adilzhan Izat, and Olzhas Bibalayev. "Methods of extracting electrocardiograms from electronic signals and images in the Python environment". Diagnostyka 21 no. 3 (2020): 95-101. doi:10.29354/diag/126398.
6.	The image	DOI	The article discusses image processing algorithms for biometric	T. Zh. Mazakov, Sh. A. Jomartova, T.

	processing algorithms for biometric identification by fingerprints	10.32014/2020.2518-170X.2	fingerprint identification. The identification features of the structure of papillary patterns on the fingers have been studied taking into account the fact that different pressure, speed, direction, ambient temperature and humidity level lead to different images. Due to various digital image processing and analysis algorithms such as: the SIFT descriptor, as well as the closest competitor, the SURF descriptor, it is possible to quickly obtain unique characteristics for each image. This study used a database of photographs obtained from open sources – the Fingerprint Verification Competition 2004 (FVC2004). As a result of the work, the graphic image of the matching key points, as well as the number of matched key points by fingerprints, have been investigated. Search key points is performed using the Hesse matrix. The determinant of the Hesse matrix (Hessian) reaches the extremum at the points of maximum variation of the brightness gradient. Fingerprints were obtained using the optical sensor "Cross Match V300". The experimental study showed that the developed software system has invariance to image rotations. © 2020, National Academy of Sciences of the Republic of Kazakhstan.	S. Shormanov , G. Z. Ziyatbekova, B. S. Amirkhanov, P. Kisala The image processing algorithms for biometric identification by fingerprints N E W S OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN SERIES OF GEOLOGY AND TECHNICAL SCIENCES Volume 1, Number 439 (2020), 14 – 22 https://doi.org/10.32014/2020.2518-170X.2
7.	Integrable and non-integrable Lotka-Volterra systems	https://doi.org/10.1016/j.physleta.2021.127360	In a recent paper [1], completely integrable cases were discovered of the Lotka Volterra Hamiltonian (LVH) system without linear terms, [Formula presented], aij=−aji, satisfying the condition H=∑i=1nxi=h=const. In this paper, we first generalize this system to one that includes an arbitrary set of linear terms that preserve the Hamiltonian integral. We thus discover a wide class of LVH systems which we claim to be integrable, since their equations possess the Painlevé property, i.e. their solutions have only poles as movable singularities in the complex t-plane. Next, we focus on the case n=3 and vary some of the parameters, including additional nonlinearities to look for nonintegrable extensions with interesting dynamical properties. Our results suggest that, in this class of systems, non - integrability generally yields simple dynamics far removed from the type of complexity one expects from non - integrable 3 - dimensional nonlinear systems.	Bountis T., Zhunussova Zh., Dosmagulova K., Kanellopoulos G. Physics Letters A – 2021. – (402), 127360; IF 2,278, Scopus
8.	Oscillation Criteria	https://doi.org/10.1	Consider the first-order linear delay differential equation(1)where	Stavroulakis I.P., Zhunussova Zh.

	for Delay Equations with Several Non-monotone Arguments	016/j.amc.2013.10.041	$p,\tau\in C([t0,\infty),R+)$, $\tau(t)<t$ for $t\geqslant t0$ and $\lim t\to\infty\tau(t)=\infty$, and the (discrete analogue) difference equation(1′)where Δ denotes the forward difference operator $\Delta x(n)=x(n+1)-x(n),p(n)$ is a sequence of nonnegative real numbers and $\tau(n)$ is a sequence of integers such that $\tau(n)\leqslant n-1$ for all $n\geqslant 0$ and $\lim n\to\infty\tau(n)=\infty$. The state-of-the-art on the oscillation of all solutions to these equations are established especially in the case of non-monotone arguments. Examples illustrating the results are given.	Zhunussova L., Dosmagulova K. Nonlinear Dynamics and Systems Theory, – 2020. – Vol. 1. - № 1. – P. 107-118. SJR=0.388, Q3. https://www.e-ndst.kiev.ua/v20n1.htm Scopus
9.	Heat and Energy Consumption Management of a Public Object	doi:10.18576/amis/150107	The present paper addresses the effects of market and seasonal changes in the cost of heat and energy resources on the financial self-sufficiency of a public object. As an example, we take a college, the most important link in educational institutions of Kazakhstan. Computer experiments in the MathCad 15 and MatLab 6.5 environments substantiate the need to calculate the share of an energy-saving budgetary compensator, the adjustments of which will reduce the loss of unplanned funds during the period of sharp seasonal cold snaps and achieve the financial stability of the management object - the college. The calculated data allow it possible to predict the amplitude-frequency characteristics of the control signal for smoothing jumps and disturbances in the adaptive control system at the optimal time. This allows to ultimately save college money and spend part of it on additional financial support for the educational process and increase teachers' salaries. The results showed that the introduction of resource saving technologies (heat, electricity, utilities, staff) contributed to the sustainable development of the institution.	Ixanov S.Sh., Zhunussova Zh. Nikulin V.V., Zhunussov K.Kh. Applied Mathematics and Information Sciences, 15(2021), no.1, p.53-58, Q3, SJR 0.23, Impact Factor: 0.94, Scopus
10.	Optimal random packing of spheres and extremal effective conductivity	https://doi.org/10.3390/sym13061063	A close relation between the optimal packing of spheres in Rd and minimal energy E (effective conductivity) of composites with ideally conducting spherical inclusions is established. The location of inclusions of the optimal-design problem yields the optimal packing of inclusions. The geometrical-packing and physical-	Mityushev, V., Zhunussova, Z. Symmetry, 2021, 13(6), 1063 Symmetry Том 13, Выпуск 6June 2021 Номер статьи 1063 https://doi.org/10.3390/sym13061063

			conductivity problems are stated in a periodic toroidal d-dimensional space with an arbitrarily fixed number n of nonoverlapping spheres per periodicity cell. Energy E depends on Voronoi tessellation (Delaunay graph) associated with the centers of spheres ak (k = 1, 2, …, n). All Delaunay graphs are divided into classes of isomorphic periodic graphs. For any fixed n, the number of such classes is finite. Energy E is estimated in the framework of structural approximations and reduced to the study of an elementary function of n variables. The minimum of E over locations of spheres is attained at the optimal packing within a fixed class of graphs. The optimal-packing location is unique within a fixed class up to translations and can be found from linear algebraic equations. Such an approach is useful for random optimal packing where an initial location of balls is randomly chosen; hence, a class of graphs is fixed and can dynamically change following prescribed packing rules. A finite algorithm for any fixed n is constructed to determine the optimal random packing of spheres in Rd .	
11.	Temperature studies of optical absorption edge in (Ag2S)x(As2S3)1-x(x<0.2) superionic glasses	https://doi.org/10.1117/12.2580494	Synthesis of (Ag2S)x(As2S3)1-x superionic glasses for x<0.2 are carried out. The spectrometric studies of optical absorption edge in (Ag2S)x(As2S3)1-x glasses are performed in the temperature range 77-390 K. Optical absorption edge of (Ag2S)x(As2S3)1-x glasses with addition of Ag2S is strongly smeared and has an exponential shape.The influence of temperature and composition on the absorption edge behavior, parameters of optical absorption edge and electronphonon interaction as well as ordering-disordering processes in (Ag2S)x(As2S3)1-x superionic glasses are studied. © (2020) COPYRIGHT Society of Photo-Optical Instrumentation Engineers (SPIE). Downloading of the abstract is permitted for personal use only.	Ihor P. Studenyak, Olexander I. Shpak, Mladen Kranjčec, Mykhailo M. Pop, Ivan I. Shpak, Piotr Kisała, Patryk Panas, Ryszard Romaniuk, Ulzhalgas Zhunissova, and Ainur Ormanbekova "Temperature studies of optical absorption edge in (Ag2S)x(As2S3)1-x(x<0.2) superionic glasses", Proc. SPIE 11581, Photonics Applications in Astronomy, Communications, Industry, and High Energy Physics Experiments 2020, 115810T (14 October 2020); https://doi.org/10.1117/12.2580494
12.	CLASSIFICATION OF MATHEMATICAL MODELS FOR	DOI: 10.32014/2021.2518-1483.98	The problem of emergency prevention and response remains highly relevant. Emergencies caused by earthquakes, floods, mudflows, hurricanes, forest fires, in the technogenic sphere - radiation and transport accidents, accidents associated with the release of	Mazakov T.Zh., Sametova A.A. REPORTS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN

	FOREST AND STEPPE FIRES		chemically and biologically hazardous substances, explosions, fires, hydrodynamic accidents, are the most dangerous in the natural sphere on communal energy systems. This system can influence the process of forecasting the spread of fires, which will lead to a reduction in environmental damage, increased safety and significant cost savings. The final system is able to find fire hotspots, predict where the fire will spread over time, detect fires. By planning and improving resource resources, forest fires can not only provide safety, but also lead to significant financial savings. Currently, methods of fighting forest fires are not effective enough. Therefore, forecasting fires is an important and urgent problem not only for Kazakhstan, but for the entire country. Forecasting natural disasters is not fully available, but the issue of creating a forecasting and management system using modern information systems for prevention is urgent. The system for forecasting and combating forest and steppe fires not only develops the country and its economy, but also has a significant impact on the life of people and plants. The article provides an overview of the mathematical models used to create the system and their features	ISSN 2224-5227 Volume 5, Number 339 (2021), 219 – 225 https://doi.org/10.32014/2021.2518-1483.98
13.	Measuring the Knowledge-Based Performance Efficiency in the Oil-Exported Countries	DOI: 10.14254/1800-5845/2020.16-3.9	The main challenge of natural resource-rich economies is to avoid the resource curse, poor economic growth, weak institutions and corruption through the development of state program, tended to the development of knowledge-based economy. This research evaluates the productivity of the gross regional product in the context of knowledge-based economy indicators taking into account industrial structure and specialization in regional economic. The focus is on the Republic of Kazakhstan as representative of the oil-exported countries. The feature selection analysis was implemented through a panel regression model and in the aim of evaluation of knowledge-based performance of state measures was used Malmquist Productivity Index in DEA. The data set of the research is obtained from the official statistical data of state structures during the period from 2007 to 2017 for the regions of Kazakhstan. The results indicate the need to develop differentiated approaches aimed at improving the efficiency of knowledge-based performance in the context of industry 4.0. The results can be used to adjust tactics and	Galymkair Mutanov, Aziza Zhuparova and Dinara Zhaisanova, “Measuring the Knowledge-Based Performance Efficiency in the Oil-Exported Countries”, Montenegrin Journal of Economics, 2020, vol. 16, issue 3, 109-122 10.14254/1800-5845/2020.16-3.9

			development strategies of state measures in knowledge-based performance. Through this paper we hope to give our contribution to the creation Smart Specialisation strategies in emerging economy countries as a way to increase efficiency in research and innovation investments by integrating policy areas, applying a broad definition of innovations and stimulating collaboration - between regions, sectors and levels	
14.	Optimal design problem for three disks on torus		The geometrical-packing and physical-conductivity problems are stated in a periodic toroidal d-dimensional space with an arbitrarily fixed number n of nonoverlapping spheres per periodicity cell. All Delaunay graphs are divided into classes of isomorphic periodic graphs. For any fixed n, the number of such classes is finite. Energy E is estimated in the framework of structural approximations and reduced to the study of an elementary function of n variables. The minimum of E over locations of spheres is attained at the optimal packing within a fixed class of graphs. The optimal-packing location is unique within a fixed class up to translations and can be found from linear algebraic equations.	V. Mityushev, K.Dosmagulova, Zh.Zhunussova, Ashimov Ye. Materials of 13th International ISAAC congress August 2-6 Ghent Belgium p.63
15.	Applying probability theory to neural networks		Using mathematical models to create an image of the human brain reproduction of machines by artificial intelligence. An artificial neural network consists of three components: input layer, hidden layers, output layer. Also, in the center of the neural network is the loss function. Which minimizes errors known as: quadratic, cross-entropy, AdaBoost, Kullback distance. Loss function should not depend on the activation values of the neural network.	Ashimov Yeskendyr Уфимская осенняя математическая школа – 2021. Материалы международной научной конференции, том 2. г.Уфа, 6-9 октября 2021 г.
16.	KazRivDyn: Toolkit for Measuring the Dynamics of Kazakhstan Rivers with a Graphics Based on Google Earth Engine	doi.org/10.1109/SIST50301.2021.9465902	Now it is possible to control the change in the width of the rivers of Kazakhstan using remote sensing. This article presents a platform called KazRivDyn, developed on the Google Earth Engine cloud computing platform, to monitor changes in the width of Kazakhstan's rivers over the past 20 years, with a graph for more accurate data. Due to the fact that in Kazakhstan there is a problem of reducing the volume of water in rivers, identify the general trend of changing the volume of water, as well as turn prevention to prevent such phenomena as drought and pollution. This platform	1.Assel Ospan, Madina Mansurova, Erkin Kakimzhanov, Baurzhan Aldakulov. KazRivDyn: Toolkit for Measuring the Dynamics of Kazakhstan Rivers with a Graphics Based on Google Earth Engine. 2021 IEEE International Conference on Smart Information Systems and Technologies 28-30 April, 2021, Nur-

			has been applied to the pool. This platform flows through two countries, the darkest as the width of the river has changed since 1984. KazRivDyn is a publicly available tool and can be used to solve scientific problems related to rivers, as well as to create applications for operational water resources management. The results obtained are close to measurements taken using manual methods, and the application works for all rivers in Kazakhstan.	Sultan. https://doi.org/10.1109/SIST50301.2021.9465902
17.	Microclimate Monitoring System for a Home Greenhouse as Part of ESP32	January - February 2020 ISSN: 0193 - 4120 Page No. 4564 - 4573	Abstract. This article is related to designing a home greenhouse monitoring system using WSN and IoT technologies. Wireless Sensor Network (WSN) and Internet of Things (IoT) technology are the most advanced IT technologies and provide fast and distributed data collection and monitoring in various industries and widespread access to use. The developed “Microclimate GH” system allows for accurate measurements and monitoring of the microclimate of the home mini-greenhouse in real time through a mobile application. Monitoring data can be stored in the cloud and displayed in the form of reports and graphs and will be available for analysis at any time. Three important processes are being implemented: cooling, watering and lighting. The results of graphs and histograms analysis help the user to timely and accurately identify microclimate violations and take the necessary measures. The proposed system is implemented on the basis of the ESP32 microcontroller with built-in Wi-Fi and Bluetooth modules, which has a significant advantage over the analogue of the ESP8266. The developed system compares favourably with its other prototypes by its accessibility to a wide user, good communication quality, good design and construction. The economic effect of using the proposed technology amounted to 10,000 tenge, the payback period is 4 seasons.	Amantur Umarov, Murat Kunelbayev, Maxatbek Satymbekov, Gulzat Turken, Bagila Alimbayeva, Kulbarchin Imanzhanova, Laura Duisembayeva Article Info Volume 82 Page Number: 4564 - 4573 Publication Issue: January-February 2020
18.	Combustion Model of a Dual-Fuel Diesel Engine	10.1002/ceat.202000553	A mathematical model is presented for the volumetric combustion of a homogeneous fuel mixture in compression-ignition and forced-ignition engines. With careful consideration of all combustion parameters, the profile of the burning rate has a two-peak structure. A simple nonlinear heat conduction problem was solved to illustrate the importance of including the isobaric process and heat conduction as functions of the temperature. The study shows that,	Yao C., Tyulepberdinova G., Gu S. Chemical Engineering and Technology, 2021, 44(6), стр. 1025–1032 DOI:10.1002/ceat.202000553

			when the pre-exponential parameter was chosen as a calibrated parameter, the ignition delay time significantly depends on the start of combustion and the pressure in the common rail, while the effect of the engine speed seems less noticeable. The results can be extended to quasi-sized combustion models.	
19.	Comparative analysis of numerical methods of the solution of a one dimensional inverse problem of acoustics		Nowadays, a large number of methods for solving inverse problems arising in electrodynamics and acoustics have been developed, but the development of practical systems is necessary to combine a large number of equations that contribute to the substantiation of numerical methods for solving various multidimensional problems. Therefore, the main goal of the work is a comparative analysis of statistical methods for solving the one-dimensional inverse acoustic problem, as well as in the search for acoustic resistance. To achieve this goal, the means of description and comparison, which contributed to the identification of the characteristics of acoustic impedance, were used. Also, the finite-difference solution method, the differential circuit circulation method, and the Landweber iteration method were used. It was established that the inversion method of the difference scheme is expedient to apply in the case when additional information is known accurately enough, and the reconstructed solution is quite smooth. It was determined that if one of these conditions is violated, the method of reversing the difference scheme becomes unstable. The problems of the correctness of the issues for the wave equation with complex velocity in the one-dimensional and spatial cases were investigated. Formulas for solving these problems were obtained – analogs of classical formulas. Numerical computations show the kind of results that may be expected from the method under consideration. The materials of the paper imply the practical significance for the university teachers of the information technology specializations	Periodico Tche Quimica, 2020, 17(34), стр. 321–334 Tyulepberdinova G.A., Oralbekova Z.O., Gaziz G.G., Maxutova, B.A., Baitenova, S.A.
20.	Algorithm for Finding Feedback in a Problem with Constraints for One Class of Nonlinear	DOI: 10.18255/1818-1015-2021-3-220-233	For a continuous nonlinear control system on a nite time interval with control constraints, where the right-hand side of the dynamics equations is linear in control and linearizablein the vicinity of the zero equilibrium position, we consider the construction of a feedback according to the Kalman algorithm. For this, the solution	M. G. Dmitriev, Z. N. Murzabekov, and G. A. Mirzakhmedova, “Algorithm for Finding Feedback in a Problem withConstraints for One Class of Nonlinear Control Systems”, Modeling

	Control Systems		of an auxiliary optimal control problem with a quadratic functional is used by analogy with the SDRE approach. Since this approach is used in the literature to nd suboptimal synthesis in optimal control problems with a quadratic functional with formally linear systems, where all coecient matrices in dierential equations and criteria can contain state variables, then on a nite time interval it becomes necessary to solve a complicated matrix dierential Riccati equations, with state-dependent coecient matrices.	and analysis of information systems, vol. 28, no. 3, pp. 220-233, 2021
21.	Construction of Control with Constraints for Nonlinear Systems with Coefficients Depending on the Control Object State	https://doi.org/10.1007/s10958-020-04999-4	We consider an optimalcontrol problem on a finite time-interval for a three-sector economic control object. We reduce the economic system to an optimal control problem for a nonlinear system with coefficients independent of the control object state and find a nonlinear synthesizing control based on the feedback principle and certain constraints on control. The results obtained for the nonlinear system are used to construct the control parameters in the mathematical model of a three-sector economic control object. We find an optimal distribution between the labor and investment resources satisfying the balance relations.	Murzabekov, Z.N., Mirzakhmedova, G.A. Construction of Control with Constraints for Nonlinear Systems with Coefficients Depending on the Control Object State. J Math Sci 250, 76–82 (2020). https://doi.org/10.1007/s10958-020-04999-4
22.	Hardware implementation of the coding algorithm based on FPGA	DOI 10.1088/1757-899X/1047/1/012137	In this article, the efficient implementation multiplier of polynomials irreducible polynomials modulo for cryptographic encryption and decryption using FPGA is presented. For this, the Nexys 4 board based on the Artix-7 Field Programmable Gate Array (FPGA) from Xilinx was chosen. Verilog HDL is used to describe the circuit for reducing a number modulo. The results of a timing simulation of the device are presented in the form of time diagrams for a given 8-bit number, confirming the correct operation of the device. The developed encryption algorithm on the basis of non-positional polynomial notations is intended for software, hardware, and also software and hardware implementation. The main hardware-implemented device in non-positional algorithm of the cryptographic transformation is a device for the multiplication of polynomials irreducible polynomials modulo, which produces routine calculations on data encryption. These mathematical operations are computationally intensive and fundamental arithmetic operations, which are intensively used in many fields	Hardware implementation of the coding algorithm based on FPGA Ibraimov, M.K., Tynymbayev, S.T., Park, J., Zhexebay, D.M., Alimova, M.A. IOP Conference Series: Materials Science and Engineering, 2021, 1047(1), 012137

			such as cryptography, number theory, and finite field arithmetic.	
23.	Mixed convection in a channel with buoyancy force over backward and forward facing steps: The effects of inclination and geometry	DOI 10.1016/j.csite.2021.101152	This paper presents the computational results of heat transfer for a 2D laminar flow with different channel tilts with forward facing step and backward facing step, taking into account buoyancy forces for various bottom wall lengths. The inclination angle influence on the distribution of velocity and temperature is investigated. The validated numerical algorithm was used to the problem forward and backward facing steps with buoyancy force and at various tilt angles. From the obtained numerical results, it can be noticed that the length of the lower part of the channel has a very strong effect on the flow fluctuation and temperature distribution over the entire channel. It should be noticed that the tilt angle also has a very strong effect on the distribution of flow and temperature. Thus, taking into account the buoyancy force changes the shape of the main recirculation region, but at the same time, regardless of the different tilt angles, the number of vortices does not change, but only the size of the vortices changes. It should also be noticed that when the buoyancy force is taken into account, cooling occurs more efficiently in the middle of the channel.	Issakhov, A., Zhandaulet, Y., Abylkassyomova, A., Sakypbekova, M., & Issakhov, A. (2021). Mixed convection in a channel with buoyancy force over backward and forward facing steps: The effects of inclination and geometry. Case Studies in Thermal Engineering, 26, 101152. doi:10.1016/j.csite.2021.101152
24.	New technology of data transmission: Li-Fi		Motivated by the looming radio frequency (RF) spectrum crisis, this paper aims at demonstrating that optical wireless communication (OWC) has now reached a state where it can demonstrate that it is a viable and matured solution to this fundamental problem. In particular, for indoor communications where most mobile data traffic is consumed, light fidelity (Li-Fi) which is related to visible light communication (VLC) offers many key advantages, and effective solutions to the issues that have been posed in the last decade. This paper discusses all key component technologies required to realize optical cellular communication systems referred to here as optical attocell networks. Optical attocells are the next step in the progression towards ever smaller cells, a progression which is known to be the most significant contributor to the improvements in network spectral efficiencies in RF wireless networks. In this paper we analyzed the Li-Fi system using an optisystem simulation tool. In this analysis, we considered two	Sanida Yessenbek , Abdurazak Kasymov, Salima Nugmanova, Lidiya Taimuratova ARPN Journal of Engineering and Applied Sciences, ISSN 1819-6608 VOL. 15, NO. 24, DECEMBER 2020

			propagation models. In a LOS propagation model in the receiving end, we can regenerate approximated transmitted signal.	
25.	Research of the ellipsoid area geometry illuminated by a point laser source	doi.org/10.1117/12.2569781	The current state of poultry farming requires the development and application of modern technologies for daily young fledge. Young fledge of high quality guarantees the maximum profit of the production in case of its further growth. It is known that to obtain a healthy, high-immunity young fledge it is necessary to implement an effective process of the eggshell surface disinfection. Therefore, the search and development of highly efficient hatching egg disinfection technologies is an urgent task.	Imanbek Baglan, Saule Smailova, Doszhon Baitussupov, Oksana Pankova Proceedings Volume 11456, Optical Fibers and Their Applications 2020; 114560M (2020)
26.	Метод мультистарта с детерминированным механизмом рестарта	https://doi.org/10.21638/11701/spbu10.2020.202	Разработан и исследован метод решения некоторого класса задач глобальной оптимизации с интервальными ограничениями. Предложен алгоритм глобальной оптимизации, основанный на детерминированном способе выбора стартовых точек для методов локального поиска. Для выбора стартовых точек алгоритм локального поиска (в данной работе покоординатного спуска) модифицирован таким образом, что метод одномерной минимизации возвращает множество найденных им локальных минимумов. Эффективность представленного алгоритма продемонстрирована на примере задачи минимизации энергии фрагмента плоской кристаллической решетки. Энергия межатомного взаимодействия рассчитана с помощью потенциала Терсоффа. Проведено экспериментальное сравнение разработанного алгоритма с классическим вариантом метода мультистарта, в котором для выбора стартовых используются равномерно-распределенные в параллелепипеде псевдослучайные точки. В качестве метода локального поиска в обоих случаях была взята одна из модификаций метода покоординатного спуска. Описанный метод может быть применен для часто встречающихся на практике задач с неизвестным аналитическим выражением для целевой функции.	Амирханова Г. А., Горчаков А. Ю., Дуйсенбаева А.Ж., Посыпкин М.А. Метод мультистарта с детерминированным механизмом рестарта / Вестник Санкт-Петербургского университета. Прикладная математика. Информатика. Процессы управления. – СПб., 2020. – Т. 16. Вып. 2. – С. 100-111. – DOI: https://doi.org/10.21638/11701/spbu10.2020.202

27.	Named Entity Extraction Model Based on the Random Walk Method	DOI 10.1109/SIST50301.2021.9465992	In connection with the rapid development of Internet technologies, modern society in recent decades has experienced an information explosion characterized by an exponential increase in the volume of information, including low quality information. This work is intended to provide all interested parties with intelligent tools to support decision-making by automatically extracting knowledge from heterogeneous data sources, including the Internet. In the work, we examined the primary processing and morphological analysis of texts, implemented a random walk method to extract semantically related words. As a result of the calculations, we got a matrix with the affinities of words, as well as a dictionary that connects the word with the vector component. In addition, the neural network, trained to retrieve linguistic constructions, which include the possible values of descriptors of named text entities, was described in the work. © 2021 IEEE.	Mansurova M., Barakhnin V., Kyrgyzbayeva M., Kadyrbek N. SIST 2021 - 2021 IEEE International Conference on Smart Information Systems and Technologies 28 April 2021 Номер статьи 94659922021 IEEE International Conference on Smart Information Systems and Technologies, SIST 2021Nur-Sultan28 April 2021 до 30 April 2021Код 171071 DOI 10.1109/SIST50301.2021.9465992
28.	Health Monitoring System Using Internet of Things	DOI 10.1109/SIST50301.2021.9465928	The article is devoted to the technical means of monitoring the vital signs of patients. The four main vital signs routinely monitored at doctor's offices include heart rate, blood pressure, respiration rate and body temperature. In the future, this system will be supplemented with sensors for measuring the health status of patients with diabetes. Many similar systems are known for measuring and monitoring blood sugar levels. The list of tasks they solve includes actively monitoring blood glucose levels and monitoring physical activity, diet and insulin consumption. Recent advances in diabetes technology and self-management applications have made it easier for patients to access relevant data. The capabilities of the Internet of Things (IoT), information and communication technologies and machine learning help optimize costs in healthcare and the organization of online medical services. © 2021 IEEE.	Zholdas N., Postolache O., Mansurova M. SIST 2021 - 2021 IEEE International Conference on Smart Information Systems and Technologies 28 April 2021 Номер статьи 94659282021 IEEE International Conference on Smart Information Systems and Technologies, SIST 2021Nur-Sultan28 April 2021 до 30 April 2021Код 171071 DOI- 10.1109/SIST50301.2021.9465928
29.	Emulation of x86 Computer on FPGA	DOI 10.1109/AIEEE51419.2021.9435812	It is well known that, emulation in the form of software is the predominant method for engineers to evaluate the capabilities of the studied microprocessors and embedded systems. There are three main criteria for evaluating a model using software tools: modeling speed, model accuracy, and model completeness. The increasing	Vyazigin, Dyusembaev,Mansurova M. 2020 IEEE 8th Workshop on Advances in Information, Electronic and Electrical Engineering, AIEEE 2020 - Proceedings 22 April 2021

			complexity of the processor and the tendency to have an increasing number of processors on the chip put a strain on simulators to achieve all of the above criteria, including accurate fixation of processes in the OS. Thus, the main task in our work is experiments-prototyping using an emulation system and analysis of the results of the described experiments, which satisfies all three criteria. The system is a Board with FPGA, RAM, ROM, real-time clock, DAC chips, and connectors for connecting a monitor, keyboard, and mouse manipulator soldered on it. The system is based on the FPGA Cyclone IV from ALTERA. Which, thanks to a sufficient number of logical cells, allows you to simulate not only a single processor, but also other components of the computer as a whole. Therefore, you can apply architectural changes to the processor and evaluate their impact on the entire system. We use this FPGA-based emulation system to validate the computer's FPGA emulation capabilities. The paper justified the possibility of emulating a computer on an FPGA and its ability to run real operating systems that are not stripped down. The novelty of this project is that unlike other similar projects, the system developed by us allows you to emulate a full-fledged personal computer with an x86 processor architecture, on the basis of which you can emulate more modern computers with processors. For example: Intel Atom or Intel Celeron. However, to achieve these goals, you will need to use a more developed FPGA, based on the methodology proposed in this paper. © 2021 IEEE.	Номер статьи 94358128th IEEE Workshop on Advances in Information, Electronic and Electrical Engineering, AIEEE 2020Virtual, Vilnius22 April 2020 до 24 April 2020 DOI-10.1109/AIEEE51419.2021.9435812
30.	Development of Web Application for Visualizing City Emergencies	DOI 10.1109/SIST50301.2021.9465919	To solve problems with emergencies, you need to have an idea in which regions more different emergencies occurred, in order to identify some kind of report and analysis. It is also not enough to have only the location of the emergency itself, you need to have different types of information about the emergency itself. This work describes a system that displays different types on a map with the necessary information about from sources of news sites. RandomForest and xgboost machine learning methods were used for forecasting. With the help of the geographic information system, types of emergencies are visualized on the maps of the city of Almaty. All visualization algorithms and technologies are	Akhmed-Zaki D.,Mansurova M., Yertuyak A., Chikibayeva D. SIST 2021 - 2021 IEEE International Conference on Smart Information Systems and Technologies 28 April 2021 Номер статьи 94659192021 IEEE International Conference on Smart Information Systems and Technologies, April 2021

			implemented in Python. © 2021 IEEE.	
31.	The Problem of Named Entities Unification based on Geographical Ontologies	DOI 10.1109/AIEEE51419.2021.9435777	The subject of this research is to develop a system for extracting knowledge from both semi-structured and unstructured data and filling with this system a knowledge base that would provide support for decision-making on any problematic issues. The article deals with the problem of unification of named entities based on geographical ontologies. © 2021 IEEE.	Sarsembayeva T.,Mansurova M.,Chikibayeva D.,Karymsakova D. 2020 IEEE 8th Workshop on Advances in Information, Electronic and Electrical Engineering, AIEEE 2020 - Proceedings 22 April 2021 Номер статьи 94357778th IEEE Workshop on Advances in Information, Electronic and Electrical Engineering, , Vilnius22 April 2020 DOI-10.1109/AIEEE51419.2021.9435777
32.	Technologies for automation creation of an ontology of urbanonyms in the aspect of historical changes (on the example of Almaty)	DOI 10.1088/1742-6596/1727/1/012015	When creating geoinformation systems of a city scale, relation this or that information from Internet, there comes the task of creation an ontology of urbanonyms taking into account their historical changes. The account of historical changes is necessary, for example, to process messages about urban event from blogs: since more and more representatives of the middle and older generations are becoming active Internet users, the massages often contain the former names of urbanonyms. Let us note that it is the accounting of historical changes that is required to solve this problem thatdetermines the need to create not a thesaurus, which is sufficient, as shown in [1], to take into account geographical names commonly used (at least in natural science articles) in their actual from, but an ontology. Taking into account the specifics of the task of creating an ontology of Almaty,in should be bilingual: in the Kazakh and Russian languages. © Published under licence by IOP Publishing Ltd.	Barakhnin V., Mansurova M., Dossanov B.,Kyrgyzbayeva M. Journal of Physics: Conference Series Том 1727, Выпуск 119 January 2021 Номер статьи 0120152020 Big Data and Artificial Intelligence Conference, BDAY 2020Moscow, Virtual17 September 2020 до 18 September 2020Код 167120 DOI-10.1088/1742-6596/1727/1/012015
33.	Parallel news clustering and topic modeling approaches	DOI 10.1088/1742-6596/1727/1/012018	At the current age there is an urgent need in developing massively scalable and efficient tools to Big Data processing. Even the smallest companies nowadays inevitably require more and more resources for data processing routines that could enhance decision making and reliably predict and simulate different scenarios. In the	Shomanov A.S.,Mansurova M.E. Journal of Physics: Conference Series Том 1727, Выпуск 119 January 2021 Номер статьи 0120182020 Big Data and Artificial Intelligence Conference,

			current paper we present our combined work on different massivelyscalable approaches for the task of clustering and topic modeling of the dataset, collected by crawling Kazakhstan news websites. In particular, we propose Apache Spark parallel solutions to news clustering and topic modeling problems and, additionally, we describe results of implementing document clustering using developed partitioned global address space Mapreduce system. In our work we describe our experience in solving these problems and investigate the efficiency and scalability of theproposed solutions. © Published under licence by IOP Publishing Ltd.	BDAY 2020Moscow, Virtual17 September 2020 до 18 September 2020
34.	Algorithmic Approach to Building a Route for the Removal of Household Waste with Associated Additional Loads in the “Smart Clean City” Project	DOI 10.1007/978-3-030-88081-1_56	Growing population in urban areas has led to the necessity of solving the problem of targeted municipal garbage collection. In the smart city Optimization problem for complex smart city dynamic systems is one of the most important elements for garbage collection analysis. The paper contributes with a mathematical model for solving optimization problems and transport scheduling for the targeted garbage collection is suggested, which is a part of a wide range of “Smart City” concepts. The model is based on the apparatus of network optimization algorithms. The possibility of additional loading of the garbage truck during waste collection is the basis for optimizing the parameters of the entire process. As optimization criteria, the cost of the services rendered, the weight of the removed waste, and the reduction in idle run can be considered. © 2021, Springer Nature Switzerland AG.	Dolinina O.,Pechenkin V.,Mansurova M.,Tolek D.,Ixsanov S Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)Том 12876 LNAI, 13th International Conference on Computational Collective Intelligence, ICCCI 2021Virtual, Online29 September 2021 до 1 October 2021 DOI 10.1007/978-3-030-88081-1_56
35.	Understanding Bike Sharing Stations Usage with Chi-Square Statistics	DOI 10.1007/978-3-030-88113-9_34	Bike sharing systems have both great potential and great challenge for the development of smart and green urban environment. Many problems, arising from design and operation of bike sharing systems, have no easy solutions and call for complex mathematical models. Nowadays, there are a lot of sophisticated methods for understanding and administration of bike sharing systems, based on Data mining techniques, graph computations, temporal networks models, etc. At the same time, as the digitalization is accelerating, easy and affordable old-school methods are often overlooked. This paper presents a simple but efficient Chi-square test for analyzing bike sharing stations usage in mornings and evenings. The proposed	Nugumanova A.,Maulit A.,Mansurova M.,Baiburin Y. Communications in Computer and Information Science Том 1463, Страницы 425 - 4362021 13th International Conference on Computational Collective Intelligence, ICCCI 2021Virtual, Online29 September 2021 DOI 10.1007/978-3-030-88113-9_34

			method determines stations that keep the same usage patterns over time. Experiments conducted on CitiBike trip data for New York City's bike sharing service, have shown promising performance of the proposed method. © 2021, Springer Nature Switzerland AG.	
36.	Development of the information system for the Kazakh language preprocessing	DOI 10.1080/23311916.2021.1896418	The aim of this work is the design and development of linguistic resources and preprocessing tools for the Kazakh language. The media-corpus of the Kazakh language is presented as a linguistic resource, which is available on Al-Farabi Kazakh National University platform. The media-corpus of the Kazakh language consists of texts of news content and is implemented as an information system. The general architecture of an information system for the automatic and reliable collection, storage and analysis of texts in the Kazakh language is described. Three automatic text preprocessing tools for the Kazakh language–word forms generator, morphological analyzer, and morphological disambiguation tool–are presented in the article. The proposed tools can also be applied in the systems of automatic analysis of texts, in creation of other linguistic resources such as thesauri and ontologies. © 2021 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.	Akhmed-Zaki D.,Mansurova M.,Madiyeva G.,Kadyrbek N.,Kyrgyzbayeva M. Cogent Engineering Том 8, Выпуск 12021 Номер статьи 1896418 DOI 10.1080/23311916.2021.1896418
37.	Unsupervised keyword extraction using non-smooth NMF	-	In this paper, we introduce a novel unsupervised method for keyword extraction, based on non-smooth nonnegative matrix factorization. We generate a document-term matrix from a given corpus and factorize it into the product of two special matrices: documents-by-topics and topics-by-terms. In our method, we choose a low degree of factorization (k=3,4,5) and use only topics-by-terms matrix to extract top N keywords for each of k topics. Then we merge these obtained N*k keywords into a resulting keyword list excluding duplicates and assign keywords to documents. We validate our method with a large text corpora: "Introduction to information retrieval" textbook (by Manning, Raghavan and Schütze), available online. The result of our method is compared with three popular unsupervised keyword extraction algorithms: TextRank, Rake and Yake. The experiments confirm that the	Nugumanova A.,Ahmed-Zaki D., Mansurova M., Baiburin Y., Apayev K., Maulit A. Journal of Theoretical and Applied Information Technology Том 98, Выпуск 22, Страницы 3583 - 359630 November 2020

			proposed method shows the promising performance in terms of precision, recall and F-measure with respect to various number of candidate keywords. © 2020 Little Lion Scientific. All rights reserved.	
38.	Creation of a Dependency Tree for Sentences in the Kazakh Language	DOI 10.1007/978-3-030-63007-2_55	In the semantico-syntactic analysis of great importance is understanding of its formal structure. For this, in the text it is necessary to distinguish units of lexical meaning and designate the types of relations between them. The dependency tree is an indispensable tool for parsing sentences and determination of hierarchical relationships between the main components in it. In this work, an algorithm for constructing a dependency tree for sentences in the Kazakh language using the filter method is proposed. The dependency tree was created on the basis of the spinning tree from the oriented graph constructed according to the rules of syntactic relationship in the Kazakh language. © 2020, Springer Nature Switzerland AG.	Akhmed-Zaki D., Mansurova M., Kadyrbek N., Barakhnin V.,Misebay A. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)Том 12496 LNAI, Страницы 709 - 7182020 12th, ICCCI 2020 Da Nang30 November 2020 DOI 10.1007/978-3-030-63007-2_55
39.	Development of Kazakh Named Entity Recognition Models	DOI 10.1007/978-3-030-63007-2_54	Named entity recognition is one of the important tasks in natural language processing. Its practical application can be found in various areas such as speech recognition, information retrieval, filtering, etc. Nowadays there are a variety of available methods for implementing named entity recognition. In this work we experimented with three models and compared the performances of machine learning based models and probabilistic sequence modeling method on the task of Kazakh language named entity recognition. We considered three models based on BERT, Bi-LSTM and CRF baseline. In the future these models can be parts of an ensemble learning system for name entity recognition in order to achieve better performance results. © 2020, Springer Nature Switzerland AG.	Akhmed-Zaki D., Mansurova M., Barakhnin V., Kubis M., Chikibayeva D., Kyrgyzbayeva M Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)Том 12496 LNAI, Страницы 697 - 7082020 12th International Conference on Computational Collective Intelligence, ICCCI 2020Da Nang30 November 2020 DOI 10.1007/978-3-030-63007-2_54
40.	Solving of classification problem in spatial analysis applying	-	In the paper two models of spatial analysis are considered. The models are dedicated for spatial analysis of ecological factors distribution, such as distribution of contaminant concentration on researched territory. The models are created using the method of	Safarov R.Z., Shomanova Z.K., Nossenko Y.G., Berdenov Z.G., Bexeitova Z.B., Shomanov A.S., Mansurova M.

	the technology of gradient boosting catboost		machine learning - gradient boosting. In order to build the models we have used open source effective library CatBoost. Functions AUC and Accuracy were calculated for each model. MultiClass - integrated function of CatBoost library was used for loss minimization. For solving the problem, it was necessary to define affiliation of searched point from test dataset to one of four classes. This problem belongs to the type of classification, or rather multiclassification. As a result of the studies, an effective model was obtained that allows one to perform with sufficient accuracy the spatial forecast of the factor distribution at points and regions of the studied field with an unknown gradient value of this factor. This model works adequately with a training dataset of 0.5% of all analyzed information about the object.	Folia Geographica Том 62, Выпуск 1, Страницы 112 - 1262020 **ISSN**-13366157
41.	Emulation of x86 Computer on FPGA	10.1109/AIEEE51419.2021.9435812	It is well known that, emulation in the form of software is the predominant method for engineers to evaluate the capabilities of the studied microprocessors and embedded systems. There are three main criteria for evaluating a model using software tools: modeling speed, model accuracy, and model completeness. The increasing complexity of the processor and the tendency to have an increasing number of processors on the chip put a strain on simulators to achieve all of the above criteria, including accurate fixation of processes in the OS. Thus, the main task in our work is experiments-prototyping using an emulation system and analysis of the results of the described experiments, which satisfies all three criteria. The system is a Board with FPGA, RAM, ROM, real-time clock, DAC chips, and connectors for connecting a monitor, keyboard, and mouse manipulator soldered on it. The system is based on the FPGA Cyclone IV from ALTERA. Which, thanks to a sufficient number of logical cells, allows you to simulate not only a single processor, but also other components of the computer as a whole. Therefore, you can apply architectural changes to the processor and evaluate their impact on the entire system. We use this FPGA-based emulation system to validate the computer's FPGA emulation capabilities. The paper justified the possibility of emulating a computer on an FPGA and its ability to run real operating systems	Vyazigin S., Dyusembaev A., Mansurova M. 8th IEEE Workshop on Advances in Information, Electronic and Electrical Engineering, AIEEE 2020 10.1109/AIEEE51419.2021.9435812

			that are not stripped down. The novelty of this project is that unlike other similar projects, the system developed by us allows you to emulate a full-fledged personal computer with an x86 processor architecture, on the basis of which you can emulate more modern computers with processors. For example: Intel Atom or Intel Celeron. However, to achieve these goals, you will need to use a more developed FPGA, based on the methodology proposed in this paper. © 2021 IEEE.	
42.	Study of the innovations diffusion on the base of naming game mathematical model	10.6084/ijact.v9i1.1036	The innovation diffusion is the research issue being a subject of multiple research works in the recent years. The goal of the innovation diffusion theory is to explain the way, new ideas and practices are spread among the social system's members. The major part of the existing models is based on parameters determining the process of innovation adoption and simple mathematical functions focused on the observation and description of diffusion models. These models allow researching the process of diffusion more accurately, but its use foresees the evaluation of diffusion coefficients obtained as a rule from the empirical data of chronological rows. This may cause some trouble, for example, when the data is insufficient or missing. The paper considers the process of innovations distribution in the social community based on the Naming Game Model. Numerous experiments have been conducted and main scenarios of the innovation diffusion in the social system are identified. There is a suggestion to apply an alternative approach to modeling the innovation diffusion in order to overcome some issues typical of the existing models. © National Institute of Science Communication and Information Resources (NISCAIR).	Murzakhmetov A., Dyusembaev A., Umbetov U., Abdimomynova M., Shekeyeva K. Compusoft Том 9, Выпуск 1, Страницы 3547 – 35512020 **ISSN**-23200790 **DOI**-10.6084/ijact.v9i1.1036
43.	End-to-End Model Based on RNN-T for Kazakh Speech Recognition	10.1109/ICCCI51764.2021.9486811*87	3rd Automatic speech recognition is a rapidly developing area in machine learning. The most popular speech recognition systems today are end-to-end systems, especially those models that directly output a sequence of words taking into account the input sound in real time, which are online end-to-end models. Stream speech recognition allows to transfer the audio stream to speech-to-text conversion and get the results of stream speech recognition in real	Orken Mamyrbayev, Dina Oralbekova, Aizat Kydyrbekova, Tolganay Turdalykyzy, Akbayan Bekarystankyzy International Conference on Computer Communication and the Internet (ICCCI) June 25-27, 2021, Nagoya,

			time as the audio is processed. This article discusses and implements a popular RNN-T-based model for recognizing Kazakh speech. The analysis of works related to recognition of Kazakh speech based on the CTC model is also given. The findings demonstrated that an RNN-T-based model can work well without additional components, like a language model and showed the best outcome on our dataset. As a result of the research, the system reached 10.6% CER, which is the best indicator among other end-to-end systems for recognizing Kazakh speech. © 2021 IEEE.	Japan, -P. 163 – 167.
44.	Transient analysis in 1st order electrical circuits in violation of commutation laws	10.15199/48.2021.09.05	The paper considers the usage of non-standard analysis mathematical apparatus to solve some non-trivial problems of electrical engineering theory. The axiomatics of non-standard analysis makes it possible to simplify the transient analysis in the 1st order electrical circuits in violation of the commutation laws. Examples of solving such problems are given. © 2021 Wydawnictwo SIGMA-NOT. All rights reserved.	Orken Mamyrbayev,V. V. Kukharchuk, S. V. Pavlov. S. Sh. Katsyv, A. M. Koval, V.S. Holodiuk, M. V. Lysyi, A. Kotyra, A. Kalabayeva
45.	Single-Word Speech Recognition using Convolutional CNN Neural Networks		This work focuses on monosyllabic speech recognition, where the ultimate goal is to accurately recognize a set of predefined words from short audio clips. It uses a data set of speech commands that consist of 64,000 one-second utterances of 30 short words, from which we learn to classify 10 words, as well as classes for "unknown" words, and also "Silence". We use a convolutional neural network (CNN) with one-dimensional convolusions on the raw audio signal to classify the samples. The results show that the model can predict samples of words it saw during training with high accuracy, but it somewhat struggles with generalizing to words that are beyond the training data, and extremely noisy samples.	Nurbapa Mekebayev, Orken Mamyrbayev, Dina Oralbekova, Madiyar Tasbolatov Psychology and education.-2021. Volume 2. №. 58. P. 10572 - 10576.
46.	Metrological features of a pathospecific device for the diagnostic of glaucoma		The chapter describes the structure of the pathospecific device for the diagnosis of glaucoma. Performed a description of the phase space is given and a metrological analysis of the errors possible with the use of such an installation. Using of such devices can improve the quality of glaucoma diagnostics and increase the productivity of diagnostic physicians. © 2021 Taylor & Francis Group, London, UK.All right reserved.	O.A. Avdeyuk, Yu.P. Mukha, D.N. Avdeyuk, M.G. Skvortsov, Z. Omiotek, R. Dzier˙zak, M. Dzie´nkowski, A. Kozbakova Information Technology in Medical Diagnostics III. – 2021. February 10, P.

				15-25.
47.	Output Tracking Control for High-Order Nonlinear Systems with Time Delay via Output Feedback Design	https://doi.org/10.3390/sym13040675	Design approach of an output feedback tracking controller is proposed for a class of high-order nonlinear systems with time delay. To deal with the time delays, an appropriate Lyapunov–Krasovskii the tracking analysis is ingeniously constructed, and an output feedback tracking controller is designed by using a homogeneous domination method. It is shown that the proposed output controller independent of time delay can make the tracking error be adjusted to be sufficiently small and render all the trajectory of the closed-loop system as bounded. An example is given to illustrate the effectiveness of the proposed method. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.	Keylan Alimhan,G. A. Abdenova,A. Akmetkalyeva Symmetry. - 2021. Volume 675. P. 1 - 13.
48.	Automatic Multilingual Ontology Generation Based on Texts Focused on Criminal Topic		Nowadays, the explosive growth of textual information on computer networks has made the automatic ontology generation from the text a very up-and-coming research area. The main reason for this is that usage of ontologies can produce efficient and beneficial in such different applications as information extraction, question answering systems, information retrieval and many others. However, the manual creation of ontologies is a time-consuming and costly process. Accordingly, over the past few years, many approaches tried to automate ontologies generation based on textual data have appeared. This paper suggests the approach to automated multilingual ontology generation that covers the domain focused on the criminal topic. The approach is based on the three basic components: multilingual synonym dictionary, themultilingual and parallel text corpora focused on criminal topics and the logical-linguistic model of facts extraction from texts. This paper shows these basic components created for four languages: English, Ukrainian, Kazakh and Russian. In addition, it also discusses the ontology construction process that includes all of these three mentioned essential components.	Nina Khairovaa, Anastasiia Kolesnyka, Orken Mamyrbayev, Galiya Ybytayeva, Yuliia Lytvynenko 5th International Conference on Computational Linguistics and Intelligent Systems. April 22–23, 2021, Kharkiv, Ukraine, - P. 1-10.
49.	Kaznewsdataset: Single country overall digital mass	10.3390/data6030031	Mass media is one of the most important elements influencing the information environment of society. The mass media is not only a source of information about what is happening but is often the	Yakunin K.,Kalimoldayev M.,Mukhamediev R.I.,Mussabayev R.Barakhnin V.Kuchin,Murzakhmetov

	media publication corpus		authority that shapes the information agenda, the boundaries, and forms of discussion on socially relevant topics. A multifaceted and, where possible, quantitative assessment of mass media performance is crucial for understanding their objectivity, tone, thematic focus and, quality. The paper presents a corpus of Kazakhstan media, which contains over 4 million publications from 36 primary sources (which has at least 500 publications). The corpus also includes more than 2 million texts of Russian media for comparative analysis of publication activity of the countries, also about 4000 sections of state policy documents. The paper briefly describes the natural language processing and multiple-criteria decision-making methods, which are the algorithmic basis of the text and mass media evaluation method, and describes the results of several research cases, such as identification of propaganda, assessment of the tone of publications, calculation of the level of socially relevant negativity, comparative analysis of publication activity in the field of renewable energy. Experiments confirm the general possibility of evaluating the socially significant news, identifying texts with propagandistic content, evaluating the sentiment of publications using the topic model of the text corpus since the area under receiver operating characteristics curve (ROC AUC) values of 0.81, 0.73 and 0.93 were achieved on abovementioned tasks. The described cases do not exhaust the possibilities of thematic, tonal, dynamic, etc., analysis of the considered corpus of texts. The corpus will be interesting to researchers considering both multiple publications and mass media analysis, including comparative analysis and identification of common patterns inherent in the media of different countries.	S.Buldybayev T.Ospanova U,Yelis M.,Zhumabayev A.,Gopejenko V. Data, 2021, 6(3), 31 Том 6, Выпуск 3 March 2021 Номер статьи 31
50.	Study of the mathematical model of Kazakhstan's electricity system	10.1109/CoDIT49905.2020.9263947	In recent years, with the continued growth of energy demand, intelligent energy systems have become a common choice for the world's energy to meet the challenges of the future. This article presents the current state of the electric power system of Kazakhstan on the basis of a mathematical model. The production and consumption of electricity in Kazakhstan has been studied, and a mathematical model for the stabilization of the power system has been developed. The numerical solution of this problem is obtained	Kalimoldayev M,Abdildayeva A,Zhukabayeva T.7th International Conference on Control, Decision and Information Technologies, CoDIT 2020Страницы 604 - 60929 June 2020 Номер статьи 92639477th International Conference on Control, Decision and Information

			using multistep methods of Adams-Bashforth and Adams-Moulton and graphical results are shown.	Technologies, CoDIT 2020Prague29 June 2020 до 2 July 2020Код 165461 1109/CoDIT49905.2020.9263947
51.	Robot Singular Motion at Onward Travelling and Kinematics Problem Solving and Covering of Workspace and Global Asymptotic Control	10.1109/ICECCE49384.2020.9179428	In this paper, we consider the plane motion of a mobile platform of a 3RPR type robot with three degrees of freedom [3]. For each time point, it is required to solve the minimization problem. The requirement of constancy of the rotation angle of the platform is obtained. Jacobian is used when moving from the speeds of actuators to the generalized speeds of the working tool. The method of the non-uniform coverings is applied for a planar parallel robot of 3RPR type. The coverings of the workspace are constructed for different rotation angles of the robot's mobile platform. Volumes of the workspace at different rotation angles were calculated. The dependence of the number of covering elements on the approximation tolerance and the length of the linking rods was analyzed. Control actions that ensure stabilization of intelligent electric power systems have been found. © 2020 IEEE.	Kalimoldayev M,Mukanova B,Akhmetzhanov M,Kunelbayev M.2nd International Conference on Electrical, Communication and Computer Engineering, ICECCE 2020 June 2020 Номер статьи 9179428
52.	FPGA Implementation of Encryption Algorithms Based on Residual Polynomials	10.1109/ELNANO50318.2020.9088890	This paper describes an encryption algorithm based on a polynomial system of residual classes. We study the FPGA bitstream implementation on the Xilinx and 16-nm UltraScale™ ASIC architecture which enables floating-point operation, multi-processing, parallelism, pipelining, highperformance computing, etc. The software-based bitstream encryption and on-chip decryption are performed with the stored encryption key and encrypted bitstream, generated by a Vivado tool. The self-authenticating algorithms with a symmetric key are investigated. The encryption algorithms are implemented using the polynomial system of residual numbers. Data encryption in a residual number system is effectively implemented by ASICs. Design of irreducible polynomial is proposed and discussed. Our developments and findings are empowered by the low-power FinFET FPGA architecture.	Kalimoldayev M,Tynymbayev S,Magzom M,Tananova D,Lyshevski S.E.2020 IEEE 40th International Conference on Electronics and Nanotechnology, ELNANO 2020 - Proceedings Страницы 667 - 671
53.	Mobile composite wind power plant	10.32014/2020.2518-170X.101	This research focuses on the stage of engineering a technical prototype of a composite wind power plant with a diffuser (WPPD).	Baishagirov K.Z,Kalimoldayev M,Karimbayev T.D,Omarov

	with diffuser		The area of a particular interest in the article is the mathematical aspect of the engineering stage. The article presents a theoretical study as well as experimental and practical data essential to obtain an effective shape of the diffuser. Here are also given engineering calculations and results of patent researches and field tests. The authors calculate the most rational design parameters capable of ensuring the maximum speed in the area of the blades. This leads to an increase in the generated electricity, since it depends on the speed cubed. The increase in speed is stipulated by the passage of the air flow through the narrow part of the diffuser into the area of expansion and is consistent with the Bernoulli equation. The differential equation relates the flow velocity to the cross-sectional area of the diffuser. It should be noted that its inner part is the surface of rotation of the generatrixes around the axis of the diffuser. The surface shape can be adjusted based on the obtained mathematical calculations. In the research, these curves are described in the form of polynomials of various degrees. After integrating the differential equation for each curve individually the best option is selected. Here is also given an example with a quadratic function, which was experimentally substantiated in earlier researches and is used to compare the effects received from different generators. The described technology, with account taken of the shape of the generator fairings, contributes to the further improvement of the WPPD. The article serves as the basis for engineering a technical prototype of a mobile composite WPPD.	B.M,Yermaganbetova S.K. News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences Том 5, Выпуск 443, Страницы 30 - 38
54.	[Assessment of the knowledge quality level based on fuzzy models of its acquisition processes] [(Ocena poziomu jakości wiedzy na bazie rozmytych	10.15199/48.2020.09.24	To assess the quality of knowledge acquisition by students of technical universities and to acquire relevant competencies, it is proposed to apply the idea of integrating education and the fuzzy mathematical model, supplemented by a procedure of probabilistic processing of fuzzy values. The fuzzy mathematical model is synthesized in the form of the Mamdani knowledge base, whose language variables characterize various parameters of the process of knowledge acquisition by students. A technique of assessing the quality of the knowledge acquisition process with the use of a	Mokin B.I,Mokin O.B,Kosaruk O.M,Kalimoldayev M,Wójcik W,Muslimov K.Przeglad Elektrotechniczny Том 96, Выпуск 9, Страницы 114 – 1192020 ISSN-00332097 10.15199/48.2020.09.24

	modeli procesów jej zdobywania)]		synthetic model and suggested efficiency evaluation criteria have been developed. The testing of the suggested model and technique was performed in Vinnytsia National Technical University, the results of testing proved their efficiency. © 2020 Wydawnictwo SIGMA-NOT. All rights reserved.	
55.	The device for multiplying polynomials modulo with analysis of two least significant bits of the multiplier per step	10.32014/2020.2518-170X.60	We consider a device for multiplying polynomials modulo where two bits of the polynomial multiplier are analyzed per multiplication step. Such a device can serve as the basic unit for building cryptosystems based on non-positional polynomial number systems, where the binary representation of the polynomial multiplicand can show a fragment of the encrypted text, and the binary representation of the polynomial multiplier can serve as a secret key. The module is a binary representation of the irreducible polynomial of these two polynomials. © 2020, National Academy of Sciences of the Republic of Kazakhstan. All rights reserved.	Kalimoldayev M,Tynymbayev S,Gnatyuk S,Ibraimov M,Magzom M.News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical SciencesОткрытый доступТом 3, Выпуск 441, Страницы 102 - 1092020
56.	Analysis of modern approaches for the prediction of electric energy consumption	10.1515/eng-2020-0028	A review of modern methods of forming a mathematical model of power systems and the development of an intelligent information system for monitoring electricity consumption. The main disadvantages and advantages of the existing modeling approaches, as well as their applicability to the energy systems of Ukraine and Kazakhstan,are identified. The main factors that affect the dynamics of energy consumption are identified. A list of the main tasks that need to be implemented in order to develop algorithms for predicting electricity demand for various objects, industries and levels has been developed. © 2020 M. Kalimoldayev et al., published by De Gruyter.	Kalimoldayev M,Drozdenko A,Koplyk I,Marinich T,Abdildayeva A,Zhukabayeva T. Open Engineering Том 10, Выпуск 1, Страницы 350 - 3611 January 2020
57.	Algorithms for detection gender using neural networks	10.46300/9106.2020.14.24	In this paper, we investigate two neural architecture for gender detection tasks by utilizing Mel-frequency cepstral coefficients (MFCC) features which do not cover the voice related characteristics. One of our goals is to compare different neural architectures, multi-layers perceptron (MLP) and, convolutional neural networks (CNNs) for both tasks with various settings and learn the gender-specific features automatically. © 2020, North	Kalimoldayev M,Mamyrbayev O,Mekebayev N,Kydyrbekova A International Journal of Circuits, Systems and Signal Processing Том 14, Страницы 154 - 1592020

			Atlantic University Union.	
58.	Graph models with multiple bayesian networks	10.15199/48.2020.12.55	This paper is devoted to some issues of using multiple Bayesian networks in the various applied problems. Sometimes we deal with applied problems that are difficult to describe with a model that is represented by only one Bayesian network. At the same time, the considered problem may contain blocks with various types of uncertainties that can be well described by multiple Bayesian networks. Even if the problem can be described by only one Bayesian network, the size of this network could be so large that it will be impossible to find the solution with the help of existing software products. In this case, it is better to decompose in some way this large Bayesian network into several smaller ones. However, existing software products are poorly adapted to work with several Bayesian networks simultaneously. In this project, we develop and describe a software product that allows us to work with several Bayesian networks simultaneously. © 2020 Wydawnictwo SIGMA-NOT. All rights reserved.	Shayakhmetova A. Litvinenko N.Mamyrbaev, O.Wojcik W. Przeglad Elektrotechniczny Том 96, Выпуск 12, Страницы 252 - 255
59.	Bayesian approach for competence formation for students of it-specialty		The Bayesian networks theory has recently become very popular in solving various applied problems in multiple fields of science and industry. For the practical application of the Bayesian approach, a high quality software product that implements the mathematical theory of Bayesian networks is required. The Bayesian approach is a promising approach for creating an intelligent environment to enhance student competence. To implement Bayesian networks, the BayesiaLab application software package is well suited and is one of the high-quality software products, which is specialised in artificial intelligence technologies. With the help of the BayesiaLab package, various models of Bayesian networks can be created, explored, edited and analysed. This article introduces student competences and explores the possibilities of using Bayesian networks in the formation of the competences of information technology (IT) students and for this purpose, a general algorithm and a specific architecture of the intellectual environment have been developed. It is a known fact that improved professional competence in education increases the competitiveness of	Shayakhmetova A,Seisenbekova P,Othman M,Mamyrbayev O,Kassymova D.ISSN-19928645.Journal of Theoretical and Applied Information TechnologyТом 10, Выпуск 19, Страницы 3172 – 3182 October 2020

			specialists and updates the corresponding educational environment.	
60.	Verification of University Student and Graduate Data using Blockchain Technology	10.15837/ijccc.2021.5.4266	Blockchain is a reliable and innovative technology that harnesses education and training through digital technologies. Nonetheless, it has been still an issue keeping track of student/graduate academic achievement and blockchain access rights management. Detailed information about academic performance within a certain period (semester) is not present in the official education documents. Furthermore, academic achievement documents issued by institutions are not secured against unauthorized changes due to the involvement of intermediaries. Therefore, verification of official educational documents has become a pressing issue owing to the recent development of digital technologies. However, effective tools to accelerate the verification are rare as the process takes time. This study provides a prototype of the UniverCert platform based on a consortium version of the decentralized, open-source Ethereum blockchain technology. The proposed platform is based on a globally distributed peer-to-peer network that allows educational institutions to partner with the blockchain network, track student data, verify academic performance, and share documents with other stakeholders. The UniverCert platform was developed on a consortium blockchain architecture to address the problems universities face in storing and securing student data. The system provides a solution to facilitate students' registration, verification, and authenticity of educational documents.	Shakan Y,Kumalakov B,Mutanov G,Mamykova Z,Kistaubayev Y. International Journal of Computers, Communications and Control Том 16, Выпуск 5, Страницы 1 - 162021.ISSN-18419836
61.	Multi-class sentiment analysis of social media data with machine learning algorithms	10.32604/cmc.2021.017827	The volume of social media data on the Internet is constantly growing. This has created a substantial research field for data analysts. The diversity of articles, posts, and comments on news websites and social networks astonishes imagination. Nevertheless, most researchers focus on posts on Twitter that have a specific format and length restriction. The majority of them are written in the English language. As relatively few works have paid attention to sentiment analysis in the Russian and Kazakh languages, this article thoroughly analyzes news posts in the Kazakhstan media space. The amassed datasets include texts labeled according to three sentiment classes: positive, negative, and neutral. The datasets are	Mutanov G,Karyukin V,Mamykova Z. Computers, Materials and Continua Том 69, Выпуск 1, Страницы 913 - 9302021.ISSN-15462218

			highly imbalanced, with a significant predominance of the positive class. Three resampling techniques (undersampling, oversampling, and synthetic minority oversampling (SMOTE)) are used to resample the datasets to deal with this issue. Subsequently, the texts are vectorized with the TF-IDF metric and classified with seven machine learning (ML) algorithms: naïve Bayes, support vector machine, logistic regression, k-nearest neighbors, decision tree, random forest, and XGBoost. Experimental results reveal that oversampling and SMOTE with logistic regression, decision tree, and random forest achieve the best classification scores. These models are effectively employed in the developed social analytics platform. © 2021 Tech Science Press. All rights reserved.	
62.	Application of system-dynamic modeling to improve distribution logistics processes in the supply chain	10.26552/com.C.2020.3.29-39	This article presents an approach of improve logistics processes with the system dynamics modeling of two different processes scenarios. System dynamics is used, not only as a causal loop diagram, but calculated measures of end-user satisfaction indicators were provided by experts, as well. Literature review of fundamental definitions and recent ideas in subject of supply chain management (SCM), system dynamics (SD), business processes model and notation (BPMN) and distribution logistics for dozens of major sources, has been made. In the work, methods of expert interviews, content analysis of recent publications, system-dynamic modeling and business process modeling, were used. Developed BPMN-models of distribution logistics business processes are given in Appendices #1 and #2	Communications - Scientific Letters of the University of Zilina Том 22, Выпуск 3, Страницы 29 - 398 July 2020ISSN-13354205
63.	Applied research of data management in the education system for decision-making on the example of Al-Farabi Kazakh National University	10.1051/e3sconf/202015909003	In the context of the university digital transformation, the development of digitalization processes, it is necessary to introduce a data management culture. In most cases, this approach does not allow to see a big picture, as well as to identify bottlenecks. There is a need to develop a unified data management strategy, which will assess the value of IT technology, and ensure the adoption of effective decisions. This article highlights the conceptual issues of data management strategies in higher education, using the example of the university. The place of the data processing strategy within the university's information space is considered a map model for	Mutanov G,Mamykova Z,Kopnova O,Bolatkhan M. E3S Web of Conferences Том 15924 ,March 2020 ,Номер статьи 090031st International Conference on Business Technology for a Sustainable Environmental System, BTSES 2020 Almaty19 March 2020 до 20 March 2020

			analyzing key issues for decision making. The basic principles of organizing a data strategy for the university are determined. There is also considered an approach to designing and implementing an information and analytical system on the Microsoft Power BI cloud-based business analysis platform, which integrates all disparate data from university's corporate information systems and transactional data sources. The analysis of reports of key business processes of the university is carried out, in which the formulation of research questions is shown, and there have been given conclusions to these issues. Introduction of the information and analytical system in the contour of the university's corporate information system will contribute to the early identification of bottlenecks in the organization of the educational system and prompt decision-making in a systematic and comprehensive analysis of the main business processes of the educational organization through building a data map and visualizing all statistical reports. © The Authors, published by EDP Sciences, 2020.	
64.	Measuring the knowledge-based performance efficiency in the oil-exported countries	10.14254/1800-5845/2020.16-3.9	The main challenge of natural resource-rich economies is to avoid the resource curse, poor economic growth, weak institutions and corruption through the development of state program, tended to the development of knowledge-based economy. This research evaluates the productivity of the gross regional product in the context of knowledge-based economy indicators taking into account industrial structure and specialization in regional economic. The focus is on the Republic of Kazakhstan as representative of the oil-exported countries. The feature selection analysis was implemented through a panel regression model and in the aim of evaluation of knowledge-based performance of state measures was used Malmquist Productivity Index in DEA. The data set of the research is obtained from the official statistical data of state structures during the period from 2007 to 2017 for the regions of Kazakhstan. The results indicate the need to develop differentiated approaches aimed at improving the efficiency of knowledge-based performance in the context of industry 4.0. The results can be used to adjust tactics and development strategies of state measures in knowledge-based performance. Through this paper we hope to give our contribution	Mutanov G,Zhuparova A,Zhaisanova D.Montenegrin Journal of Economics, Том 16, Выпуск 3, Страницы 109 - 1222020 ISSN-18005845

			to the creation Smart Specialisation strategies in emerging economy countries as a way to increase efficiency in research and innovation investments by integrating policy areas, applying a broad definition of innovations and stimulating collaboration-between regions, sectors and levels.	
65.	Model for determining classification of filling materials hardening	10.32014/2020.2518-170X.98	This paper presents the model for solving the problem of classification of trajectories of development of states of filling material in the presence of a priori information on the trajectories of processes that have already passed the development of states of the processes. Consideration of the hardening process of stowage material as a chemical-technological process, which can be considered as a multi-parameter dynamic (time) series, allows us to determine the development class of the state of the material based on the classification of the state of the stowage. The proposed approach has established the fundamental possibility of using the proposed methodology to solve the problem of dividing given trajectories represented by time series into classes. It allows us to obtain a model that, according to formal rules, determines the classification of trajectories by sets of heterogeneous features of its state at certain time and improves the reliability of the classification.	Arslanov M.Z,Mustafin S.A,Zeinullin A.A,Kulpeshov B.S,Mustafin T.S,Korobova E.B. News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences Том 5, Выпуск 443, Страницы 6 - 12 ISSN-22245278. DOI-10.32014/2020.2518-170X.98
66.	Review of some applications of unmanned aerial vehicles technology in the resource-rich country	10.3390/app112110171	The use of unmanned aerial vehicles (UAVs) in various spheres of human activity is a promising direction for countries with very different types of economies. This statement refers to resource-rich economies as well. The peculiarities of such countries are associated with the dependence on resource prices since their economies present low diversification. Therefore, the employment of new technologies is one of the ways of increasing the sustainability of such economy development. In this context, the use of UAVs is a prospect direction, since they are relatively cheap, reliable, and their use does not require a high-tech background. The most common use of UAVs is associated with various types of monitoring tasks. In addition, UAVs can be used for organizing communication, search,	Mukhamediev R.I,Symagulov A,Kuchin Y,Zaitseva E,Bekbotayeva A,Yakunin K,Assanov I,Levashenko V,Popova Y,Akzhalova A,Bastaubayeva S,Tabynbaeva L. Applied Sciences (Switzerland) Том 11, Выпуск 21 November-1 2021 Номер статьи 10171 DOI-10.3390/app112110171

			cargo delivery, field processing, etc. Using additional elements of artificial intelligence (AI) together with UAVs helps to solve the problems in automatic or semi-automatic mode. Such UAV is named intelligent unmanned aerial vehicle technology (IUAVT), and its employment allows increasing the UAV-based technology efficiency. However, in order to adapt IUAVT in the sectors of economy, it is necessary to overcome a range of limitations. The research is devoted to the analysis of opportunities and obstacles to the adaptation of IUAVT in the economy. The possible economic effect is estimated for Kazakhstan as one of the resource-rich countries. The review consists of three main parts. The first part describes the IUAVT application areas and the tasks it can solve. The following areas of application are considered: precision agriculture, the hazardous geophysical processes monitoring, environmental pollution monitoring, exploration of minerals, wild animals monitoring, technical and engineering structures monitoring, and traffic monitoring. The economic potential is estimated by the areas of application of IUAVT in Kazakhstan. The second part contains the review of the technical, legal, and software-algorithmic limitations of IUAVT and modern approaches aimed at overcoming these limitations. The third part—discussion—comprises the consideration of the impact of these limitations and unsolved tasks of the IUAVT employment in the areas of activity under consideration, and assessment of the overall economic effect. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.	
67.	Evolutionary Strategies of Intelligent Agent Training	10.1007/978-3-030-30604-5_12	Groups of interacting agents are able to solve complex tasks in a dynamic environment. Robots in a group can have a simpler device than single stand-alone robots. Each agent in the group has the ability to accumulate interaction experience with the environment and share it with other members of the group. In many cases, the group behavior is not deduced from any properties of its parts. The paper proposes an approach to modeling the mobile agent group behavior that is busy with a common goal. The main purpose of the agents is to study the greatest territory at minimal time. The agents interact with the environment. A control of each agent is carried out by a modified neural network with restrictions imposed on it.	Akzhalova A,Inoue A,Mukharsky D. Advances in Intelligent Systems and Computing Том 1051, Страницы 135 - 1452020 40th Anniversary International Conference on Information Systems Architecture and Technology, DOI-10.1007/978-3-030-30604-5_12

			Weights of the neural network are chosen by a genetic evolution method. The agents compete among themselves for obtaining the greatest reward from the environment. An efficiency of the proposed model is confirmed by some convergence speed tests by computer simulation. The proposed model can be applied to a group of robots that perform search tasks in a real physical space. © Springer Nature Switzerland AG 2020.	
68.	Interaction of Adjacent Smart Traffic Lights During Traffic Jams at an Intersection	10.18576/amis/150316	The present paper aims to study based on the movement in the transport system of Almaty, to develop an intelligent adaptive traffic light control system. The relevance of the topic under study has been substantiated. A conceptual scheme for adaptive traffic light control and a module for calculating traffic flow parameters have been developed. This allows to monitor traffic parameters and collect statistics to further improve road safety. © 2021 NSP Natural Sciences Publishing Cor. All Rights Reserved	Mansurova M.E,Belgibaev B.A,Ixanov S.S,Karimsakova D.T,Zhamangarin D.S. Applied Mathematics and Information Sciences Том 15, Выпуск 3, Страницы 383 - 393.2021 DOI-10.18576/amis/150316
69.	Kinetics of hydrogen generation from oxidation of hydrogenated silicon nanocrystals in aqueous solutions	10.3390/nano10071413	Hydrogen generation rate is one of the most important parameters which must be considered for the development of engineering solutions in the field of hydrogen energy applications. In this paper, the kinetics of hydrogen generation from oxidation of hydrogenated porous silicon nanopowders in water are analyzed in detail. The splitting of the Si-H bonds of the nanopowders and water molecules during the oxidation reaction results in powerful hydrogen generation. The described technology is shown to be perfectly tunable and allows us to manage the kinetics by: (i) varying size distribution and porosity of silicon nanoparticles; (ii) chemical composition of oxidizing solutions; (iii) ambient temperature. In particular, hydrogen release below 0◦C is one of the significant advantages of such a technological way of performing hydrogen generation. © 2020 by the authors. Licensee MDPI, Basel, Switzerland.	Mussabek G,Alekseev S.A,Manilov A.I,Tutashkonko S,Nychyporuk T,Shabdan Y,Amirkhanova G,Litvinenko S.V,Skryshevsky V.A,Lysenko V. Nanomaterials Том 10, Выпуск 7, Страницы 1 - 14 July 2020 Номер статьи 1413 DOI-10.3390/nano10071413
70.	Multi-start method with deterministic restart mechanism	10.21638/11701/SPBU10.2020.202	The work is devoted to the development and study of a method for solving global optimization problems with interval constraints. The paper proposes a global optimization algorithm based on a deterministic method of selecting starting points for local search	Amirkhanova G.A,Gorchakov A.Y,Duysenbaeva A.Z,Posypkin M.A. Vestnik Sankt-Peterburgskogo Universiteta, Prikladnaya Matematika,

			methods. The starting points are the extremum points of functions of one variable, obtained by restricting the objective function to straight, collinear coordinate vectors. The effectiveness of the proposed algorithm is demonstrated by the example of the problem of minimizing the energy of a fragment of a flat crystal lattice. The energy of interatomic interaction is calculated using the Tersoff potential. An experimental comparison is made of the developed algorithm with the classical version of the multi-start method, in which pseudo-random points uniformly distributed in the parallelepiped are used to select starting points. As a local search method, in both cases, one of the modifications of the coordinate wise descent method is used. The developed method can be applied to problems with an unknown analytical expression for an objective function that is often encountered in practice.	Informatika, Protsessy Upravleniya Том 16, Выпуск 2, Страницы 100 - 111 June 2020 DOI- 10.21638/11701/SPBU10.2020.202
71.	Silicon nanostructures for solar hydrgen generation: Advantage and perspectives		Nowadays, modern technical solutions in various spheres of human activity from the opto-electronics up to nanobiotechnology are increasingly dependent on the level of technology. Applied research on nanomaterials plays a key role in the development of nanotechnologies. The nanostructured silicon is one of the materials attracting the special attention of researchers in various applied areas. A new and widely discussed application of nanostructured silicon is a possibility of their usage in the process of efficient hydrogen generation. The present paper is devoted to a brief review of recent advances in the study of the applicability of porous silicon nanostructures for hydrogen generation. The main possible mechanisms of the photocatalytic activity of silicon nanostructures, as well as the influence of such parameters as their shape, size and degree of surface development on the hydrogen generation efficiency of the material are discussed. In addition, based on literature overview, an analysis regarding the most likely paths for the development of this area of semiconductor materials science and an assessment of the feasibility of using silicon nanostructures for hydrogen generation has been made.	Mussabek, G., Yermukhamed, D., Shokobaeva, G., Amirkhanova G., Sivakov, V. International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM
72.	Sybil Attack	10.1109/AICT5017	There are many vulnerabilities to attack in wireless sensor networks.	Zhukabayeva T.K,Mardenov

	Detection in Wireless Sensor Networks	6.2020.9368790	Among them, the sybil attack is especially malicious to generate many false nodes and enter false information on the network. They are detrimental to many functions of the FSU, such as data pooling, fair distribution of resources, etc. Therefore, it is crucial to protect and detect Sybil attacks. The Sybil attack has a significant impact on network performance, and once it was detected, network performance will be obviously improving.In this article, we consider a new method of detecting Sybil attacks using random keys. In the proposed method, signs are used that there is a weak connection between the group of normal nodes and the group of false nodes. Experiment results show that the proposed method detects a false node with a probability of more than 90% with a small energy consumption. © 2020 IEEE.	E.M,Abdildaeva A.A. 14th IEEE International Conference on Application of Information and Communication Technologies, AICT 20s DOI-10.1109/AICT50176.2020.9368790
73.	Expert System for Assessing the Efficiency of Information Security	10.1109/ICEEE49618.2020.9102555	The paper considers an expert system that provides an assessment of the state of information security in authorities and organizations of various forms of ownership. The proposed expert system allows to evaluate the state of compliance with the requirements of both organizational and technical measures to ensure the protection of information, as well as the level of compliance with the requirements of the information protection system in general. The expert assessment method is used as a basic method for assessing the state of information protection. The developed expert system provides a significant reduction in routine operations during the audit of information security. The results of the assessment are presented quite clearly and provide an opportunity for the leadership of the authorities and organizations to make informed decisions to further improve the information protection system. © 2020 IEEE.	Erulanova A,Soltan G,Baidildina A,Amangeldina M,Aset A. 2020 7th International Conference on Electrical and Electronics Engineering, ICEEE 2020 Страницы 355 - 359April 2020 Expert System for Assessing the Efficiency of Information Security ISBN-978-172816788-6 DOI-10.1109/ICEEE49618.2020.9102555
74.	Developing the system of collecting, storing and processing information from solar collectors	10.24425/ijet.2021.135945	The article herein presents a new technique of controlling the system of collecting, storing and processing the information from the solar collectors, which might be applied to heating the industrial and domestic compartments for hot water supply. The most profitable usage of the solar collectors in the industry is replacement of a human interference with wireless sensor nets. The solar collector standard system consumes in average 30% of the heat due to poor control and configuration. Our monitoring and control system	Wojcik W,Amirgaliyev Y,Kunelbayev M,Kalizhanova A,Kozbakova A,Sundetov T,Yedilkhan D. International Journal of Electronics and Telecommunications Том 67, Выпуск 1, Страницы 65 - 702021 ISSN-20818491 DOI-10.24425/ijet.2021.135945

			allows upgrade the performance of heating the industrial and domestic premises by means of solar collector for hot water supply. © 2021 Polish Academy of Sciences. All rights reserved.	
75.	Determination of the main parameters of the photovoltaic solar module	10.1051/e3sconf/202019101004	This article deals with the determination of the main operating parameters of a photovoltaic solar module. In laboratory tests, the study of the dependence of current, voltage and power on time and density of solar radiation, as well as monitoring of environmental parameters: temperature and humidity of the outside air. Analysis of the test results shows that a photoelectric module with an installed capacity of 800 W and a total battery capacity of 800 Ah provides the electric power industry with a daily consumption of 2.0.. 2.2 kWh. The discharge time of the battery varies from 11.7 to 3.5 hours when the average electric load of the consumer changes from 300 to 1000 watts. © 2020 The Authors, published by EDP Sciences.	Urmashev B.A,Kunelbayev M,Temirbekov A.N,Kassenov S,Zhaksylykova Z,Amenova F. E3S Web of Conferences Том 19124 September 2020 Номер статьи 010043rd DOI-10.1051/e3sconf/202019101004
76.	Computation of heat transfer on flat solar collector upper surface and power balance of solar heat supply system	10.30534/ijatcse/2020/208942020	In the work herein there is considered the heat transfer computation at the solar collector and environment boundaries and solar heat supply system energy balance. Heat exchange and heat transfer occur simultaneously by several means: conduction, convection and irradiation. Role of heat transfer in solar collector total heat transfer means is different and depends both on its material elements' thermal-physical characteristics and air medium, circumfluous solar collector's external and internal surfaces We have computed the solar power value from the horizontal surface for summer and autumn seasons in the Republic of Kazakhstan. © 2020, World Academy of Research in Science and Engineering. All rights reserved.	Yedilkhan D,Kunelbayev M,Kozbakova A,Auelbekov O,Katayev N,Amirgaliyev M. International Journal of Advanced Trends in Computer Science and Engineering Том 9, Выпуск 4, Страницы 5601 - 5607 DOI-10.30534/ijatcse/2020/208942020
77.	Mathematical Substantiation of Principal Parameters of Thermosiphon Effect for Solar Heating	10.1109/ICECCE49384.2020.9179218	An article hereby considers the thermosyphon circulation solar collector main parameters for the solar heat supply system. To fulfill the given task there has been stipulated a new thermosyphon circulation flat solar collector's construction having been developed by us, in which the thermal transmission coefficient has been increased at the expense of removing the additional partitions between a panel and heat insulation. Being considered solar collector's efficiency is reached owing to the availability of a tank-	M.Kunelbayev,Ormanov T,Sundetov T,Amirgaliyev M. 2nd International Conference on Electrical, Communication and Computer Engineering, ICECCE 2020 June 2020 Номер статьи 9179218 2nd International Conference on Electrical, Communication and

			dozer and thermal pump in the construction herein, where a condenser and evaporator have been executed in the form of a heat-exchanger of «spiral in spiral» type, and heat exchangers pipe connections are laid one above another, which allows increasing the square and heat exchange intensity. Outcome of the work herein is description of the mathematical analysis of the heat transmission process in the tank-accumulator jointly with the initial and boundary conditions. We have shown a heat carrier thermophysical parameters dependence on the temperature, which is shown with equations. We have solved the equation of a heat carrier motion along the base-collector circuit line under the thermosyphon effect influence. © 2020 IEEE.	Computer Engineering, ICECCE 2020Istanbul12 June 2020 до 13 June 2020 10.1109/ICECCE49384.2020.9179218
78.	Methodology of computing electric energy consumption by thermal pump system and seasonal efficiency	10.24247/ijmperdapr2020118	The present article has studied the thermal pimp system of air-water type, maintaining heat production for the building in Almaty (Kazakhstan). The thermal pump system's working mode in winter time is considered as intermittent. Thermal pump system's heat characteristics, environment external temperature values have been conducted using the real data. The methodology for calculating the energy consumption and seasonal efficiency of the heat pump was calculated. The minimum temperature for heating the heat pump is determined, and the duration of operation at the temperature of the outside air is also calculated. © TJPRC Pvt. Ltd.	Kunelbayev M,Yedilhan D,Amirgaliyev B,Auelbekov O,Katayev N. International Journal of Mechanical and Production Engineering Research and Development Том 10, Выпуск 2, Страницы 1227 - 1244April 2020 DOI-10.24247/ijmperdapr2020118
79.	Corona discharge based meters for manufacturing of conducting microwires	10.24425/ijet.2021.135977	The wide variety of electrode shapes and their arrangement relative to each other, as well as the possibility of corona discharge in the ambient air, have created prerequisites for the development of a number of new methods and corona discharge transducers designed to measure microwire parameters and linear dimensions of various objects. The principally new non-contact control method is based on the dependence of the corona discharge current value on the diameter of the corona wire placed inside the discharge chamber. This paper provides an overview of this method. © 2021 Polish Academy of Sciences. All rights reserved.	Tergeussizova A.S,Bakhtaev S.A,Wojcik W,Aitchanov B.H,Mussapirova G.D,Toygozhinova A.Zh. International Journal of Electronics and Telecommunications Том 67, Выпуск 2, Страницы 283 - 2882021 10.24425/ijet.2021.135977
80.	Measurement of linear parameters of	10.24425/ijet.2021.135955	On the basis of a unipolar corona discharge, a method of non-contact and continuous measurement of linear parameters of thin and ultra-	Tergeussizova A.S,Bakhtaev S.A,Wojcik W,Romaniuk R,Aitchanov

	dielectric filaments based on the corona discharge		thin dielectric fibres and optical fibres (10 to 125 microns) in the process of their manufacture was developed. The measurement method differs from the commonly known methods by high accuracy and reliability of measurement and resistance to changes in the electrical characteristics of the discharge gap and the state of ambient air. © The Author(s).	B.H,Mussapirova G.D,Toygozhinova A.Zh. International Journal of Electronics and Telecommunications Том 67, Выпуск 1, Страницы 133 - 1382021 ISSN-20818491 DOI-10.24425/ijet.2021.135955

1.	RISK ASSESSMENT OF INVESTMENT LOSSES AIMED AT THE DEVELOPMENT OF SMART CITY SYSTEMS	ISSN: 1992-8645, E-ISSN: 1817-3195	In the article is suggested a model for the computing core for the decision support system (DSS) in assessing the risks of investment loss during the dynamic planning (DP) of SmartCity development. Unlike existing solutions, the suggested model gives specific recommendations for assessing the risks of loss. If the risk forecast is unsatisfactory, flexible adjustment of the investment process parameters is possible in order to achieve an acceptable financial result for the parties. The novelty of scientific results consists in the fact that for the first time it is suggested to apply a new class of bilinear multi-step games. This class allowed us to adequately describe the process of risk assessment of investment loss, using the example of dynamic planning for the placement of players' financial resources in SmartCity projects. A distinctive feature of the considered approach is the use of tools based on the solution of a bilinear multi-step game of both quality with several terminal surfaces and a degree game solved in the class of mixed strategies. Computational experiments were carried out in the Maple mathematical modeling package. An DSS was developed in which a risk assessment model is implemented. The developed DSS allows you to reduce the discrepancy between the data of forecasting the risks of investment loss during SmartCity and real return on investment. The model presented in the paper is based on solving a linear multistep degree game using the results of solving a multistep quality game with multiple terminal surfaces. The problem in the article is considered in the statement, standard for a multi-step game.	LAKHNO V., KARTBAYEV T., MALYUKOV V., USKENBAYEVA R., TOGZHANOVA K., ALIMSEITOVA ZH., BEKETOVA G., TURGYNBAYEVA A. RISK ASSESSMENT OF INVESTMENT LOSSES AIMED AT THE DEVELOPMENT OF SMART CITY SYSTEMS 15th August 2021. Vol.99. No 15, ISSN: 1992-8645, E-ISSN: 1817-3195, pp.3683-3692.

2.	THE STABILITY INTERVAL OF THE SET OF LINEAR SYSTEM	DOI: 10.24425/ijet.2021.135958	The article considers the problem of stability of interval-defined linear systems based on the Hurwitz and Lienard- Shipar interval criteria. Krylov, Leverier, and Leverier- Danilevsky algorithms are implemented for automated construction and analysis of the interval characteristic polynomial. The interval mathematics library was used while developing the software. The stability of the dynamic system described by linear ordinary differential equations is determined and based on the properties of the eigenvalues of the interval characteristic polynomial. On the basis of numerical calculations, the authors compare several methods of constructing the characteristic polynomial. The developed software that implements the introduced interval arithmetic operations can be used in the study of dynamic properties of automatic control systems, energy, economic and other non-linear systems.	Talgat Mazakov, Waldemar Wójcik, Sholpan Jomartova, Nurgul Karymsakova, Gulzat Ziyatbekova, and Aisulu Tursynbai. THE STABILITY INTERVAL OF THE SET OF LINEAR SYSTEM // JOURNAL OF ELECTRONICS AND TELECOMMUNICATIONS, 2021, VOL. 67, NO. 2, PP. 155-161 DOI: 10.24425/ijet.2021.135958
3.	Automated system for monitoring the threat of waterworks breakout	ISSN: 1992-8645, E-ISSN: 1817-3195.	The article is devoted to the creation of an automated system for monitoring the water level in reservoirs to prevent the breakthrough of weirs and dams. The paper offers hardware and software for monitoring the reservoir occupancy with prompt notification of interested organizations (local administrations) and local emergency departments. The article developed an automated system for monitoring the water level in a reservoir, which allows to get real-time information about the relative humidity and air temperature, the distance from the dam crest to the water surface in the reservoir. Based on the information received, the system allows to estimate the forecast time of increasing the volume of water level from the current to the critical level and inform the population about the state of the reservoir.	Mazakov T., Jomartova Sh., Ziyatbekova G., Aliaskar M. Automated system for monitoring the threat of waterworks breakout // Journal of Theoretical and Applied Information Technology, 2020. – Vol. 98, – No 15. – Pp. 3176-3189. ISSN: 1992-8645, E-ISSN: 1817-3195.
4.	The image processing algorithms for biometric identification by fingerprints	https://doi.org/10.32014/2020.2518-170X.2	The article discusses image processing algorithms for biometric fingerprint identification. The identification features of the structure of papillary patterns on the fingers have been studied taking into account the fact that different pressure, speed, direction, ambient temperature and humidity level lead to different images. Due to various digital image processing and analysis algorithms such as: the SIFT descriptor, as well as the closest competitor, the SURF descriptor, it is possible to quickly obtain unique characteristics for each image. This study used a database of photographs obtained from open sources – the Fingerprint Verification Competition 2004	T.Zh. Mazakov, Sh.A. Jomartova, G.Z. Ziyatbekova, T.S. Shormanov, B.S. Amirkhanov, P. Kisala. The image processing algorithms for biometric identification by fingerprints. Series of Geology and Technical Sciences, 2020. – Vol. 1, - No 439. – P. 14-22. ISSN 2518-170X (Online), ISSN 2224-5278 (Print).

			(FVC2004). As a result of the work, the graphic image of the matching key points, as well as the number of matched key points by fingerprints, have been investigated. Search key points is performed using the Hesse matrix. The determinant of the Hesse matrix (Hessian) reaches the extremum at the points of maximum variation of the brightness gradient. Fingerprints were obtained using the optical sensor "Cross Match V300". The experimental study showed that the developed software system has invariance to image rotations.	https://doi.org/10.32014/2020.2518-170X.2
5.	Mathematical modeling forecasting of consequences of damage breakthrough	https://doi.org/10.32014/2020.2518-170X.111	The article is devoted to the development of a mathematical model for preventing a breakthrough of a dam and predict its possible consequences. In this work, the task of developing a single integrated approach to ensuring the safe operation of hydraulic structures, based on the notification of interested bodies in real time, was solved. A mathematical model of the state of the reservoir is developed, on the basis of which a hardware-software complex for operational notification of interested organizations (akimats) and local emergency departments is implemented. A mathematical model of predicting the consequences of a dam break is proposed. An algorithm for calculating the maximum level of the breakout wave has been formulated, taking into account many parameters of the hydraulic structures. The convergence of the developed algorithm in the form of a theorem has been proved. This method has a large practical focus, compared with existing formulas. The Java language implements a hardware-software complex (PAC) for predicting the effects of a dam break, consisting of the following modules: 1) a module for receiving and transmitting current information about the water level, humidity and temperature on the crest of the dam; 2) a module for processing constant and operational information about the threat of dam breakthrough (server); 3) a module for predicting the effects of a dam break. Based on the solution of the model problem, the effectiveness of the developed hardware-software complex is shown. The practical basis for the model task was the events that took place in Kyzylagash village of Almaty region of the Republic of Kazakhstan.	T. Zh. Mazakov, P. Kisala, Sh. A. Jomartova, G.Z. Ziyatbekova, N. T. Karymsakova. Mathematical modeling forecasting of consequences of damage breakthrough Series of Geology and Technical Sciences. – 2020. – Vol. 5, No 403. – Pp. 116-124. // https://doi.org/10.32014/2020.2518-170X.111.

6.	Universal complex of psychophysiological testing	https://doi.org/10.32014/2020.2518-1726.10	An experimental version of the system of psychological testing with fixation in real time of physiological parameters of the tested person has been developed. The Data of photoplethysmogram (PPG) and galvanic skin reaction (GSR) have been determined as sources of physiological data. The soft & hardware complex of psychophysiological testing allows in relation to each question of the test to capture and evaluate the psychophysiological state of the testing person, which provides additional information for the psychologist. For experimental tests two methods were chosen, the first one was the Buss-Durkee technique (BDHI), which allows to diagnose the aggressiveness of the individual, and the second was the method of assessing the neuropsychological stability. These tests are recommended for use in psychological selection for military service [1-2]. The tests are adapted to the Kazakh language and tested on cadets of military institutions and students of civil Universities in Almaty.	T.Zh. Mazakov, Sh.A. Jomartova, Waldemar Wojcik, G.Z. Ziyatbekova, B.S. Amirkhanov, B.R. Zholmagambetova. Universal complex of psychophysiological testing // News of the National Academy of Sciences of the Republic of Kazakhstan. Physical-mathematical series, 2020. – Vol. 2, - No 330. – P. 14-22. ISSN 2518-1726 (Online), ISSN 1991-346X (Print) https://doi.org/10.32014/2020.2518-1726.10 (Scopus, процентиль 35)
7.	Global output tracking control for high-order non-linear systems with time-varying delays	ISSN: 1992-8645; E-ISSN: 1817-3195	This paper studies the problem of global practical output tracking for a class of high-order non-linear systems with time-varying delays under the weaker conditions on the system nonlinearities. With the help of an appropriate Lyapunov-Krasovskii functionals and by using the method of adding a power integrator, a continuous state-feedback controller is successfully designed such that all the states of the resulting close loop system are bounded while the output tracking error converges to an arbitrarily small residual set. A numerical example demonstrates the effectiveness of the result.	Alimhan, K., Tasbolatuly, N., Yerdenova, A. Article Global output tracking control for high-order non-linear systems with time-varying delays Journal of Theoretical and Applied Information Technology, 2021, 99(13), стр. 3337–3352
8.	Morphology Model and Segmentation for Old Turkic Language	https://doi.org/10.1007/978-3-030-88081-1_47	Old Turkic language is the basis of all modern Turkic languages. Its study is very important for Turkic peoples who possess modern Turkic lan-guages. This is important both from a historical point of view and for the study of modern issues of neural machine translation, issues of the linguistic distance of modern Turkic languages from their progenitor. This paper proposes the de-velopment of a computational model of the morphology of Old Turkic language based on the CSE (Complete Set of Endings) – model of morphology and a study on this basis of the issue of morphological segmentation of the texts of Old Turkic language, which will subsequently be used for neural machine translation of	Zhanabergenova D., Tukeyev U. (2021) Morphology Model and Segmentation for Old Turkic Language. In: Nguyen N.T., Iliadis L., Maglogiannis I., Trawiński B. (eds) Computational Collective Intelligence. ICCCI 2021. Lecture Notes in Computer Science, vol 12876. Springer, Cham. https://doi.org/10.1007/978-3-030-88081-1_47

			Old Turkic language into modern Turkic languages. Since most of the modern Turkic languages, except for the Turkish language, belong to low-resource languages, the issues of developing computational models of morphology, developing mod-els, algorithms and software for processing Turkic languages are relevant.	
9.	Universal Programs for Stemming, Segmentation, Morphological Analysis of Turkic Words	https://doi.org/10.1007/978-3-030-88081-1_48	In this paper are proposed universal programs for Turkic languages stemming, segmentation, morphological analysis based on the "complete set of endings" (CSE) model of Turkic morphologies. The CSE-model is based on four types of endings: plural, case, personal, and possessive. For all Turkic languages, these four types of endings are similar. For each of considered NLP tasks is cre-ated a special relational data model – decision table. Relational data models – decision tables, algorithms and programs for stemming, segmentation, morpho-logical parsing is shown for the examples of the Kazakh language.	Tukeyev U., Karibayeva A., Turganbayeva A., Amirova D. (2021) Universal Programs for Stemming, Segmentation, Morphological Analysis of Turkic Words. Lecture Notes in Computer Science, vol 12876. Springer, Cham. https://doi.org/10.1007/978-3-030-88081-1_48
10.	Integrated Technology for Creating Quality Parallel Corpora	https://doi.org/10.1007/978-3-030-88113-9_41	What determines the quality of parallel corpora? Firstly, it is deter-mined by the quality of the translation. However, in this paper, we consider not the substantial quality of the translation, but the “technical” quality of parallel texts. Parallel texts are collected from different sources and often such texts have the following disadvantages: language mixing, font mixing, text alignment prob-lems, the need for manual correction of parallel texts. All these problems require, firstly, their recognition, and secondly, they need to be resolved, and with large volumes of parallel texts, performing these operations manually is a very time-consuming process. Therefore, the work proposes an integrated technology for creating parallel corpora, which allows to minimize the number of manual oper-ations. The authors present the technology as an example of a new linguistic re-source - an open Kazakh-English parallel corpus	Zhumanov Z., Tukeyev U. (2021) Integrated Technology for Creating Quality Parallel Corpora. In: Wojtkiewicz K., Treur J., Pimenidis E., Maleszka M. (eds) Advances in Computational Collective Intelligence. ICCCI 2021. Communications in Computer and Information Science, vol 1463. Springer, Cham. https://doi.org/10.1007/978-3-030-88113-9_41
11.	Development of Technology for Summarization of Kazakh Text	Digital Object Identifier (DOI): 10.14569/IJACSA.2021.0120914	This paper presents the solution to the problem of summarizing Kazakh texts. The problem of Kazakh text	Talgat Zhabayev and Ualsher Tukeyev. Development of Technology for Summarization of Kazakh Text. (IJACSA) International Journal of

			summarization is considered as a sequence of two tasks: extracting the most important sentences of the text and simplifying the received sentences. The task of extracting the most important sentences of the text is solved using the TF-IDF method and the task of simplifying sentences is solved using the neural network technology “Seq2Seq”. Problem of using NMT method for simplification of Kazakh was in absence of Kazakh dataset for training. To solve this problem in this work propose use transfer learning method. The use of transfer learning made it possible to use a ready-made model that was trained on a parallel corpus of Simple English Wikipedia and not create a simplification corpus in Kazakh from scratch. For this, a transfer learning technology for simplifying sentences of the Kazakh language has been developed, based on training a neural model for simplifying sentences in the English language. Main scientific contribution of this work is transfer learning technology for the simplification of Kazakh sentences using the parallel corpus of the English language simplification.	Advanced Computer Science and Applications, Vol. 12, No. 9, 2021, pp. 111-116. Digital Object Identifier (DOI): 10.14569/IJACSA.2021.0120914
12.	Applying machine learning techniques for religious extremism detection on online user contents	doi:10.32604/cmc.2022.019189	In this research paper, we propose a corpus for the task of detecting religious extremism in social networks and open sources and compare various machine learning algorithms for the binary classification problem using a previously created corpus, thereby checking whether it is possible to detect extremist messages in the Kazakh language. To do this, the authors trained models using six classic machine-learning algorithms such as Support Vector Machine, Decision Tree, Random Forest, K Nearest Neighbors, Naive Bayes, and Logistic Regression. To increase the accuracy of detecting extremist texts, we used various characteristics such as Statistical Features, TF-IDF, POS, LIWC, and applied oversampling and undersampling techniques to handle imbalanced data. As a result, we achieved 98% accuracy in detecting religious extremism in Kazakh texts for the collected dataset. Testing the developed machine learning models in various databases that are often found in everyday life “Jokes”, “News”, “Toxic content”, “Spam”, “Advertising” has also shown high rates of extremism detection.	Mussiraliyeva, S., Omarov, B., Yoo, P., Bolatbek, M. Applying machine learning techniques for religious extremism detection on online user contents. Computers, Materials and Continua, 2021, 70(1), стр. 915–934 , doi:10.32604/cmc.2022.019189

13.	Encryption and Re-Randomization Techniques for Malware Propagation	doi: 10.1109/ACCESS.2021.3112750	Encryption, which is essential for the protection of sensitive information can also transform any malicious content to illegible form, which can then reside in any network, undetected. Encryption of malicious payload is used by malware authors to mask their code, however, the objective of hiding the malicious code can be further improved by techniques of re-randomization. The concept of re-randomization using asymmetric cryptography has been emerged as a new area of interest for malware designers. Re-randomizing is a technique which can prevent detection of source path of a malware and makes it indistinguishable. This article extends the idea of using asymmetric cryptography for re-randomization and has proposed a novel scheme using Pailliar's asymmetric cryptosystem. Moreover, this research work illustrates the limitations of RSA for malware re-randomization. A comprehensive performance analysis of the re-randomization techniques for various malware payloads is also presented, which can be used for the detection of re-randomized malware effectively. © 2013 IEEE. **Key words** ElGamal; environmental keys; homomorphic encryption; malware encryption; Paillier cryptosystem; re-encryption; RSA	A. R. Abbasi, M. Afzal, W. Iqbal, S. Mussiraliyeva, F. Khan and A. U. Rehman, "Encryption and Re-Randomization Techniques for Malware Propagation," in *IEEE Access*, vol. 9, pp. 132522-132532, 2021, doi: 10.1109/ACCESS.2021.3112750
14.	Applying Deep Learning for Extremism Detection.	https://doi.org/10.1007/978-981-16-3660-8_56	According to recent research, the use of social media to track the spread of radical ideas and extremist threats has attracted the attention of researchers for more than 10 years. In the last 3 years, there has been a surge in research interest in identifying and predicting based on the analysis of the text content of messages in open social networks as extremists actively use social networks and the number of calls to extremism and the number of recruitment through social networks is growing. In this paper, we consider an important applied problem of using deep learning methods to identify potential extremist and terrorist information on the Internet. It provides an overview of existing solutions and approaches and offers its own method for detecting online extremism. The applicability and effectiveness of the proposed method is demonstrated experimentally on a reference set of real data potentially containing extremist information. The results of the	S. Mussiraliyeva, M. Bolatbek, B. Omarov, Z. Medetbek, G. Baispay, R. Ospanov and Yeltay Zh., (2021) Applying Deep Learning for Extremism Detection. In: Luhach A.K., Jat D.S., Bin Ghazali K.H., Gao XZ., Lingras P. (eds) Advanced Informatics for Computing Research. ICAICR 2020. Communications in Computer and Information Science, vol 1393. Springer, Singapore. https://doi.org/10.1007/978-981-16-3660-8_56

			experiment show high accuracy in detecting extremist messages. © 2021, Springer Nature Singapore Pte Ltd. Ключевые слова автора Classification; Deep learning; Extremism; Machine learning; NLP	
15.	Bigram Based Deep Neural Network for Extremism Detection in Online User Generated Contents in the Kazakh Language	https://doi.org/10.1007/978-3-030-88113-9_45	Countering the spread of aggressive information and extremism in the global network is an urgent problem of society and government agencies, which is solved in particular by filtering unwanted Internet resources. A necessary condition for such filtering is the classification of the content of websites, texts and documents of the information flow. Therefore, an urgent problem of information technologies is the classification of texts in natural languages in order to detect extremist texts, such as calls for extremism and other messages that threaten the security of citizens. Therefore, our research examines the detection of extremist messages in online content in the Kazakh language. To do this, we have collected a corpus of extremist texts from open sources, developed a deep neural network based on bigrams for detecting extremist texts in the Kazakh language. The proposed model has shown high efficiency in comparison with classical methods of machine learning and deep learning. © 2021, Springer Nature Switzerland AG.	Mussiraliyeva S., Omarov B., Bolatbek M., Bagitova K., Alimzhanova Z. (2021) Bigram Based Deep Neural Network for Extremism Detection in Online User Generated Contents in the Kazakh Language. Rodos, Greece, October 2021. In: Wojtkiewicz K., Treur J., Pimenidis E., Maleszka M. (eds) Advances in Computational Collective Intelligence. ICCCI 2021. Communications in Computer and Information Science, vol 1463. Springer, Cham. https://doi.org/10.1007/978-3-030-88113-9_45
16.	Detection of Extremist Ideation on Social Media Using Machine Learning Techniques	https://doi.org/10.1007/978-3-030-63007-2_58	At present, the number of terrorist attacks carried out by lone terrorists under the influence of propaganda and extremist ideology, as well as by organized terrorist communities with a network and poorly connected structure, is increasing. The main means of information exchange, recruitment and promotion for such structures is the Internet, namely web resources, social networks and e-mail. In this regard, the task of detecting, identifying topics of communication, connections, as well as monitoring the behavior and forecasting of threats emanating from individual users, groups and network communities that generate and distribute terrorist and extremist information on the Internet arises. The paper is devoted to the research and application of machine learning methods aimed at solving the problems of detecting potentially dangerous information on the Internet. The study examines the development of a corpus in	Mussiraliyeva S., Bolatbek M., Omarov B., Bagitova K. (2020) Detection of Extremist Ideation on Social Media Using Machine Learning Techniques. In: Nguyen N.T., Hoang B.H., Huynh C.P., Hwang D., Trawiński B., Vossen G. (eds) Computational Collective Intelligence. ICCCI 2020. Lecture Notes in Computer Science, vol 12496. Springer, Cham. https://doi.org/10.1007/978-3-030-63007-2_58

			Kazakh language for detecting extremist messages, and explores machine learning algorithms that used to detect content that contains calls for terrorist attacks and propaganda materials. © 2020, Springer Nature Switzerland AG.	
17.	Deep Neural Network Model for Recognition of Speaker's Emotion	doi: 10.1109/PICST51311.2020.9468017	The article is devoted to the development of neural network tools for recognizing the speaker's emotions. It is determined that a deep neural network of the multi-layer perceptron type is the most effective when recognizing emotions on fixed fragments of a speech signal. The expediency of training the network on the examples of the TESS database is proved, where each individual record corresponds to one of the seven basic emotions. The architectural parameters of the neural network model are calculated based on the use of the specified speech corpus. The output neurons of the network are associated with 7 emotions. The number of hidden layers of neurons is 2. The number of neurons in each hidden layer is 200. The input neurons of the network are associated with Mel-frequency cepstral coefficients (MFCC) of each of the quasi-stationary fragments of the speech signal. The expression is developed to calculate the number of input neurons depending on the number of Mel-frequency cepstral coefficients. The feasibility of describing one quasi-stationary fragment with 20 Mel-frequency cepstral coefficients was determined by computer experiments. At an acceptable level of resource intensity, the developed neural network model allows to achieve an accuracy of emotion recognition of about 0.94, which corresponds to known tools of similar purpose. The necessity of further research is justified in the direction of developing a method for neural network recognition of the speaker's emotions using CNN. © 2020 IEEE.	S. Toliupa, I. Tereikovskyi, L. Tereikovska, S. Mussiraliyeva and K. Bagitova, "Deep Neural Network Model for Recognition of Speaker's Emotion," 2020 IEEE International Conference on Problems of Infocommunications. Science and Technology (PIC S&T), 2020, pp. 172-176, doi: 10.1109/PICST51311.2020.9468017
18.	On detecting online radicalization and extremism using natural language processing	DOI: 10.1109/ACIT50332.2020.9300086	Due to the activity of terrorist propaganda on the Internet and social networks, as well as given the high dynamics of the emergence of new sites and accounts of extremist orientation, it is important to quickly detect content that demonstrates a tendency to extremism in the prevention of extremist and terrorist activities. This article is intended to explore the possibilities of automatic recognition of extremist content using machine learning from this point of view.	S. Mussiraliyeva, M. Bolatbek, B. Omarov, Z. Medetbek, G. Baispay and R. Ospanov, "On Detecting Online Radicalization and Extremism Using Natural Language Processing," 2020 21st International Arab Conference on Information Technology (ACIT), 2020,

			This article is devoted to the application of machine learning methods for solving the problem of security, in part-countering terrorism and extremism using information from the Internet. © 2020 IEEE.	pp. 1-5, doi: 10.1109/ACIT50332.2020.9300086
19.	User Keystroke Authentication and Recognition of Emotions Based on Convolutional Neural Network	DOI: 10.1007/978-3-030-39162-1_26	The article is devoted to the problem of improving Biometric identification systems based on Keystroke Dynamics for recognizing emotions and authenticating users of information systems through the implementation of modern neural network solutions based on Convolutional Neural Network (CNN). It is established that the difficulties of such implementation are associated with coding the keystroke parameters to a form suitable for CNN processing. A coding procedure based on the presentation of fixed-size keystroke parameters in the form of a color square image is proposed. Each encoded text symbol corresponds to a separate point of the image and is characterized using the corresponding ASCII code and keystroke parameters such as the key hold time and the time between keystrokes. Experimental studies showed that the proposed coding procedure made it possible to use CNN for analyzing Keystroke Dynamics and achieve recognition error of emotions and personality at the level of the best modern recognition systems. © 2020, The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG.	Tereikovskyi, I., Tereikovska, L., Korystin, O., Mussiraliyeva, S., Sambetbayeva, User Keystroke Authentication and Recognition of Emotions Based on Convolutional Neural Network. In book: Advances in Intelligent Systems and Computing. 1126 AISC, 2020, pp 283-292, III.DOI: 10.1007/978-3-030-39162-1_26, January 2020
20.	Using the cuda technology to speed up computation in problems of chemical kinetics	https://doi.org/10.32014/2021.2518-1726.19	The main idea of the implementation is reducing the time for calculation and thereby implement a multi-user mode for users by placing it on a server with access via a web browser. To model the kinetics of chemical reacting systems were used 4th and 5th grade Runge-Kutta methods and to receive the index of advantages of this elaboration were written programs in C# for sequential computation on a central processor and was used a platform for parallel computation of CUDA on graphic processors. Parallelization of data during calculation on a GPU was performed by the distribution of the reaction to individual strands, when changes of the concentration was calculated over a given time interval of a certain substance. Parallelization is performed over all elementary	M. Sarsembayev, B. Urmashev, O. Mamyrbayev, M. Turdalyuly, T. Sarsembayeva. Using the cuda technology to speed up computation in problems of chemical kinetics Vol. 2, 336 (2021). – P. 39 – 47 DOI: doi.org/10.32014/2021.2518-1726.19

			reactions, with the increasing of the number of reactions in the mechanism, because of this the computation on the GPU has a noticeable gain in time	
21.	Digital Generators of a Pseudorandom Pulses Sequence AND Their Modeling With Use OF FPGA in the Environment Cad Quartus II	https://doi.org/10.32014/2020.2518-1726.87	The paper considers the functional modeling of digital generators of a pseudo and ompulses sequence based on FPGAs in the environment of the computer-aided design system (CAD) QUARTUS II by Altera, which supports all stages of designing digital devices based on programmable and reconfigurable logics. Digital generators of a pseudo and ompulses sequence of the Fibonacci or Galois configuration are built on linear feedback shift registers with XOR logic gates. Using the QUATUS II CAD system, the project was compiled, the RTL circuits of digital generators of a pseudo and ompulses sequence were synthesized and obtained, their functional modeling was performed, and the timing diagrams of the circuits operation were constructed. Thus, the problem of developing a circuit for a digital generator of a pseudo and ompulses sequence based on the linear feedback shift registers using FPGAs in the Quartus II CAD environment is relevant and is of practical interest in using it to protect confidential speech information at creating cryptographic keys for encrypted data transmission. In order to provide improved cryptographic strength of generated sequences with a relatively long period and good statistical properties by improving the scheme of the LFSR shift algorithm generator with a complicated timing scheme	Seilova N.A., Dzhuruntaev D.Z., Mamyrbayev O.Zh., Batyrgaliev A.B., Turdalyuly M. Digital Generators of a Pseudorandom Pulses Sequence AND Their Modeling With Use OF FPGA in the Environment Cad Quartus II // News of the National Academy of Sciences of the Republic of Kazakhstan Physico-Mathematical Series. – 2021. – Vol. 5, 339 (2021). – P. 83 – 90 DOI: doi.org/10.32014/2020.2518-1726.87
22.	Grammatical categories determination for Turkish and Kazakh languages based on machine learning algorithms and fulfilling dictionaries	https://doi.org/10.15587/1729-4061.2021.238743	This research is aimed at identifying the parts of speech for the Kazakh and Turkish languages in an information retrieval system. The proposed algorithms are based on machine learning techniques. In this paper, we consider the binary classification of words according to parts of speech. We decided to take the most popular machine learning algorithms. In this paper, the following approaches and well-known machine learning algorithms are studied and considered. We defined 7 dictionaries and tagged 135	Yerimbetova, A., Tussupova, M., Sambetbayeva, M., Turdalyuly, M., & Sakenov, B. (2021). Grammatical categories determination for Turkish and Kazakh languages based on machine learning algorithms and fulfilling dictionaries of link grammar parser // Eastern-European Journal of Enterprise Technologies. – 5 (2 (113), P. 55–65.

	of link grammar parser		million words in Kazakh and 9 dictionaries and 50 million words in the Turkish language. The main problem considered in the paper is to create algorithms for the execution of dictionaries of the so-called Link Grammar Parser (LGP) system, in particular for the Kazakh and Turkish languages, using machine learning techniques. The focus of the research is on the review and comparison of machine learning algorithms and methods that have accomplished results on various natural language processing tasks such as grammatical categories determination. For the operation of the LGP system, a dictionary is created in which a connector for each word is indicated – the type of connection that can be created using this word. The authors considered methods of filling in LGP dictionaries using machine learning. The complexities of natural language processing, however, do not exclude the possibility of identifying narrower tasks that can already be solved algorithmically: for example, determining parts of speech or splitting texts into logical groups. However, some features of natural languages significantly reduce the effectiveness of these solutions. Thus, taking into account all word forms for each word in the Kazakh and Turkish languages increases the complexity of text processing by an order of magnitude	https://doi.org/10.15587/1729-4061.2021.238743
23.	Applying machine learning to detect depression-related texts on social networks	DOI https://doi.org/10.1007/978-981-16-3660-8_15	This interdisciplinary study is aimed at determining the informative signs of behavior of users of the social network Vkontakte of the Kazakh segment in connection with the level of severity of signs of depression in them. We applied six machine learning algorithms with different features to depression related post detection problem. Our experimental results show that the problem can be successfully solved and applied to detect depressive or suicidal behavior or texts in online user contents. Experiment results with depressive and suicide related texts detection show that we can achieve high accuracy in depression related text classification using the collected dataset.	Shirinkyz Shekerbekova , Meruyert Yerekesheva , Kuralay Turganbay , Zhazira Kozhamkulova , Lyailya Tukenova , Batyrkhan Omarov https://www.scimagojr.com/journalsearch.

24.	Towards Smart Building: Exploring of Indoor Microclimate Comfort Level Thermal Processes	DOI: 10.1007 / 978-3-030-74717-6_7	Modern requirements to reduce the consumption of energy resources while maintaining comfortable conditions for people in residential, public and administrative buildings pose the task of developing new approaches to assessing the comfort of the microclimate. Currently used methods for assessing the comfort of the microclimate do not take into account the specific hazards characteristic of non-industrial premises, and for this reason, the introduction of energy-saving measures may lead to a violation of the comfort conditions in the premises of buildings. In this regard, the development of methods and methods to take into account the impact of energy-saving measures on the microclimate is an urgent task. This research paper is devoted to solving the urgent problem – energy efficiency of buildings. We explore mathematical model of indoor microclimate thermal processes, parameters that affect to indoor microclimate, comfort microclimate serving, and represent simulation results of the developed mathematical model of thermal processes. Also, we explore how to control heating, ventilation and air conditioning equipments considering indoor and outdoor temperature and humidity level, and the problem, how to keep stable indoor comfort temperature and humidity.	Aigerim Altayeva, Karlygash Baisholanova, Lyailya Tukenova, Bayan Abduraimova, Marat Nurtas, Zharasbek Baishemirov, Sanida Yessenbek, Bauyrzhan Omarov, Batyrkhan Omarov https://link.springer.com/chapter/10.1007/978-3-030-74717-6_7
25.	RISK ASSESSMENT OF INVESTMENT LOSSES AIMED AT THE DEVELOPMENT OF SMART CITY SYSTEMS	ISSN: 1992-8645, E-ISSN: 1817-3195	ABSTRACT : In the article is suggested a model for the computing core for the decision support system (DSS) in assessing the risks of investment loss during the dynamic planning (DP) of SmartCity development. Unlike existing solutions, the suggested model gives specific recommendations for assessing the risks of loss. If the risk forecast is unsatisfactory, flexible adjustment of the investment process parameters is possible in order to achieve an acceptable financial result for the parties. The novelty of scientific results consists in the fact that for the first time it is suggested to apply a new class of bilinear multi-step games. This class allowed us to adequately describe the process of risk assessment of investment loss, using the example of dynamic planning for the placement of players' financial resources in SmartCity projects. A distinctive feature of the	LAKHNO V., KARTBAYEV T., MALYUKOV V., USKENBAYEVA R., TOGZHANOVA K., ALIMSEITOVA ZH., BEKETOVA G., TURGYNBAYEVA A. RISK ASSESSMENT OF INVESTMENT LOSSES AIMED AT THE DEVELOPMENT OF SMART CITY SYSTEMS 15th August 2021. Vol.99. No 15, ISSN: 1992-8645, E-ISSN: 1817-3195, pp.3683-3692.

			considered approach is the use of tools based on the solution of a bilinear multi-step game of both quality with several terminal surfaces and a degree game solved in the class of mixed strategies. Computational experiments were carried out in the Maple mathematical modeling package. An DSS was developed in which a risk assessment model is implemented. The developed DSS allows you to reduce the discrepancy between the data of forecasting the risks of investment loss during SmartCity and real return on investment. The model presented in the paper is based on solving a linear multistep degree game using the results of solving a multistep quality game with multiple terminal surfaces. The problem in the article is considered in the statement, standard for a multi-step game.	
26.	THE STABILITY INTERVAL OF THE SET OF LINEAR SYSTEM	DOI: 10.24425/ijet.2021.135958	The article considers the problem of stability of interval-defined linear systems based on the Hurwitz and Lienard- Shipar interval criteria. Krylov, Leverier, and Leverier- Danilevsky algorithms are implemented for automated construction and analysis of the interval characteristic polynomial. The interval mathematics library was used while developing the software. The stability of the dynamic system described by linear ordinary differential equations is determined and based on the properties of the eigenvalues of the interval characteristic polynomial. On the basis of numerical calculations, the authors compare several methods of constructing the characteristic polynomial. The developed software that implements the introduced interval arithmetic operations can be used in the study of dynamic properties of automatic control systems, energy, economic and other non-linear systems.	Talgat Mazakov, Waldemar Wójcik, Sholpan Jomartova, Nurgul Karymsakova, Gulzat Ziyatbekova, and Aisulu Tursynbai. THE STABILITY INTERVAL OF THE SET OF LINEAR SYSTEM // JOURNAL OF ELECTRONICS AND TELECOMMUNICATIONS, 2021, VOL. 67, NO. 2, PP. 155-161 DOI: 10.24425/ijet.2021.135958 (Scopus, процентиль 35)
27.	Automated system for monitoring the threat of waterworks breakout	ISSN: 1992-8645, E-ISSN: 1817-3195.	The article is devoted to the creation of an automated system for monitoring the water level in reservoirs to prevent the breakthrough of weirs and dams. The paper offers hardware and software for monitoring the reservoir occupancy with prompt notification of interested organizations (local administrations) and local emergency departments. The article developed an automated system for monitoring the water level in a reservoir, which allows to get real-time information about the relative humidity and air temperature, the distance from the dam	Mazakov T., Jomartova Sh., Ziyatbekova G., Aliaskar M. Automated system for monitoring the threat of waterworks breakout // Journal of Theoretical and Applied Information Technology, 2020. – Vol. 98, – No 15. – Pp. 3176-3189. ISSN: 1992-8645, E-ISSN: 1817-3195. (Scopus, процентиль 37)

			crest to the water surface in the reservoir. Based on the information received, the system allows to estimate the forecast time of increasing the volume of water level from the current to the critical level and inform the population about the state of the reservoir.	
28.	The image processing algorithms for biometric identification by fingerprints	https://doi.org/10.32014/2020.2518-170X.2	The article discusses image processing algorithms for biometric fingerprint identification. The identification features of the structure of papillary patterns on the fingers have been studied taking into account the fact that different pressure, speed, direction, ambient temperature and humidity level lead to different images. Due to various digital image processing and analysis algorithms such as: the SIFT descriptor, as well as the closest competitor, the SURF descriptor, it is possible to quickly obtain unique characteristics for each image. This study used a database of photographs obtained from open sources – the Fingerprint Verification Competition 2004 (FVC2004). As a result of the work, the graphic image of the matching key points, as well as the number of matched key points by fingerprints, have been investigated. Search key points is performed using the Hesse matrix. The determinant of the Hesse matrix (Hessian) reaches the extremum at the points of maximum variation of the brightness gradient. Fingerprints were obtained using the optical sensor "Cross Match V300". The experimental study showed that the developed software system has invariance to image rotations.	T.Zh. Mazakov, Sh.A. Jomartova, G.Z. Ziyatbekova, T.S. Shormanov, B.S. Amirkhanov, P. Kisala. The image processing algorithms for biometric identification by fingerprints // News of the National Academy of Sciences of the Republic of Kazakhstan. Series of Geology and Technical Sciences, 2020. – Vol. 1, - No 439. – P. 14-22. ISSN 2518-170X (Online), ISSN 2224-5278 (Print). https://doi.org/10.32014/2020.2518-170X.2 (Scopus, процентиль 35)
29.	Mathematical modeling forecasting of consequences of damage breakthrough	https://doi.org/10.32014/2020.2518-170X.111	The article is devoted to the development of a mathematical model for preventing a breakthrough of a dam and predict its possible consequences. In this work, the task of developing a single integrated approach to ensuring the safe operation of hydraulic structures, based on the notification of interested bodies in real time, was solved. A mathematical model of the state of the reservoir is developed, on the basis of which a hardware-software complex for operational notification of interested organizations (akimats) and local emergency departments is implemented. A mathematical model of predicting the consequences of a dam break is proposed. An algorithm for calculating the maximum level of the breakout wave has been formulated, taking into account many parameters of	T. Zh. Mazakov, P. Kisala, Sh. A. Jomartova, G.Z. Ziyatbekova, N. T. Karymsakova. Mathematical modeling forecasting of consequences of damage breakthrough // News of the National Academy of Sciences of the Republic of Kazakhstan. Series of Geology and Technical Sciences. – 2020. – Vol. 5, No 403. – Pp. 116-124. // https://doi.org/10.32014/2020.2518-170X.111. (Scopus, процентиль 35)

			the hydraulic structures. The convergence of the developed algorithm in the form of a theorem has been proved. This method has a large practical focus, compared with existing formulas. The Java language implements a hardware-software complex (PAC) for predicting the effects of a dam break, consisting of the following modules: 1) a module for receiving and transmitting current information about the water level, humidity and temperature on the crest of the dam; 2) a module for processing constant and operational information about the threat of dam breakthrough (server); 3) a module for predicting the effects of a dam break. Based on the solution of the model problem, the effectiveness of the developed hardware-software complex is shown. The practical basis for the model task was the events that took place in Kyzylagash village of Almaty region of the Republic of Kazakhstan.	
30.	Universal complex of psychophysiological testing	https://doi.org/10.32014/2020.2518-1726.10	An experimental version of the system of psychological testing with fixation in real time of physiological parameters of the tested person has been developed. The Data of photoplethysmogram (PPG) and galvanic skin reaction (GSR) have been determined as sources of physiological data. The soft & hardware complex of psychophysiological testing allows in relation to each question of the test to capture and evaluate the psychophysiological state of the testing person, which provides additional information for the psychologist. For experimental tests two methods were chosen, the first one was the Buss-Durkee technique (BDHI), which allows to diagnose the aggressiveness of the individual, and the second was the method of assessing the neuropsychological stability. These tests are recommended for use in psychological selection for military service [1-2]. The tests are adapted to the Kazakh language and tested on cadets of military institutions and students of civil Universities in Almaty.	T.Zh. Mazakov, Sh.A. Jomartova, Waldemar Wojcik, G.Z. Ziyatbekova, B.S. Amirkhanov, B.R. Zholmagambetova. Universal complex of psychophysiological testing // News of the National Academy of Sciences of the Republic of Kazakhstan. Physical-mathematical series, 2020. – Vol. 2, - No 330. – P. 14-22. ISSN 2518-1726 (Online), ISSN 1991-346X (Print) https://doi.org/10.32014/2020.2518-1726.10 (Scopus, процентиль 35)
31.	Global output tracking control for high-order non-linear	ISSN: 1992-8645; E-ISSN: 1817-3195	This paper studies the problem of global practical output tracking for a class of high-order non-linear systems with time-varying delays under the weaker conditions on the system nonlinearities. With the help of an appropriate Lyapunov-Krasovskii functionals	Article Global output tracking control for high-order non-linear systems with time-varying delays

	systems with time-varying delays		and by using the method of adding a power integrator, a continuous state-feedback controller is successfully designed such that all the states of the resulting close loop system are bounded while the output tracking error converges to an arbitrarily small residual set. A numerical example demonstrates the effectiveness of the result.	Alimhan, K., Tasbolatuly, N., Yerdenova, A. Journal of Theoretical and Applied Information Technology, 2021, 99(13), стр. 3337–3352
32.	Morphology Model and Segmentation for Old Turkic Language	https://doi.org/10.1007/978-3-030-88081-1_47	Old Turkic language is the basis of all modern Turkic languages. Its study is very important for Turkic peoples who possess modern Turkic lan-guages. This is important both from a historical point of view and for the study of modern issues of neural machine translation, issues of the linguistic distance of modern Turkic languages from their progenitor. This paper proposes the de-velopment of a computational model of the morphology of Old Turkic language based on the CSE (Complete Set of Endings) – model of morphology and a study on this basis of the issue of morphological segmentation of the texts of Old Turkic language, which will subsequently be used for neural machine translation of Old Turkic language into modern Turkic languages. Since most of the modern Turkic languages, except for the Turkish language, belong to low-resource languages, the issues of developing computational models of morphology, developing mod-els, algorithms and software for processing Turkic languages are relevant.	Zhanabergenova D., Tukeyev U. (2021) Morphology Model and Segmentation for Old Turkic Language. In: Nguyen N.T., Iliadis L., Maglogiannis I., Trawiński B. (eds) Computational Collective Intelligence. ICCCI 2021. Lecture Notes in Computer Science, vol 12876. Springer, Cham. https://doi.org/10.1007/978-3-030-88081-1_47
33.	Universal Programs for Stemming, Segmentation, Morphological Analysis of Turkic Words	https://doi.org/10.1007/978-3-030-88081-1_48	In this paper are proposed universal programs for Turkic languages stemming, segmentation, morphological analysis based on the "complete set of endings" (CSE) model of Turkic morphologies. The CSE-model is based on four types of endings: plural, case, personal, and possessive. For all Turkic languages, these four types of endings are similar. For each of considered NLP tasks is cre-ated a special relational data model – decision table. Relational data models – decision tables, algorithms and programs for stemming, segmentation, morpho-logical parsing is shown for the examples of the Kazakh language.	Tukeyev U., Karibayeva A., Turganbayeva A., Amirova D. (2021) Universal Programs for Stemming, Segmentation, Morphological Analysis of Turkic Words. In: Nguyen N.T., Iliadis L., Maglogiannis I., Trawiński B. (eds) Computational Collective Intelligence. ICCCI 2021. Lecture Notes in Computer Science, vol 12876. Springer, Cham. https://doi.org/10.1007/978-3-030-88081-1_48

34.	Integrated Technology for Creating Quality Parallel Corpora	https://doi.org/10.1007/978-3-030-88113-9_41	What determines the quality of parallel corpora? Firstly, it is determined by the quality of the translation. However, in this paper, we consider not the substantial quality of the translation, but the "technical" quality of parallel texts. Parallel texts are collected from different sources and often such texts have the following disadvantages: language mixing, font mixing, text alignment problems, the need for manual correction of parallel texts. All these problems require, firstly, their recognition, and secondly, they need to be resolved, and with large volumes of parallel texts, performing these operations manually is a very time-consuming process. Therefore, the work proposes an integrated technology for creating parallel corpora, which allows to minimize the number of manual oper-ations. The authors present the technology as an example of a new linguistic re-source - an open Kazakh-English parallel corpus	Zhumanov Z., Tukeyev U. (2021) Integrated Technology for Creating Quality Parallel Corpora. In: Wojtkiewicz K., Treur J., Pimenidis E., Maleszka M. (eds) Advances in Computational Collective Intelligence. ICCCI 2021. Communications in Computer and Information Science, vol 1463. Springer, Cham. https://doi.org/10.1007/978-3-030-88113-9_41
35.	Development of Technology for Summarization of Kazakh Text	Digital Object Identifier (DOI): 10.14569/IJACSA.2021.0120914	This paper presents the solution to the problem of summarizing Kazakh texts. The problem of Kazakh text summarization is considered as a sequence of two tasks: extracting the most important sentences of the text and simplifying the received sentences. The task of extracting the most important sentences of the text is solved using the TF-IDF method and the task of simplifying sentences is solved using the neural network technology "Seq2Seq". Problem of using NMT method for simplification of Kazakh was in absence of Kazakh dataset for training. To solve this problem in this work propose use transfer learning method. The use of transfer learning made it possible to use a ready-made model that was trained on a parallel corpus of Simple English Wikipedia and not create a simplification corpus in Kazakh from scratch. For this, a transfer learning technology for simplifying sentences of the Kazakh language has been developed, based on training a neural model for simplifying sentences in the English language. Main scientific contribution of this work is transfer learning technology for the simplification of Kazakh sentences using the parallel corpus of the English language simplification.	Talgat Zhabayev and Ualsher Tukeyev. Development of Technology for Summarization of Kazakh Text. (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 12, No. 9, 2021, pp. 111-116. Digital Object Identifier (DOI): 10.14569/IJACSA.2021.0120914
36.	Applying machine learning techniques	doi:10.32604/cmc.2022.019189	In this research paper, we propose a corpus for the task of detecting religious extremism in social networks and open sources and	Mussiraliyeva, S., Omarov, B., Yoo, P., Bolatbek, M. Applying machine learning

	for religious extremism detection on online user contents		compare various machine learning algorithms for the binary classification problem using a previously created corpus, thereby checking whether it is possible to detect extremist messages in the Kazakh language. To do this, the authors trained models using six classic machine-learning algorithms such as Support Vector Machine, Decision Tree, Random Forest, K Nearest Neighbors, Naive Bayes, and Logistic Regression. To increase the accuracy of detecting extremist texts, we used various characteristics such as Statistical Features, TF-IDF, POS, LIWC, and applied oversampling and undersampling techniques to handle imbalanced data. As a result, we achieved 98% accuracy in detecting religious extremism in Kazakh texts for the collected dataset. Testing the developed machine learning models in various databases that are often found in everyday life “Jokes”, “News”, “Toxic content”, “Spam”, “Advertising” has also shown high rates of extremism detection. © 2021 Tech Science Press. All rights reserved.	techniques for religious extremism detection on online user contents. Computers, Materials and Continua, 2021, 70(1), стр. 915–934 , doi:10.32604/cmc.2022.019189
37.	Encryption and Re-Randomization Techniques for Malware Propagation	doi: 10.1109/ACCESS.2021.3112750	Encryption, which is essential for the protection of sensitive information can also transform any malicious content to illegible form, which can then reside in any network, undetected. Encryption of malicious payload is used by malware authors to mask their code, however, the objective of hiding the malicious code can be further improved by techniques of re-randomization. The concept of re-randomization using asymmetric cryptography has been emerged as a new area of interest for malware designers. Re-randomizing is a technique which can prevent detection of source path of a malware and makes it indistinguishable. This article extends the idea of using asymmetric cryptography for re-randomization and has proposed a novel scheme using Pailliar's asymmetric cryptosystem. Moreover, this research work illustrates the limitations of RSA for malware re-randomization. A comprehensive performance analysis of the re-randomization techniques for various malware payloads is also presented, which can be used for the detection of re-randomized malware effectively. © 2013 IEEE.	A. R. Abbasi, M. Afzal, W. Iqbal, S. Mussiraliyeva, F. Khan and A. U. Rehman, "Encryption and Re-Randomization Techniques for Malware Propagation," in *IEEE Access*, vol. 9, pp. 132522-132532, 2021, doi: 10.1109/ACCESS.2021.3112750

38.	Applying Deep Learning for Extremism Detection.	https://doi.org/10.1007/978-981-16-3660-8_56	According to recent research, the use of social media to track the spread of radical ideas and extremist threats has attracted the attention of researchers for more than 10 years. In the last 3 years, there has been a surge in research interest in identifying and predicting based on the analysis of the text content of messages in open social networks as extremists actively use social networks and the number of calls to extremism and the number of recruitment through social networks is growing. In this paper, we consider an important applied problem of using deep learning methods to identify potential extremist and terrorist information on the Internet. It provides an overview of existing solutions and approaches and offers its own method for detecting online extremism. The applicability and effectiveness of the proposed method is demonstrated experimentally on a reference set of real data potentially containing extremist information. The results of the experiment show high accuracy in detecting extremist messages.	S. Mussiraliyeva, M. Bolatbek, B. Omarov, Z. Medetbek, G. Baispay, R. Ospanov and Yeltay Zh., (2021) Applying Deep Learning for Extremism Detection. In: Luhach A.K., Jat D.S., Bin Ghazali K.H., Gao XZ., Lingras P. (eds) Advanced Informatics for Computing Research. ICAICR 2020. Communications in Computer and Information Science, vol 1393. Springer, Singapore. https://doi.org/10.1007/978-981-16-3660-8_56
39.	Bigram Based Deep Neural Network for Extremism Detection in Online User Generated Contents in the Kazakh Language	https://doi.org/10.1007/978-3-030-88113-9_45	Countering the spread of aggressive information and extremism in the global network is an urgent problem of society and government agencies, which is solved in particular by filtering unwanted Internet resources. A necessary condition for such filtering is the classification of the content of websites, texts and documents of the information flow. Therefore, an urgent problem of information technologies is the classification of texts in natural languages in order to detect extremist texts, such as calls for extremism and other messages that threaten the security of citizens. Therefore, our research examines the detection of extremist messages in online content in the Kazakh language. To do this, we have collected a corpus of extremist texts from open sources, developed a deep neural network based on bigrams for detecting extremist texts in the Kazakh language. The proposed model has shown high efficiency in comparison with classical methods of machine learning and deep learning.	Mussiraliyeva S., Omarov B., Bolatbek M., Bagitova K., Alimzhanova Z. (2021) Bigram Based Deep Neural Network for Extremism Detection in Online User Generated Contents in the Kazakh Language. Rodos, Greece, October 2021. In: Wojtkiewicz K., Treur J., Pimenidis E., Maleszka M. (eds) Advances in Computational Collective Intelligence. ICCCI 2021. Communications in Computer and Information Science, vol 1463. Springer, Cham. https://doi.org/10.1007/978-3-030-88113-9_45
40.	Detection of Extremist Ideation on Social Media Using	https://doi.org/10.1007/978-3-030-63007-2_58	At present, the number of terrorist attacks carried out by lone terrorists under the influence of propaganda and extremist ideology, as well as by organized terrorist communities with a network and	Mussiraliyeva S., Bolatbek M., Omarov B., Bagitova K. (2020) Detection of Extremist Ideation on Social Media

	Machine Learning Techniques		poorly connected structure, is increasing. The main means of information exchange, recruitment and promotion for such structures is the Internet, namely web resources, social networks and e-mail. In this regard, the task of detecting, identifying topics of communication, connections, as well as monitoring the behavior and forecasting of threats emanating from individual users, groups and network communities that generate and distribute terrorist and extremist information on the Internet arises. The paper is devoted to the research and application of machine learning methods aimed at solving the problems of detecting potentially dangerous information on the Internet. The study examines the development of a corpus in Kazakh language for detecting extremist messages, and explores machine learning algorithms that used to detect content that contains calls for terrorist attacks and propaganda materials.	Using Machine Learning Techniques. In: Nguyen N.T., Hoang B.H., Huynh C.P., Hwang D., Trawiński B., Vossen G. (eds) Computational Collective Intelligence. ICCCI 2020. Lecture Notes in Computer Science, vol 12496. Springer, Cham. https://doi.org/10.1007/978-3-030-63007-2_58
41.	Deep Neural Network Model for Recognition of Speaker's Emotion	doi: 10.1109/PICST51311.2020.9468017	The article is devoted to the development of neural network tools for recognizing the speaker's emotions. It is determined that a deep neural network of the multi-layer perceptron type is the most effective when recognizing emotions on fixed fragments of a speech signal. The expediency of training the network on the examples of the TESS database is proved, where each individual record corresponds to one of the seven basic emotions. The architectural parameters of the neural network model are calculated based on the use of the specified speech corpus. The output neurons of the network are associated with 7 emotions. The number of hidden layers of neurons is 2. The number of neurons in each hidden layer is 200. The input neurons of the network are associated with Mel-frequency cepstral coefficients (MFCC) of each of the quasi-stationary fragments of the speech signal. The expression is developed to calculate the number of input neurons depending on the number of Mel-frequency cepstral coefficients. The feasibility of describing one quasi-stationary fragment with 20 Mel-frequency cepstral coefficients was determined by computer experiments. At an acceptable level of resource intensity, the developed neural network model allows to achieve an accuracy of emotion recognition of about 0.94, which corresponds to known tools of similar purpose. The necessity of further research is justified in the	S. Toliupa, I. Tereikovskyi, L. Tereikovska, S. Mussiraliyeva and K. Bagitova, "Deep Neural Network Model for Recognition of Speaker's Emotion," 2020 IEEE International Conference on Problems of Infocommunications. Science and Technology (PIC S&T), 2020, pp. 172-176, doi: 10.1109/PICST51311.2020.9468017

			direction of developing a method for neural network recognition of the speaker's emotions using CNN. © 2020 IEEE.	
42.	On detecting online radicalization and extremism using natural language processing	DOI: 10.1109/ACIT50332.2020.9300086	Due to the activity of terrorist propaganda on the Internet and social networks, as well as given the high dynamics of the emergence of new sites and accounts of extremist orientation, it is important to quickly detect content that demonstrates a tendency to extremism in the prevention of extremist and terrorist activities. This article is intended to explore the possibilities of automatic recognition of extremist content using machine learning from this point of view. This article is devoted to the application of machine learning methods for solving the problem of security, in part-countering terrorism and extremism using information from the Internet. © 2020 IEEE.	S. Mussiraliyeva, M. Bolatbek, B. Omarov, Z. Medetbek, G. Baispay and R. Ospanov, "On Detecting Online Radicalization and Extremism Using Natural Language Processing," 2020 21st International Arab Conference on Information Technology (ACIT), 2020, pp. 1-5, doi: 10.1109/ACIT50332.2020.9300086
43.	User Keystroke Authentication and Recognition of Emotions Based on Convolutional Neural Network	DOI: 10.1007/978-3-030-39162-1_26	The article is devoted to the problem of improving Biometric identification systems based on Keystroke Dynamics for recognizing emotions and authenticating users of information systems through the implementation of modern neural network solutions based on Convolutional Neural Network (CNN). It is established that the difficulties of such implementation are associated with coding the keystroke parameters to a form suitable for CNN processing. A coding procedure based on the presentation of fixed-size keystroke parameters in the form of a color square image is proposed. Each encoded text symbol corresponds to a separate point of the image and is characterized using the corresponding ASCII code and keystroke parameters such as the key hold time and the time between keystrokes. Experimental studies showed that the proposed coding procedure made it possible to use CNN for analyzing Keystroke Dynamics and achieve recognition error of emotions and personality at the level of the best modern recognition systems. © 2020, The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG.	Tereikovskyi, I., Tereikovska, L., Korystin, O., Mussiraliyeva, S., Sambetbayeva, User Keystroke Authentication and Recognition of Emotions Based on Convolutional Neural Network. In book: Advances in Intelligent Systems and Computing. 1126 AISC, 2020, pp 283-292, III.DOI: 10.1007/978-3-030-39162-1_26, January 2020

44.	Using the cuda technology to speed up computation in problems of chemical kinetics	https://doi.org/10.32014/2021.2518-1726.19	The main idea of the implementation is reducing the time for calculation and thereby implement a multi-user mode for users by placing it on a server with access via a web browser. To model the kinetics of chemical reacting systems were used 4th and 5th grade Runge-Kutta methods and to receive the index of advantages of this elaboration were written programs in C# for sequential computation on a central processor and was used a platform for parallel computation of CUDA on graphic processors. Parallelization of data during calculation on a GPU was performed by the distribution of the reaction to individual strands, when changes of the concentration was calculated over a given time interval of a certain substance. Parallelization is performed over all elementary reactions, with the increasing of the number of reactions in the mechanism, because of this the computation on the GPU has a noticeable gain in time	M. Sarsembayev, B. Urmashev, O. Mamyrbayev, M. Turdalyuly, T. Sarsembayeva. Using the cuda technology to speed up computation in problems of chemical kinetics // News of the National Academy of Sciences of the Republic of Kazakhstan Physico-Mathematical Series. – 2021. – Vol. 2, 336 (2021). – P. 39 – 47 DOI: doi.org/10.32014/2021.2518-1726.19
45.	Digital Generators of a Pseudorandom Pulses Sequence AND Their Modeling With Use OF FPGA in the Environment Cad Quartus II	https://doi.org/10.32014/2020.2518-1726.87	The paper considers the functional modeling of digital generators of a pseudo and ompulses sequence based on FPGAs in the environment of the computer-aided design system (CAD) QUARTUS II by Altera, which supports all stages of designing digital devices based on programmable and reconfigurable logics. Digital generators of a pseudo and ompulses sequence of the Fibonacci or Galois configuration are built on linear feedback shift registers with XOR logic gates. Using the QUATUS II CAD system, the project was compiled, the RTL circuits of digital generators of a pseudo and ompulses sequence were synthesized and obtained, their functional modeling was performed, and the timing diagrams of the circuits operation were constructed. Thus, the problem of developing a circuit for a digital generator of a pseudo and ompulses sequence based on the linear feedback shift registers using FPGAs in the Quartus II CAD environment is relevant and is of practical interest in using it to protect confidential speech information at creating cryptographic keys for encrypted data transmission. In order to provide improved cryptographic strength of generated sequences with a relatively long period and good statistical properties by improving the scheme of the LFSR shift algorithm generator with a complicated timing scheme	Seilova N.A., Dzhuruntaev D.Z., Mamyrbayev O.Zh., Batyrgaliev A.B., Turdalyuly M. Digital Generators of a Pseudorandom Pulses Sequence AND Their Modeling With Use OF FPGA in the Environment Cad Quartus II // News of the National Academy of Sciences of the Republic of Kazakhstan Physico-Mathematical Series. – 2021. – Vol. 5, 339 (2021). – P. 83 – 90 DOI: doi.org/10.32014/2020.2518-1726.87

46.	Grammatical categories determination for Turkish and Kazakh languages based on machine learning algorithms and fulfilling dictionaries of link grammar parser	https://doi.org/10.15587/1729-4061.2021.238743	This research is aimed at identifying the parts of speech for the Kazakh and Turkish languages in an information retrieval system. The proposed algorithms are based on machine learning techniques. In this paper, we consider the binary classification of words according to parts of speech. We decided to take the most popular machine learning algorithms. In this paper, the following approaches and well-known machine learning algorithms are studied and considered. We defined 7 dictionaries and tagged 135 million words in Kazakh and 9 dictionaries and 50 million words in the Turkish language. The main problem considered in the paper is to create algorithms for the execution of dictionaries of the so-called Link Grammar Parser (LGP) system, in particular for the Kazakh and Turkish languages, using machine learning techniques. The focus of the research is on the review and comparison of machine learning algorithms and methods that have accomplished results on various natural language processing tasks such as grammatical categories determination. For the operation of the LGP system, a dictionary is created in which a connector for each word is indicated – the type of connection that can be created using this word. The authors considered methods of filling in LGP dictionaries using machine learning. The complexities of natural language processing, however, do not exclude the possibility of identifying narrower tasks that can already be solved algorithmically: for example, determining parts of speech or splitting texts into logical groups. However, some features of natural languages significantly reduce the effectiveness of these solutions. Thus, taking into account all word forms for each word in the Kazakh and Turkish languages increases the complexity of text processing by an order of magnitude	Yerimbetova, A., Tussupova, M., Sambetbayeva, M., Turdalyuly, M., & Sakenov, B. (2021). Grammatical categories determination for Turkish and Kazakh languages based on machine learning algorithms and fulfilling dictionaries of link grammar parser // Eastern-European Journal of Enterprise Technologies. – 5 (2 (113), P. 55–65. https://doi.org/10.15587/1729-4061.2021.238743
47.				
48.	Applying machine learning to detect depression-related texts on social networks	DOI https://doi.org/10.1007/978-981-16-3660-8_15	This interdisciplinary study is aimed at determining the informative signs of behavior of users of the social network Vkontakte of the Kazakh segment in connection with the level of severity of signs of depression in them. We applied six machine learning algorithms with different features to depression related post detection problem.	Shirinkyz Shekerbekova , Meruyert Yerekesheva , Kuralay Turganbay , Zhazira Kozhamkulova , Lyailya Tukenova , Batyrkhan Omarov

			Our experimental results show that the problem can be successfully solved and applied to detect depressive or suicidal behavior or texts in online user contents. Experiment results with depressive and suicide related texts detection show that we can achieve high accuracy in depression related text classification using the collected dataset.	https://www.scimagojr.com/journalsearch.php?q=17700155007&tip=sid&clean=0, sjr=0.16 – Q3, citation per document = 0.476
49.	"RECOGNITION OF EMOTIONS BY FACIAL GEOMETRY USING A CAPSULE NEURAL NETWORK"	International Journal of Civil Engineering and Technology (IJCIET) Volume 10, Issue 03, March 2019, pp. 1424-1434, Article ID: IJCIET_10_03_139 Available online at http://www.iaeme.com/ijciet/issues.asp?JType=IJCIET&VType=10&IType=03 ISSN Print: 0976-6308 and ISSN Online: 0976-6316	The article is devoted to the problem of improving the efficiency of neural network means of emotion recognition by the geometry of the human face. It is shown that one of the most significant drawbacks of modern neural network means of emotion recognition, which are used in General-purpose information systems, is the lack of recognition accuracy under the influence of characteristic interference. It is proposed to improve the accuracy of recognition through the use of capsule neural network model, which has increased adaptability to the analysis of noisy images. As a result of the research, a neural network model of the CapsNet type was developed, designed to recognize basic emotions taking into account such interference as face rotation. It is shown experimentally that in the analysis of undistorted images CapsNet slightly exceeds the accuracy of the classical convolutional neural network type LaNet, which is approximately equal to its resource intensity. The accuracy of CapsNet recognition of undistorted images is somewhat inferior to modern types of convolution networks, which have a much higher resource consumption compared to it. When detecting emotions on rotated images, the accuracy of CapsNet is comparable with the accuracy of modern types of convolution networks and significantly exceeds the accuracy of LaNet. Prospects for further research in the field of neural network recognition of emotions on the geometry of the face can be associated with the improvement of architectural solutions of the capsule neural network in the direction of reducing the number of training iterations while ensuring acceptable recognition accuracy.	Liudmyla Tereikovska, Ihor Tereikovskyi, Shynar Mussiraliyeva, Gulmaral Akhmed, Aiman Beketova and Aizhan Sambetbayeva

50.	Machine Learning And Neural Network Methodologies of Analyzing Social Media	https://doi.org/10.1145/3410352.3410739	The rapid development of the Internet has led to a significant increase in the number of news sites and social networks that describe various events in the world and society. People actively share their opinions about various events in the world. Manually tracking and analyzing such a volume of information is not possible. So, in this way, the use of algorithms for automatic analysis of texts and user comments is an important feature. Published articles and user comments in most cases are of a certain emotional aspect. This article analyzes texts and user comments of Kazakhstan media space. Sentiment classification is done using machine learning algorithms and convolutional and recurrent neural networks (CNN and RNN). A comparative review of the obtained results was performed after the classification.	Vladislav Karyukin, Aidana Zhumabekova, and Sandugash Yessenzhanova. 2020. Machine Learning And Neural Network Methodologies of Analyzing Social Media. In *Proceedings of the 6th International Conference on Engineering & MIS 2020* (*ICEMIS'20*). Association for Computing Machinery, New York, NY, USA, Article 9, 1–7. DOI:https://doi.org/10.1145/3410352.3410739
51.	Multi-Class Sentiment Analysis of Social Media Data with Machine Learning Algorithms	https://www.techscience.com/cmc/v69n1/42767	The volume of social media data on the Internet is constantly growing. This has created a substantial research field for data analysts. The diversity of articles, posts, and comments on news websites and social networks astonishes imagination. Nevertheless, most researchers focus on posts on Twitter that have a specific format and length restriction. The majority of them are written in the English language. As relatively few works have paid attention to sentiment analysis in the Russian and Kazakh languages, this article thoroughly analyzes news posts in the Kazakhstan media space. The amassed datasets include texts labeled according to three sentiment classes: positive, negative, and neutral. The datasets are highly imbalanced, with a significant predominance of the positive class. Three resampling techniques (undersampling, oversampling, and synthetic minority oversampling (SMOTE)) are used to resample the datasets to deal with this issue. Subsequently, the texts are vectorized with the TF-IDF metric and classified with seven machine learning (ML) algorithms: naïve Bayes, support vector machine, logistic regression, k-nearest neighbors, decision tree, random forest, and XGBoost. Experimental results reveal that oversampling and SMOTE with logistic regression, decision tree, and random forest achieve the best classification scores. These models are effectively employed in the developed social analytics platform.	G. Mutanov, V. Karyukin and Z. Mamykova, "Multi-class sentiment analysis of social media data with machine learning algorithms," *Computers, Materials & Continua*, vol. 69, no.1, pp. 913–930, 2021.

52.	Conceptual Diagram of An Intelligent Decision Support System in the Process of Investing in Cybersecurity Systems	ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195	The article proposes a structural diagram of the functioning of a DSS in the process of analyzing and choosing a rational (optimal) strategy for investing in cybersecurity systems (CrS) in a dynamic confrontation with the opposing side (hacker). The key functional modules of such a DSS are considered, which contribute to ensuring its continuous and efficient operation. Detailed block diagrams are given for the following key subsystems of this DSS: analysis of the problem, risks and threats associated with insufficient investment in CrS of an informatization object (OBI); the formation of goals and criteria for evaluating the effectiveness of investment in CrS of an OBI; formation of decisions; formation of the decision rule and analysis of alternative strategies for investing in CrS of the OBI. The above scheme provides full-featured decision-making in the process of choosing rational strategies for investing in cybersecurity systems of objects of informatization of any scale, from small companies or enterprises to large OBI. The article describes the results of computational experiments obtained for the online DSS in the process of searching for a rational strategy for investing in CrS of an OBI.	Akhmetov, B., Lakhno, V., Yagaliyeva, B., Oshanova, N., Adilzhanova, S. Journal of Theoretical and Applied Information Technology, 2021, 99(18), стр. 4297–4310 https://www.scopus.com/authid/detail.uri?authorId=57194443737
53.	Detection and elimination of discrepancies in big data at transport applying statistical methods	http://www.jatit.org/volumes/Vol98No9/9Vol98No9.pdf	An article herein considers the problems of discrepancies detection and elimination upon processing the big data at transport. Tasks of detecting and eliminating the discrepancies in the data has been solved by means of Grabbs method. To obtain trip time design characteristics values there have been applied statistical methods, which allow correct their prescheduled values. The given methodology is used the big data processing at transport in real time mode.	Tashev, A., Kuandykova, J., Kassymova, D. *Akhmediyarova, A.* Detection and elimination of discrepancies in big data at transport applying statistical methods. Journal of Theoretical and Applied Information Technology. - 2020.- Vol.98. No 09. - P.1435-1445. (SCOPUS, процентиль -37)
54.	Identification and authentication of user voice using DNN features and i-vector	doi.org/10.1080/23311916.2020.1751557	Currently, computerized systems, such as language learning, telephone advertising, criminal cases, computerized health care and education systems are rapidly spreading and creating an urgent need for improved productivity. Speech recordings are a rich source of personal, confidential data that can be used to support a wide variety of applications, from health profiling to biometric recognition. Therefore, it is important that the speech recordings are properly protected, so that they cannot be misused. The leakage of encrypted	Aizat, K., Mohamed, O., Orken, M., *Akhmediyarova, A.*, Zhumazhanov, B. Identification and authentication of user voice using DNN features and i-vector. Cogent Engineering, 2020, 7(1), P.1-21. (SCOPUS, процентиль - 76)

			biometric information is irreversible and biometric links are renewable. The article proposes a block diagram of the identification of the users of the systems by individual voice characteristics, based on the joint use of the Deep Neural Network (DNN) method and ii -vector in the model of the elementary speech units, distinguished by increased security from various types of attacks on the biometric identification system, which allowed identifying the users with probability of first and second errors genus 0.025 and 0.005. The analysis of the vulnerability of the modules of the biometric voice identification system was performed and a structural scheme of the voice identification system of the user identification by voice with enhanced the protection against attacks was proposed. The use of elementary speech units in the developed identification systems makes it possible to improve computational indicators, reduce subjective decisions in biometric systems, and increase the security against attacks on the voice biometric identification systems.	https://www.tandfonline.com/doi/full/10.1080/23311916.2020.1751557
55.	Ontologic design of software engineering knowledge area knowledge components	DOI: 10.25046/aj050404	The article sets forth the solution of the educational resources semantic context knowledge components development task, based on the learning technology project-oriented concepts, graduate's competency model and ontological; engineering. The being considered ontology model and knowledge display formalisms allow, firstly, relevantly image the educational resources semantic context in the support concepts ontology format, and their specifications in the form of knowledge expressions and knowledge components, and secondly, secure the knowledge components semantic interoperability withing the frame of their usage in educational environment and systems. The design process of disciplines knowledge content degree programs and individual learning guidelines is connected with specifying the knowledge content frame, the configuration of which is defined with competencies signatures and smart-contract parameters.	Kubekov, Bulat & Utegenova, Anar & Bobrov, Leonid & Naumenko, Vitaliy & Ibraimkulov, Aibek. (2020). Ontologic Design of Software Engineering Knowledge Area Knowledge Components. *Advances in Science, Technology and Engineering Systems Journal*. 5. 30-34. 10.25046/aj050404.
56.	Information - Education Milieu: Methodology of	DOI: 10.1109/SIST50301.2021.9465891.	The article herein considers the innovative methodology of forming the knowledge content, based on ontological model. The basic methodology concepts are project-oriented technology of CDIO	Kubekov, Bulat, Naumenko, Vitaliy & Ibraimkulov, Aibek., "Information - Education Milieu: Methodology of

	Forming Knowledge Content and Practice Oriented Training of IT-disciplines		training and graduate's competence model, and implementation tool is information - education milieu. Information - education milieu allows implement adaptive, in compliance with production requirements, knowledge trend planning and knowledge content forming both for specialty degree programs disciplines and individual training trajectory, using for those aims the smart-contract.For the discipline Technologies of processing the distributed applications there have been shown examples of using the technologies on modeling the knowledge, connected with designing the real time systems of parallel and distributed applications, where as a project there has been used the banking system.The methodology's software implementation has been fulfilled in the form of a web-application and currently it is going through approbation at the chair Computer and software engineering of Turan university.	Forming Knowledge Content and Practice Oriented Training of IT-disciplines," 2021 IEEE International Conference on Smart Information Systems and Technologies (SIST), 2021, pp. 1-9, doi: 10.1109/SIST50301.2021.9465891.
57.	Development of security systems using DNN and I & X-vector classifier	doi.org/10.15587/1729-4061.2021.239186	Number of articles in international databases – 15The widespread use of biometric systems entails increased interest from cybercriminals aimed at developing attacks to crack them. Thus, the development of biometric identification systems must be carried out taking into account protection against these attacks. The paper considers and analyzes the most well-known approaches from the literature to the problem of user identification by voice: dynamic programming methods, vector quantization, mixtures of Gaussian processes, hidden Markov model. The developed software package for biometric identification of users by voice and the method of forming the user's voice standards implemented in the complex allow reducing the number of errors in identifying users of information systems by voice by an average of 1.5 times.	Mamyrbayev, O., Kydyrbekova, A., Alimhan, K., Oralbekova, D., Zhumazhanov, B., & Nuranbayeva, B. (2021). Development of security systems using DNN and i & x-vector classifiers. Eastern-European Journal of Enterprise Technologies, 4(9(112), 32–45. https://doi.org/10.15587/1729-4061.2021.239186 14 Pages Posted: 13 Sep 2021
58.	End-to-End Model Based on RNN-T for Kazakh Speech Recognition	DOI: 10.1109/ICCCI51764.2021.9486811	Automatic speech recognition is a rapidly developing area in machine learning. The most popular speech recognition systems today are end-to-end systems, especially those models that directly output a sequence of words taking into account the input sound in real time, which are online end-to-end models. Stream speech recognition allows to transfer the audio stream to speech-to-text conversion and get the results of stream speech recognition in real	Orken Mamyrbayev, Dina Oralbekova, Aizat Kydyrbekova, Tolganay Turdalykyzy, Akbayan Bekarystankyzy 3rd International Conference on Computer Communication and the Internet (ICCCI) June 25-27, 2021, Nagoya, Japan, -P. 163 – 167.

			time as the audio is processed. This article discusses and implements a popular RNN-T-based model for recognizing Kazakh speech. The analysis of works related to recognition of Kazakh speech based on the CTC model is also given. The findings demonstrated that an RNN-T-based model can work well without additional components, like a language model and showed the best outcome on our dataset. As a result of the research, the system reached 10.6% CER, which is the best indicator among other end-to-end systems for recognizing Kazakh speech.	DOI: 10.1109/ICCCI51764.2021.9486811
59.	Development and research of the influence of the composition and concentration of activators on the strength of phosphorus slag binders	doi.org/10.15587/1729-4061.2021.242814	The paper discusses various ways of activating phosphorus slags by introducing additives for the development of phosphorus slag binders (PSB), replacing cement. Considering that pseudowollastonite is the main mineral of phosphorus slags and without activating components does not possess the binding properties necessary for the production of building materials based on them, we used compositions of small amounts of sodium hydroxide with alkali metal salts, the anions of which form poorly soluble compounds with calcium. When choosing activating components, scarce alkaline additives were replaced by waste from chemical plants, which allows a passing solution of their practical use and environmental problems.	Mahambetova, U., Estemesov, Z., Nuranbayeva, B., Sadykov, P., Mamyrbayev, O., & Oralbekova, D. (2021). Development and research of the influence of the composition and concentration of activators on the strength of phosphorus slag binders. Eastern-European Journal of Enterprise Technologies, 5(6 (113), 54–61. https://doi.org/10.15587/1729-4061.2021.242814
60.	Development of security systems using DNN and I & X-vector classifier	doi.org/10.15587/1729-4061.2021.239186	Number of articles in international databases – 15The widespread use of biometric systems entails increased interest from cybercriminals aimed at developing attacks to crack them. Thus, the development of biometric identification systems must be carried out taking into account protection against these attacks. The paper considers and analyzes the most well-known approaches from the literature to the problem of user identification by voice: dynamic programming methods, vector quantization, mixtures of Gaussian processes, hidden Markov model. The developed software package for biometric identification of users by voice and the method of forming the user's voice standards implemented in the complex allow reducing the number of errors in identifying users of information systems by voice by an average of 1.5 times.	*Mamyrbayev, O., Kydyrbekova, A., Alimhan, K., Oralbekova, D., Zhumazhanov, B., & Nuranbayeva, B. (2021). Development of security systems using DNN and i & x-vector classifiers. Eastern-European Journal of Enterprise Technologies, 4(9(112), 32–45. https://doi.org/10.15587/1729-4061.2021.239186* 14 Pages Posted: 13 Sep 2021

61.	Transient analysis in 1st order electrical circuits in violation of commutation laws	doi:10.15199/48.2021.09.05	The paper considers the usage of non-standard analysis mathematical apparatus to solve some non-trivial problems of electrical engineering theory. The axiomatics of non-standard analysis makes it possible to simplify the transient analysis in the 1st order electrical circuits in violation of the commutation laws. Examples of solving such problems are given.	Vasyl V. KUKHARCHUK , Sergii V. PAVLOV , Samoil Sh. KATSYV1 , Andrii M. KOVAL , Volodymyr S. HOLODIUK , Mykhailo V. LYSYI , Andrzej KOTYRA, Orken MAMYRBAEV , Aidana KALABAYEVA, PRZEGLĄD ELEKTROTECHNICZNY, ISSN 0033-2097, R. 97 NR 9/2021 doi:10.15199/48.2021.09.05
62.	End-to-End Model Based on RNN-T for Kazakh Speech Recognition	DOI: 10.1109/ICCCI51764.2021.9486811	Automatic speech recognition is a rapidly developing area in machine learning. The most popular speech recognition systems today are end-to-end systems, especially those models that directly output a sequence of words taking into account the input sound in real time, which are online end-to-end models. Stream speech recognition allows to transfer the audio stream to speech-to-text conversion and get the results of stream speech recognition in real time as the audio is processed. This article discusses and implements a popular RNN-T-based model for recognizing Kazakh speech. The analysis of works related to recognition of Kazakh speech based on the CTC model is also given. The findings demonstrated that an RNN-T-based model can work well without additional components, like a language model and showed the best outcome on our dataset. As a result of the research, the system reached 10.6% CER, which is the best indicator among other end-to-end systems for recognizing Kazakh speech.	Orken Mamyrbayev, Dina Oralbekova, Aizat Kydyrbekova, Tolganay Turdalykyzy, Akbayan Bekarystankyzy 3rd International Conference on Computer Communication and the Internet (ICCCI) June 25-27, 2021, Nagoya, Japan, -P. 163 – 167. **DOI:** 10.1109/ICCCI51764.2021.9486811
63.	Algorithms for detection gender using neural networks	DOI: 10.46300/9106.2020.14.24	In this paper, we investigate two neural architecture for gender detection tasks by utilizing Mel-frequency cepstral coefficients (MFCC) features which do not cover the voice related characteristics. One of our goals is to compare different neural architectures, multi-layers perceptron (MLP) and, convolutional neural networks (CNNs) for both tasks with various settings and learn the gender –specific features automatically.	Kalimoldayev, M., Mamyrbayev, O., Mekebayev, N., Kydyrbekova, A. Algorithms for detection gender using neural networks. International Journal of Circuits, Systems and Signal Processingthis link is disabled, 2020, 14, стр. 154–159

64.	Neural architectures for gender detection and speaker identification	DOI: 10.1080/23311916.2020.1727168	In this paper, we investigate two neural architecture for gender detection and speaker identification tasks by utilizing Mel-frequency cepstral coefficients (MFCC) features which do not cover the voice related characteristics. One of our goals is to compare different neural architectures, multi-layers perceptron (MLP) and, convolutional neural networks (CNNs) for both tasks with various settings and learn the gender/speaker-specific features automatically. The experimental results reveal that the models using z-score and Gramian matrix transformation obtain better results than the models only use max-min normalization of MFCC. In terms of training time, MLP requires large training epochs to converge than CNN. Other experimental results show that MLPs outperform CNNs for both tasks in terms of generalization errors.	Mamyrbayev, O., Toleu, A., Tolegen, G., Mekebayev, N. Neural architectures for gender detection and speaker identification Cogent Engineeringthis link is disabled, 2020, 7(1), 1727168
65.	Development of an automated system model of information protection in the cross-border exchange	DOI:10.1080/23311916.2020.1724597	A model of an automated system for secure cross-border information exchange is considered. This automated system presents as a complex of the following modules which ensure the information security: data encryption, an electronic digital signature (EDS), access control to the stored information based on two-factor authentication, resolution of possible conflict situations. In this paper, models of two modules for an automated system are described: the electronic digital signature and access control to information based on two-factor authentication. The mathematical model of the formation and verification of the digital signature is described in detail. The phased software implementation of this model with the analysis of the results is described. The two-factor authentication algorithm based on the authenticator program and a mobile phone is considered. A secret string generator based on the method of exhaustive search was carried out. A generator of trigonometric functions is described, which is used to calculate a one-time password. The phased software implementation of this model is given. The analyzed results of the algorithm are presented.	Begimbayeva Yenlik, Ussatova Olga, Biyashev Rustem, Nyssanbayeva Saule «Development of an automated system model of information protection in the cross-border exchange», // Cogent Engineering Journal, Birmingham, UK , №7, 2020 г., ISSN: 2331-1916, P.1-13; DOI:10.1080/23311916.2020.1724597
66.	Modeling of the User’s Identification Security	DOI: 10.24425/ijet.2021.135970	The article describes methods of user identification using authentication based on the second factor. Known algorithms and protocols for two-factor authentication are considered. An algorithm is proposed using mobile devices as identifiers and	Ussatova Olga

	System of on the 2FA Base		generating a temporary password based on the hash function of encryption standards. For an automated control system, a two-factor authentication model and a sequential algorithm for generating a temporary password using functions have been developed. The implementation of the system is based on the Node.js software platform using the JavaScript programming language, as well as frameworks and connected system libraries. MongoDB, an open source database management system for information storage and processing was used.	
67.	3D visualization of human body internal structures surface during stereo-endoscopic operations using computer vision techniques [Etapy wizualizacji powierzchni struktur wewnętrznych ciała ludzkiego podczas operacji stereo-endoskopowych i laparoskopowych]	DOI: 10.15199/48.2021.09.06	The paper describes visualization steps of the surface of internal structures of the human body during stereo-endoscopic and laparoscopic operations using modern computer vision techniques. The presented stages make it possible to obtain three-dimensional representation (more useful for representation and analysis), which is especially important for assessing the state of the examined area and for training health care specialists. The direction of further research is the development of training tools using the proposed approaches. © 2021 Wydawnictwo SIGMA-NOT. All rights reserved.	Selivanova, K.G., Avrunin, O.G., Tymkovych, M.Y., Manhora, T.V., Bezverkhyi, O.S., Omiotek, Z., Kalizhanova, A., Kozbakova, A. (2021) Przeglad Elektrotechniczny, 2021 (9), pp. 30-33. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85114156686&doi=10.15199%2f48.2021.09.06&partnerID=40&md5=5790e3b39a460b9a41d192e1ce663735 DOI: 10.15199/48.2021.09.06
68.	A parallel hybrid implementation of the 2D acoustic wave equation	DOI: 10.1515/ijnsns-2019-0227	In this paper, we propose a hybrid parallel programming approach for a numerical solution of a two-dimensional acoustic wave equation using an implicit difference scheme for a single computer. The calculations are carried out in an implicit finite difference scheme. First, we transform the differential equation into an implicit finite-difference equation and then using the alternating direction implicit (ADI) method, we split the equation into two sub-equations. Using the cyclic reduction algorithm, we calculate an approximate solution. Finally, we change this algorithm to parallelize on graphics processing unit (GPU), GPU + Open Multi-Processing (OpenMP), and Hybrid (GPU + OpenMP + message passing interface (MPI))	Altybay, A., Ruzhansky, M., Tokmagambetov, N. A parallel hybrid implementation of the 2D acoustic wave equation (2020) International Journal of Nonlinear Sciences and Numerical Simulation, 21 (7-8), pp. 821-827. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85089689210&doi=10.1515%2fijnsns-2019-

			computing platforms. The special focus is on improving the performance of the parallel algorithms to calculate the acceleration based on the execution time. We show that the code that runs on the hybrid approach gives the expected results by comparing our results to those obtained by running the same simulation on a classical processor core, Compute Unified Device Architecture (CUDA), and CUDA + OpenMP implementations. © 2020 De Gruyter. All rights reserved.	0227&partnerID=40&md5=771f0a8ecabca943609c98c0a7304ebb DOI: 10.1515/ijnsns-2019-0227

1.	Application of load balancing algorithms to improve the quality of service delivery using modifications of the least connections algorithm		To develop solutions to the problems of providing high-speed Internet, that is, a high-quality service, up to a certain point, there is the possibility of improving quality by increasing the hardware resources of the system, but, as practice shows, quantity does not always mean quality, and the effectiveness of the service delivery system takes into account the advantageous positioning of resources with algorithmic load balancing on servers with maximum benefit, both for the user and for the party providing services . This article provides the results of research and analysis of balancing algorithms, implementation methods for load balancing on servers and improving the quality of service delivery. Research in this direction is very relevant and in demand, the article provides an analysis and description of static and dynamic solutions, the advantages and disadvantages of algorithms. A modernization of the Least Connections algorithm is proposed. © 2020 Little Lion Scientific. All rights reserved.	Joldasbayev, S., Balakayeva, G., Joldasbayev, O. (2020) Journal of Theoretical and Applied Information Technology, 98 (12), pp. 2063-2077. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85090842574&partnerID=40&md5=5b5d9d1e92e894c8a552ccda960c2bce
2.	Automatic speech recognition system for Kazakh language using connectionist temporal classifier		This scientific report illustrates the performance evaluation of the well-known, recently popular neural network Connectionist Temporal Classifier (CTC) for speech recognition. The CTC contains LSTM layers with 256 cells and Momentum Optimizer with learning rate 0.005 and momentum 0.9. Dataset that we have used has 35 native speakers with 360 utterances. For expanding the size of our dataset with overall performance augmentation techniques has been applied using Adobe Audition software, which output 20 more speakers to our original dataset. The result of our experiment has been evaluated with LER (Label error rate). LER measures the inaccuracy between predicted an actual texts.	Amirgaliyev, Y., Kuanyshbay, D., Yedilkhan, D., Shoiynbek, A. (2020) Journal of Theoretical and Applied Information Technology, 98 (4), pp. 703-713. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85081391939&partnerID=40&md5=c5a6f5a1b7500d8e4a31cb7ace5b2f68

			The output of the experiment reported training LER 0.000 and validation LER 0.5. © 2020 Little Lion Scientific. All rights reserved.	
3.	Cogeneration Plants with Solar Radiation Concentrators	DOI: 10.1134/S0040601520100079	Results from experimental studies of a solar cogeneration system with linear photovoltaic modules of a fundamentally new design are presented. The Λ-shaped frontal walls are installed face-to-face at an angle to each other and mutually shield their own thermal radiation, which decreases the radiation heat losses by 27% compared with linear photovoltaic modules of the known designs. The photocurrent generated by cooled solar cells is directed to a system for charging chemical batteries and the thermal energy released is transmitted to the unconsumed intermediate heat-transfer fluid and then, through the surface of coil pipes of counter-current heat exchangers, to the consumed process water of the outer circulation circuit. The further transportation of thermal energy to the storage system occurs by natural circulation of the consumed process water through the temperature gradient formed by the control system over the height between the heat source, the heat exchanger, and the heat receiver, an insulated container (a heat accumulator). For the first time, efficient controlled transportation of heat has been implemented without using a circulation pump owing to the excess thermal energy released during the conversion of solar energy by the solar cells and a photo-selective film installed in the focal spot of the optical concentrator. Thus, a possibility of increasing the temperature of the heat-transfer fluids at the cogeneration system outlet has been offered. A two-circuit circulation system allows for separation of unconsumed heat-transfer fluids (antifreezing solutions) and the consumed fluid (the process water) by the pressure in the channels and installation of a linear counter-current heat exchanger that performs the functions of a supporting platform’s mechanical axis along the rotational axis of the optical concentrator. The system uses a dual-axis solar tracking concentrating system comprised of flat mirrors installed at an angle to the horizon. The arrangement of the Λ-shaped photovoltaic modules on the supporting framework in series along the heat-transfer-fluid path allows for a reduction in the overall	Nesterenkov, P.A., Nesterenkov, A.G., Temirbekov, A.N. Cogeneration Plants with Solar Radiation Concentrators (2020) Thermal Engineering, 67 (10), pp. 706-714. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85091449381&doi=10.1134%2fS0040601520100079&partnerID=40&md5=0e71c0b375c3c56038fc004e21113cd9 DOI: 10.1134/S0040601520100079

			dimensions of the channels, an increase in the total efficiency of the solar cells, and simplification of the encapsulation technology. A method for calculating the output of the cogeneration plant is provided. The method is based on the experimentally measured characteristics of silicon solar cells and heat losses in the channels of the linear photovoltaic modules. © 2020, Pleiades Publishing, Inc.	
4.	Comparative analysis of parallel algorithms for solving oil recovery problem using cuda and opencl	DOI: 10.22075/IJNAA.2021.4809	In this paper the implementation of parallel algorithm of alternating direction implicit (ADI) method has been considered. ADI parallel algorithm is used to solve a multiphase multicomponent fluid flow problem in porous media. There are various technologies for implementing parallel algorithms on the CPU and GPU for solving hydrodynamic problems. In this paper GPU-based (graphic processor unit) algorithm was used. To implement the GPU-based parallel ADI method, CUDA and OpenCL were used. ADI is an iterative method used to solve matrix equations. To solve the tridiagonal system of equations in ADI method, the parallel version of cyclic reduction (CR) method was implemented. The cyclic reduction is a method for solving linear equations by repeatedly splitting a problem as a Thomas method. To implement of a sequential algorithm for solving the oil recovery problem, the implicit Thomas method was used. Thomas method or tridiagonal matrix algorithm is used to solve tridiagonal systems of equations. To test parallel algorithms personal computer installed Nvidia RTX 2080 graphic card with 8 GB of video memory was used. The computing results of parallel algorithms using CUDA and OpenCL were compared and analyzed. The main purpose of this research work is a comparative analysis of the parallel algorithm computing results on different technologies, in order to show the advantages and disadvantages each of CUDA and OpenCL for solving oil recovery problems. © 2021, Semnan University, Center of Excellence in Nonlinear Analysis and Applications. All rights reserved.	Imankulov, T., Daribayev, B., Mukhambetzhanov, S. Comparative analysis of parallel algorithms for solving oil recovery problem using cuda and opencl (2021) International Journal of Nonlinear Analysis and Applications, 12 (1), pp. 351-364. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85101561333&doi=10.22075%2fIJNAA.2021.4809&partnerID=40&md5=7b4f03379f8ed0f46939551c10ebfcd7 DOI: 10.22075/IJNAA.2021.4809
5.	Compare encryption performance across devices to ensure the security of the IOT	DOI: 10.11591/ijeecs.v20.i2.pp894-902	The Internet of Things (IoT) combines many devices with various platforms, computing capabilities and functions. The heterogeneity of the network and the ubiquity of IoT devices place increased demands on security and privacy protection. Therefore,	Pyrkova, A.Y.U., Temirbekova, Z.H.E. Compare encryption performance across devices to ensure the security of the IOT

			cryptographic mechanisms must be strong enough to meet these increased requirements, but at the same time they must be effective enough to be implemented on devices with disabilities. One of the limited devices are microcontrollers and smart cards. This paper presents the performance and memory limitations of modern cryptographic primitives and schemes on various types of devices that can be used in IoT. In this article, we provided a detailed assessment of the performance of the most commonly used cryptographic algorithms on devices with disabilities that often appear on IoT networks. We relied on the most popular open source microcontroller development platform, on the mbed platform. To provide a data protection function, we used cryptography asymmetric fully homomorphic encryption in the binary ring and symmetric cryptography AES 128 bit. In addition, we compared run-time encryption and decryption on a personal computer (PC) with Windows 7, the Bluetooth Low Energy (BLE) Nano Kit microcontroller, the BLE Nano 1.5, and the smartcard ML3-36k-R1. Copyright © 2020 Institute of Advanced Engineering and Science. All rights reserved.	(2020) Indonesian Journal of Electrical Engineering and Computer Science, 20 (2), pp. 894-902. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85091589423&doi=10.11591%2fijeecs.v20.i2.pp894-902&partnerID=40&md5=a56099d25263162c8527dd6026ac8e71 DOI: 10.11591/ijeecs.v20.i2.pp894-902
6.	Complete Kazakh handwritten page recognition using start, follow and read method		In this article we consider end-to-end full page Handwritten Text Recognition for offline Kazakh text images written in Cyrillic alphabet using Fully connected CNN and bidirectional LSTM. The model performs training of text segmentation and recognition jointly using a new Kazakh text images dataset, named Kazakh Handwritten Dataset (KHD). The novel method, which we introduce, uses three steps: Start, Follow and Read (SFR). The proposed model makes use of Region Proposal Network in order to find the starting coordinates of lines in the page. For the case when lines are not straight, we introduce a method that pursues text lines until the end of it and prepare it for the last recognition step. The SFR model works for Russian language as well since Russian alphabet is a subset of Kazakh alphabet. The experimental analysis shows that on average the model provides 0.11 Character Error Rate. © 2021 Little Lion Scientific.	Jantayev, R., Kadyrov, S., Amirgaliyev, Y. Complete Kazakh handwritten page recognition using start, follow and read method (2021) Journal of Theoretical and Applied Information Technology, 99 (13), pp. 3133-3143. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85110715853&partnerID=40&md5=a2377322a95affdec2bb2eca61acc911
7.	Designing of CNC based agricultural robot with a novel	DOI: 10.18178/ijmerr.9.6.876-881	The agriculture industry plays an important role in the needs of humankind. The rising of the world population, as well as the decrease in the number of workers in the agricultural sector, calls	Yeshmukhametov, A., Al Khaleel, L., Koganezawa, K., Yamamoto, Y., Amirgaliyev, Y., Buribayev, Z.

	tomato harvesting continuum manipulator tool		for an increased demand for food suppliers. In this paper, we propose a novel agricultural robot based on CNC machine namely FaRo (FArming RObot), for farming crops autonomously without any human intervention. What differentiates the FaRo from other farming platforms is the ability to carrying out the farming process from seeding to the harvesting of crops. Moreover, FaRo harvesting tool will be explained and demonstrated. © 2020 Int. J. Mech. Eng. Rob. Res.	Designing of CNC based agricultural robot with a novel tomato harvesting continuum manipulator tool (2020) International Journal of Mechanical Engineering and Robotics Research, 9 (6), pp. 876-881. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85088859815&doi=10.18178%2fijmerr.9.6.876-881&partnerID=40&md5=59ee3c2637105eebb64e8543afee702e DOI: 10.18178/ijmerr.9.6.876-881
8.	Determination of the main parameters of the photovoltaic solar module	DOI: 10.1051/e3sconf/202019101004	This article deals with the determination of the main operating parameters of a photovoltaic solar module. In laboratory tests, the study of the dependence of current, voltage and power on time and density of solar radiation, as well as monitoring of environmental parameters: temperature and humidity of the outside air. Analysis of the test results shows that a photoelectric module with an installed capacity of 800 W and a total battery capacity of 800 Ah provides the electric power industry with a daily consumption of 2.0.. 2.2 kWh. The discharge time of the battery varies from 11.7 to 3.5 hours when the average electric load of the consumer changes from 300 to 1000 watts. © 2020 The Authors, published by EDP Sciences.	Urmashev, B.A., Kunelbayev, M., Temirbekov, A.N., Kassenov, S., Zhaksylykova, Z., Amenova, F. Determination of the main parameters of the photovoltaic solar module (2020) E3S Web of Conferences, 191, статья № 01004, . https://www.scopus.com/inward/record.uri?eid=2-s2.0-85094818712&doi=10.1051%2fe3sconf%2f202019101004&partnerID=40&md5=8fd822b0faaf9b11aed2f8be0bf3d4d0 DOI: 10.1051/e3sconf/202019101004
9.	Developing the system of collecting, storing and processing information from solar collectors	DOI: 10.24425/ijet.2021.135945	The article herein presents a new technique of controlling the system of collecting, storing and processing the information from the solar collectors, which might be applied to heating the industrial and domestic compartments for hot water supply. The most profitable usage of the solar collectors in the industry is replacement of a human interference with wireless sensor nets. The solar collector standard system consumes in average 30% of the heat due to poor control and configuration. Our monitoring and	Wojcik, W., Amirgaliyev, Y., Kunelbayev, M., Kalizhanova, A., Kozbakova, A., Sundetov, T., Yedilkhan, D. Developing the system of collecting, storing and processing information from solar collectors

			control system allows upgrade the performance of heating the industrial and domestic premises by means of solar collector for hot water supply. © 2021 Polish Academy of Sciences. All rights reserved.	(2021) International Journal of Electronics and Telecommunications, 67 (1), pp. 65-70. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85102600911&doi=10.24425%2fijet.2021.135945&partnerID=40&md5=36cdcebee901767384d5793194a59a3d DOI: 10.24425/ijet.2021.135945
10.	Development Of A Systematic Approach And Mathematical Support For The Evacuation Process	DOI: 10.15587/1729-4061.2021.234959	In modern conditions, due to the vastness of the territory of Kazakhstan, with a certain probability, natural disasters such as earthquakes, floods, avalanches, as well as accidents, destruction of buildings, epidemics, release of chemical toxic substances at industrial enterprises, fires in educational and medical institutions are possible, which justifies the relevance of modern methods and technologies for solving the problem of evacuation. The peculiarity of this work lies in the formation of an integrated approach for organizing the evacuation process both in peacetime as training for the event of an emergency situation (emergency), and in the event of the emergency itself. A conceptual diagram of an evacuation system is proposed that uses heterogeneous sources for receiving and transmitting information about the onset of an emergency. The input and output sources for receiving and transmitting information about the number of people in the building are determined. The main purpose of the system is to form an operational real-time evacuation plan. This work is the result of a phased implementation of an integrated evacuation system, which consists in building a mathematical model and a method for solving the problem of maximum flow in the network. A mathematical model has been developed for the optimal flow distribution along the Grindshiels network with the analysis of the flow formation and the characteristics of people's motion in enclosed spaces. A game-theoretic approach and mathematical methods of the theory of hydraulic networks for finding an equilibrium state in flow-distribution networks have been	Amirgaliyev, Y., Kalizhanova, A., Kozbakova, A., Aitkulov, Z., Astanayeva, A. Development Of A Systematic Approach And Mathematical Support For The Evacuation Process (2021) Eastern-European Journal of Enterprise Technologies, 3 (4-111), pp. 31-42. DOI: 10.15587/1729-4061.2021.234959

			developed. An algorithm for solving the evacuation problem using the graph approach is proposed. The results of this paper make it possible to systematically organize training evacuations, prepare resources, train the personnel responsible for evacuation in order to quickly respond in an emergency and carry out the evacuation process in order to avoid major consequences © 2021, Authors. This is an open access article under the Creative Commons CC BY license	
11.	Development of speaker voice identification using main tone boundary statistics for applying to robot-verbal systems	DOI: 10.24425-ijet.2020.134015/735	Hereby there is given the speaker identification basic system. There is discussed application and usage of the voice interfaces, in particular, speaker voice identification upon robot and human being communication. There is given description of the information system for speaker automatic identification according to the voice to apply to robotic-verbal systems. There is carried out review of algorithms and computer-aided learning libraries and selected the most appropriate, according to the necessary criteria, ALGLIB. There is conducted the research of identification model operation performance assessment at different set of the fundamental voice tone. As the criterion of accuracy there has been used the percentage of improperly classified cases of a speaker identification. © 2020 The Author(s).	Amirgaliyev, Y., Musabayev, T., Yedilkhan, D., Wojcik, W., Amirgaliyeva, Z. Development of speaker voice identification using main tone boundary statistics for applying to robot-verbal systems (2020) International Journal of Electronics and Telecommunications, 66 (3), pp. 583-588. DOI: 10.24425-ijet.2020.134015/735
12.	Development of the information system for the Kazakh language preprocessing	DOI: 10.1080/23311916.2021.1896418	The aim of this work is the design and development of linguistic resources and preprocessing tools for the Kazakh language. The media-corpus of the Kazakh language is presented as a linguistic resource, which is available on Al-Farabi Kazakh National University platform. The media-corpus of the Kazakh language consists of texts of news content and is implemented as an information system. The general architecture of an information system for the automatic and reliable collection, storage and analysis of texts in the Kazakh language is described. Three automatic text preprocessing tools for the Kazakh language–word forms generator, morphological analyzer, and morphological disambiguation tool–are presented in the article. The proposed tools can also be applied in the systems of automatic analysis of texts, in creation of other linguistic resources such as thesauri and ontologies. © 2021 The Author(s). This open access article is	Akhmed-Zaki, D., Mansurova, M., Madiyeva, G., Kadyrbek, N., Kyrgyzbayeva, M. Development of the information system for the Kazakh language preprocessing (2021) Cogent Engineering, 8 (1), статья № 1896418, . DOI: 10.1080/23311916.2021.1896418

			distributed under a Creative Commons Attribution (CC-BY) 4.0 license.	
13.	Development of the Scheme of the Installation for Mechanical Wastewater Treatment	DOI: 10.12911/22998993/128693	The paper presents the schemes of various equipment for the mechanical treatment of the industrial and domesticwastewater, which allows removing it from the main part of the pollution. An examination of the shortcomingsof the known equipment with the aim of its improvement was conducted. As a result, an installation scheme forcontinuous high-performance mechanical wastewater treatment was proposed. In contrast to the known equipment,the proposed installation provides a three-staged treatment of wastewater with the help of the two pairs ofgratings – for preliminary treatment (removal of large-size pollutions) and by filtration through the two metallicsieves – for normal and fine treatment (removal of small-size mechanical pollutions). The installation consists ofhighly-efficient appliances for the cleaning of filtering elements in the course of realization of the working process,which provides stable high productivity of treatment. The installation has simple reliable design and low energyexpenses. The paper contains the formulas for determining of main operational parameters of the installation: thechange of the cross-sectional area of the filtering elements and productivity of the working process, periodicity ofcleaning of gratings and sieves, the necessary electric power of installations drives. These formulas can be a basisfor further research of installation and for elaboration of a method of its design calculation. © 2020. The American Society of Hematology. All Rights Reserved.	Sevostianov, I.V., Ivanchuk, Y.V., Polishchuk, O.V., Lutsyk, V.L., Dobrovolska, K.V., Smailova, S., Wójcik, W., Kalizhanova, A. Development of the Scheme of the Installation for Mechanical Wastewater Treatment (2021) Journal of Ecological Engineering, 22 (1), pp. 20-28. DOI: 10.12911/22998993/128693
14.	Drying of Vegetable Products in Mobile Solar Dryer with Movable Shelving	DOI: 10.1134/S1810232821010112	The article outlines the relevance of production of dried products using a mobile solar dryer plant with mobile shelving. For intensification of the drying process, the convection of the drying agent flow in the proposed design of drying chamber was studied via numerical solution of the Navier–Stokes equations. As a result, a graphical interpretation of isolines of moving stream of drying agent in a chamber was obtained. Varying dimensionless parameters of the drying agent enabled complete coverage of all zones of the dryer chamber. The motion of shelves due to gravitational forces allowed uniform drying of materials. Through	Urmashev, B.A., Khazimov, K.M., Temirbekov, A.N., Tursynbay, A.T., Torzhenova, T.V., Khazimov, M.Z. Drying of Vegetable Products in Mobile Solar Dryer with Movable Shelving (2021) Journal of Engineering Thermophysics, 30 (1), pp. 145-162. DOI: 10.1134/S1810232821010112

			multivariate experiments, the influence of the temperature-time regimes of the dryer chamber on the particle size was investigated. The optimal drying conditions for cut fruit are presented. © 2021, Pleiades Publishing, Ltd.	
15.	Evolutionary Changes in the Interaction of miRNA With mRNA of Candidate Genes for Parkinson's Disease	DOI: 10.3389/fgene.2021.647288	Parkinson's disease (PD) exhibits the second-highest rate of mortality among neurodegenerative diseases. PD is difficult to diagnose and treat due to its polygenic nature. In recent years, numerous studies have established a correlation between this disease and miRNA expression; however, it remains necessary to determine the quantitative characteristics of the interactions between miRNAs and their target genes. In this study, using novel bioinformatics approaches, the quantitative characteristics of the interactions between miRNAs and the mRNAs of candidate PD genes were established. Of the 6,756 miRNAs studied, more than one hundred efficiently bound to mRNA of 61 candidate PD genes. The miRNA binding sites (BS) were located in the 5′-untranslated region (5′UTR), coding sequence (CDS) and 3′-untranslated region (3′UTR) of the mRNAs. In the mRNAs of many genes, the locations of miRNA BS with overlapping nucleotide sequences (clusters) were identified. Such clusters substantially reduced the proportion of nucleotide sequences of miRNA BS in the 5′UTRs, CDSs, and 3′UTRs. The organization of miRNA BS into clusters leads to competition among miRNAs to bind mRNAs. Differences in the binding characteristics of miRNAs to the mRNAs of genes expressed at different rates were identified. Single miRNA BS, polysites for the binding for one miRNA, and multiple BS for two or more miRNAs in one mRNA were identified. Evolutionary changes in the BS of miRNAs and their clusters in 5′UTRs, CDSs and 3′UTRs of mRNA of orthologous candidate PD genes were established. Based on the quantitative characteristics of the interactions between miRNAs and mRNAs candidate PD genes, several associations recommended as markers for the diagnosis of PD. © Copyright © 2021 Kamenova, Aralbayeva, Kondybayeva, Akimniyazova, Pyrkova and Ivashchenko.	Kamenova, S., Aralbayeva, A., Kondybayeva, A., Akimniyazova, A., Pyrkova, A., Ivashchenko, A. Evolutionary Changes in the Interaction of miRNA With mRNA of Candidate Genes for Parkinson's Disease (2021) Frontiers in Genetics, 12, статья № 647288, . DOI: 10.3389/fgene.2021.647288

16.	Fractional Klein-Gordon equation with singular mass	DOI: 10.1016/j.chaos.2020.110579	We consider a space-fractional wave equation with a singular mass term depending on the position and prove that it is very weak well-posed. The uniqueness is proved in some appropriate sense. Moreover, we prove the consistency of the very weak solution with classical solutions when they exist. In order to study the behaviour of the very weak solution near the singularities of the coefficient, some numerical experiments are conducted where the appearance of a wall effect for the singular masses of the strength of δ2 is observed. © 2020	Altybay, A., Ruzhansky, M., Sebih, M.E., Tokmagambetov, N. Fractional Klein-Gordon equation with singular mass (2021) Chaos, Solitons and Fractals, 143, статья № 110579, . DOI: 10.1016/j.chaos.2020.110579
17.	Fractional Schrödinger Equation with Singular Potentials of Higher Order	DOI: 10.1016/S0034-4877(21)00016-1	In this paper the space-fractional Schrödinger equations with singular potentials are studied. Delta like or even higher-order singularities are allowed. By using the regularising techniques, we introduce a family of 'weakened' solutions, calling them very weak solutions. The existence, uniqueness and consistency results are proved in an appropriate sense. Numerical simulations are done, and a particles accumulating effect is observed in the singular cases. From the mathematical point of view a "splitting of the strong singularity" phenomena is also observed. © 2021 Polish Scientific Publishers	Altybay, A., Ruzhansky, M., Sebih, M.E., Tokmagambetov, N. Fractional Schrödinger Equation with Singular Potentials of Higher Order (2021) Reports on Mathematical Physics, 87 (1), pp. 129-144. DOI: 10.1016/S0034-4877(21)00016-1
18.	Fragmented algorithm for construction of adapted structured computational grids based on inverted beltrami equation	DOI: 10.3997/2214-4609.202035177	The paper describes implementation of Language for Numerical Algorithms (LuNA), which is the system aimed at automatic generation of parallel programs for the large-scale numerical modeling, for construction of structured computational grids adapted to the field of values and gradients. This system is based on operating with data fragments and operation fragments as separate objects with their call and use order and hierarchy. As any automated system generation of parallel programs may show less efficiency comparing to straight implementation of parallelization for computational programs. But benefit of automatization is in optimization of resource spent for development both in terms of funding in human resources. So, when the time loss of automated program is not too large, i.e. in cases of comparable speed of operation automated approach is counted as effective. Grid construction method is based on solving border problem for inverted Beltrami equation. Adaptation of the grid is managed by control metric that is different from the metric of the space volume where the computations take place. The behavior of such model	Turar, O., Akhmed-Zaki, D., Khakimzyanov, G., Daribayev, B., Lebedev, D. Fragmented algorithm for construction of adapted structured computational grids based on inverted beltrami equation (2020) ECMOR 2020 - 17th European Conference on the Mathematics of Oil Recovery, . DOI: 10.3997/2214-4609.202035177

			close to diffuse equation problems considering that metric of the domain is different from flat metric of cartesian grid. Parallelization is based on algorithm of 3D decomposition for the computational area. The equation is solved on each subdomain of the initial domain using alternating directions implicit (ADI) method in 3D. This parallel algorithm does not exactly parallelize similar ADI method for whole domain. It rather performs adaptation of whole domain as connected patches of lesser domains each of which adapts to control metric and changes border values on each iteration. Correctness of the approach is based on previous research of grid construction method where the correctness such technique for constructing of continuous adapted grids for patched domains are stated. The results and performance of computations on LuNA system were compared with straight parallel algorithm on the same machine. Copyright © ECMOR 2020. All rights reserved.	
19.	GMRES based numerical simulation and parallel implementation of multicomponent multiphase flow in porous media	DOI: 10.1080/23311916.2020.1785189	This article considered the numerical simulation of multicomponent multiphase flow in porous media. The resulting system of nonlinear equations linearized by the Newton-Raphson method and solved with the iterative Generalized minimal residual method (GMRES) algorithm. To achieve better convergence, we used the ILU(0) preconditioner to the GMRES algorithm. As a result, we used a completely implicit scheme called the Newton-ILU0-GMRES algorithm to solve the problem of interest. Based on the obtained sequential algorithm, we implemented a parallel algorithm using Message Passing Interface (MPI) technology. Additionally, we made comparisons between the parallel program of the presented algorithm and the parallel program using the ready-made Portable Extensible Toolkit for Scientific Computation (PETSc) library. We developed an MPI parallel algorithm and tested it on the MVS-10P supercomputer of the Interdepartmental Supercomputer Center of the Russian Academy of Sciences. © 2020, © 2020 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.	Mukhambetzhanov, S.T., Lebedev, D.V., Kassymbek, N.M., Imankulov, T.S., Matkerim, B., Akhmed-Zaki, D.Z. (2020) Cogent Engineering, 7 (1), статья № 1785189, . DOI: 10.1080/23311916.2020.1785189

20.	Gpu-based parallel algorithm for solving multiphase, multicomponent fluid filtration problem	DOI: 10.3997/2214-4609.202035205	Hydrodynamic modeling of oil reservoir processes is one of the complex problems of fluid mechanics, since underground reservoir processes can be very complex. It is necessary to take into account phase transitions, chemical transformations, temperature effects, and etc. When simulating multiphase, multicomponent liquid filtration, the properties of the phase can vary depending on the composition of temperature and pressure. The oil phase consists of hydrocarbon components that range from the lightest (methane) to the heaviest (bitumen). You can simulate the process of multicomponent filtration, knowing the physical parameters of the pseudo-components (molecular weight, critical pressure, critical temperature, compressibility, density, viscosity, thermal conductivity and specific heat). Parallel algorithms implemented on graphic processors (GPUs) than on traditional processors (CPUs) are excellently suited to speed up such demanding tasks. In various fields of research, there have been many successful implementations on the GPU, such as medical image analysis and computational fluid dynamics. The GPU achieves high performance by executing more than a thousand threads at the same time, and each of them processes different data sets. The purpose of this paper is to implement the parallel algorithm on modern graphic processors (GPUs) for numerically solving a multiphase multicomponent fluid filtration problem in porous media, taking into account the number of phases and components. For the numerical solution of the problem, the alternating direction implicit method (ADI) was chosen. ADI is a finite difference numerical method for solving parabolic, hyperbolic and elliptic equations, and it is widely used in the fields of science and technology. In the ADI method, each numerical step is divided into several sub-steps, depending on the spatial dimension of the problem, and systems of linear equations are solved implicitly in one direction, with an explicit scheme in the other direction. In addition, at each sub-stage, the equations have a tridiagonal structure. To solve the tridiagonal system of equations, several parallel algorithms were implemented: Cyclic reduction (CR) and parallel cyclic reduction (PCR) methods. And to implement the sequential algorithm, the Thomas implicit method was used. In	Imankulov, T., Akhmed-Zaki, D., Daribayev, B., Turar, O. Gpu-based parallel algorithm for solving multiphase, multicomponent fluid filtration problem (2020) ECMOR 2020 - 17th European Conference on the Mathematics of Oil Recovery, . DOI: 10.3997/2214-4609.202035205

			this paper, to implement parallel algorithms CUDA technology and the OpenCL framework were used. The results of the study showed that the OpenCL framework is promising to use on any GPUs of any devices and get comparable results in terms of calculation time with CUDA. And to calculate parallel algorithms on CUDA, only GPUs from Nvidia are needed. Copyright © ECMOR 2020. All rights reserved.	
21.	Group decision support system based on Bayesian network	DOI: 10.15199/48.2020.09.26	The article examines the process of building a developed group decision support system, its analytical and informational support. Different modes of the operation of the system are described. Software implementation and practical aspects of using such a system to resolve conflicts in supporting group decision making process are proposed. The experimental results, which allowed to confirm the effectiveness of the developed system and its application for evaluation and teaching of users are presented. © 2020 Wydawnictwo SIGMA-NOT. All rights reserved.	Kvyetnyy, R.N., Kuzmina, N.F., Poplavskyy, O.A., Drabovska, V.A., Kuzmik, V.B., Gromaszek, K., Kalizhanova, A., Smailova, S. Group decision support system based on Bayesian network (2020) Przeglad Elektrotechniczny, 96 (9), pp. 123-128. DOI: 10.15199/48.2020.09.26
22.	Improved method of searching the associative rules while developing the software	DOI: 10.24425-ijet.2020.131895/715	As the delivery of good quality software in time is a very important part of the software development process, it's a very important task to organize this process very accurately. For this, a new method of the searching associative rules were proposed. It is based on the classification of all tasks on three different groups, depending on their difficulty, and after this, searching associative rules among them, which will help to define the time necessary to perform a specific task by the specific developer. © 2020 The Author(s).	Savchuk, T.O., Pryimak, N.V., Slyusarenko, N.V., Smolarz, A., Smailova, S., Amirgaliyev, Y. Improved method of searching the associative rules while developing the software (2020) International Journal of Electronics and Telecommunications, 66 (3), pp. 425-430. DOI: 10.24425-ijet.2020.131895/715
23.	In silico Prediction of miRNA Interactions With Candidate Atherosclerosis Gene mRNAs	DOI: 10.3389/fgene.2020.605054	The involvement of genes and miRNAs in the development of atherosclerosis is a challenging problem discussed in recent publications. It is necessary to establish which miRNAs affect the expression of candidate genes. We used known candidate atherosclerosis genes to predict associations. The quantitative characteristics of interactions of miRNAs with mRNA candidate genes were determined using the program, which identifies the localization of miRNA binding sites in mRNA, the free energy interaction of miRNA with mRNA. In mRNAs of GAS6 and	Mukushkina, D., Aisina, D., Pyrkova, A., Ryskulova, A., Labeit, S., Ivashchenko, A. In silico Prediction of miRNA Interactions With Candidate Atherosclerosis Gene mRNAs (2020) Frontiers in Genetics, 11, статья № 605054, .

			NFE2L2 candidate genes, binding sites of 21 miRNAs and of 15 miRNAs, respectively, were identified. In IRS2 mRNA binding sites of 25 miRNAs were located in a cluster of 41 nt. In ADRB3, CD36, FASLG, FLT1, PLA2G7, and PPARGC1A mRNAs, clusters of miR-466, ID00436.3p-miR, and ID01030.3p-miR BS were identified. The organization of overlapping miRNA binding sites in clusters led to their compaction and caused competition among the miRNAs. The binding of 53 miRNAs to the mRNAs of 14 candidate genes with free energy interactions greater than −130 kJ/mole was determined. The miR-619-5p was fully complementary to ADAM17 and CD36 mRNAs, ID01593.5p-miR to ANGPTL4 mRNA, ID01935.5p-miR to NFE2L2, and miR-5096 to IL18 mRNA. Associations of miRNAs and candidate atherosclerosis genes are proposed for the early diagnosis of this disease. © Copyright © 2020 Mukushkina, Aisina, Pyrkova, Ryskulova, Labeit and Ivashchenko.	DOI: 10.3389/fgene.2020.605054
24.	Indoor air quality control using backpropagated neural networks	DOI: 10.32604/cmc.2022.020491	Providing comfortable indoor air quality control in residential construction is an exceedingly important issue. This is due to the structure of the fast response controller of air quality. The presented work shows the breakdown and creation of a mathematical model for an interactive, nonlinear system for the required comfortable air quality. Furthermore, the paper refers to designing traditional proportional integral derivative regulators and proportional, integral, derivative regulators with independent parameters based on a backpropagation neural network. In the end, we perform the experimental outputs of a suggested backpropagation neural network-based proportional, integral, derivative controller and analyze model results by applying the proposed system. The obtained results demonstrated that the proposed controller can provide the required level of clean air in the room. The proposed developed model takes into consideration international Heating, Refrigerating, and air conditioning standards as ASHRAE AND ISO. Based on the findings, we concluded that it is possible to implement a proposed system in homes and offer equivalent indoor air quality with continuous mechanical ventilation without a profuse amount of energy. © 2022 Tech Science Press. All rights reserved.	Uskenbayeva, R., Altayeva, A., Gusmanova, F., Abdulkarimova, G., Berkimbaeva, S., Dalbekova, K., Suiman, A., Zhanseitova, A., Amreyeva, A. Indoor air quality control using backpropagated neural networks (2022) Computers, Materials and Continua, 70 (2), pp. 3837-3853. DOI: 10.32604/cmc.2022.020491

25.	Information technologies for assessing the quality of it-specialties graduates' training of university by means of fuzzy logic and neural networks	DOI: 10.24425-ijet.2020.131893/713	The information technologies for assessing the quality of IT-specialties graduates' training of university by means of fuzzy logic and neural networks are developed in the article. It makes possible taking into account a wide set of estimation and output parameters, influence of the external and internal factors and allows to simplify the assessing process by means of modern mathematical apparatuses of artificial intelligence. © 2020 The Author(s).	Azarova, A.O., Azarova, L.E., Pavlov, S.V., Savina, N.B., Kaplun, I.S., Wójcik, W., Smailova, S., Kalizhanova, A. (2020) International Journal of Electronics and Telecommunications, 66 (3), pp. 411-416. DOI: 10.24425-ijet.2020.131893/713
26.	Interrogation system of signals from rotation sensors using tilted fiber Bragg gratings	DOI: 10.1080/23311916.2020.1743405	The paper herein is concerned with the system of interrogating the signals, entering from rotation sensors. The systems for analyzing the sensors thereof most often require capacity's reference measurement. It allows obtaining the measurement's higher resolution comparing to single-channel systems, in which it is impossible to measure the reference power. In case of single-channel solutions, there is most frequently tracked the wavelength shift, corresponding to the extreme, according to spectral specifications. © 2020, © 2020 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.	Ainur, K., Kisała, P., Waldemar, W., Aliya, K., Orken, M., Maksat, A. (2020) Cogent Engineering, 7 (1), статья № 1743405, . DOI: 10.1080/23311916.2020.1743405
27.	Mathematical justification of thermosyphon effect main parameters for solar heating system	DOI: 10.1080/23311916.2020.1851629	This paper considers the main parameters of the solar collector with thermosyphon circulation for the solar heat supply system. There was developed a flat solar collector construction with thermosyphon circulation wherein the heat transfer coefficient is increased by removing the additional partitions between a panel and heat insulation. The solar collector's efficiency reached by the availability of a tank and thermal pump in the construction where a condenser and evaporator executed the form of a heat exchanger of «spiral in spiral» type and heat exchanger pipe connections are one above another, which allows increasing the square and heat exchange intensity. The outcome of the study is a description of the mathematical analysis of the heat transmission process in the tank accumulator. We have shown a heat carrier thermophysical parameter dependence on the temperature. © 2020 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.	Yedilkhan, A., Murat, K., Beibut, A., Aliya, K., Ainur, K., Tumur, M., Azhibek, D. Mathematical justification of thermosyphon effect main parameters for solar heating system (2020) Cogent Engineering, 7 (1), статья № 1851629, . DOI: 10.1080/23311916.2020.1851629

28.	Mathematical Modeling of the Water Saturation Algorithm of the Mountain Slope on the Example of the Catastrophic Landslide of the Northern Tien Shan Ak Kain	DOI: 10.18280/mmep.080318	The purpose of this article is to present the developed methodology, a brief algorithm of mechanical-and-mathematical modeling to investigate the causes and mechanism of soil disruption from the hillsides and the results of its use for restoring the pre-landslide stress state using the example of one of the tragic landslides. The numerical finite element algorithm of studying the stress–strain state (SSS) of soil deposits of slopes of the inclined-layered structure is briefly described, with specific features of the use of isoparametric elements of the quadrangular shape with four nodes of arbitrary shape. For detailed studying the SSS, the cover soils of the steep slope of the inclined-layered structure, in height from the arch to the foot, are conventionally divided into three zones, each of which has layered structures. Studies of the geometry of its area and the angle of inclination of the slope showed that the two-layer structure of its original structure made a curved path repeating the outline of the gorge. The finite element method helped to model the soil deposits of the slope with the granite-basalt rock as close as possible to the landslide initial shape. The proposed methodology, the mechanical-mathematical model, algorithms and calculation examples allow predicting the possible occurrence of landslides on other countless hillsides of the Northern Tien Shan by determining stress concentration zones. © 2021	Baimakhan, R., Kadirova, Z., Seinassinova, A., Baimakhan, A., Abdiakhmetova, Z. Mathematical Modeling of the Water Saturation Algorithm of the Mountain Slope on the Example of the Catastrophic Landslide of the Northern Tien Shan Ak Kain (2021) Mathematical Modelling of Engineering Problems, 8 (3), pp. 467-476. DOI: 10.18280/mmep.080318
29.	Mathematical models and methods for solving the problem of evacuation		The problem of evacuation of people from closed premises such as universities, colleges and schools is considered. The peculiarity of this work lies in the formation of an integrated approach for organizing the evacuation process in peacetime as a training for an emergency. A conceptual diagram of an evacuation system is proposed that uses heterogeneous sources for receiving and transmitting information about the onset of an emergency. The input and output sources for receiving and transmitting information about the number of people in the building are determined. The main purpose of the system is to form an operational evacuation plan in real time. The optimal solution to the problem of maximum network flow is implemented using a game-theoretic approach. A mathematical model has been developed for the optimal distribution of the flow along the	Kozbakova, A., Kalizhanova, A., Malikova, F., Amirgaliyev, Z., Kartbayev, T., Sharipova, B., Aitkulov, Z., Astanayeva, A. Mathematical models and methods for solving the problem of evacuation (2021) Journal of Theoretical and Applied Information Technology, 99 (14), pp. 3529-3541.

			grindshill network with the analysis of the flow formation and the characteristics of the ways of people moving in closed spaces. A game-theoretic approach and mathematical methods of the theory of hydraulic networks for finding an equilibrium state in flow-distribution networks have been developed. An algorithm for solving the evacuation problem using the graph approach is proposed. © 2021 Little Lion Scientific	
30.	miRNA Binding Site Clusters in mRNAs of Colorectal Cancer Candidate Genes	DOI: 10.1134/S1995078020060038	Colorectal cancer is one of the three most common oncological diseases worldwide and has a high mortality rate. The complexity of early diagnosis of the disease lies in its polygenic nature. Colorectal cancer is accompanied by a change in the concentration of nanoscale miRNAs (mRNA-inhibiting RNA), which can alter the expression of candidate genes associated with the disease. The purpose of this study was to identify the interactions between 6274 human miRNAs and 28 mRNAs (messenger RNA) of colorectal cancer candidate gene. The quantitative characteristics of these interactions were determined using the MirTarget program. The binding sites of 142 miRNAs in 28 candidate gene mRNAs were determined. 28 miRNAs and mRNA genes associations in 5′UTR (5′-untranslated region), ten in CDS (coding sequence) with a free energy of interaction more than -130 kJ/mol, and multiple binding sites clusters of ID00436.3p-miR, ID01030.3p-miR, miR-466 and ID00470.5p-miR, miR-574-5p are recommended for the diagnosis of colorectal cancer. Significant differences were found in the characteristics of the miRNA interactions in the 5′UTR, CDS and 3′UTR (3′-untranslated region) of mRNA candidate genes. The features of the miRNA binding sites have been established depending on their location in the 5′UTR, CDS and 3′UTR. The miRNA binding sites with overlapping nucleotide sequences that form clusters were identified. The organization of binding sites on clusters leads to compaction and competition between miRNAs for binding in the cluster. The most effective associations between miRNAs and candidate target genes, which are proposed as markers for the development of methods for the early diagnosis of colorectal cancer are determined. © 2020, Pleiades Publishing, Ltd.	Akimniyazova, A.N., Pyrkova, A.Y., Aisina, D.E., Ivashchenko, A.T. miRNA Binding Site Clusters in mRNAs of Colorectal Cancer Candidate Genes (2020) Nanotechnologies in Russia, 15 (11-12), pp. 807-818. DOI: 10.1134/S1995078020060038

31.	Modification of the Euler Polygonal Method for Solving a Semi-periodic Boundary Value Problem for Pseudo-parabolic Equation of Special Type	DOI: 10.1007/s00009-020-01540-4	A semi-periodic boundary value problem for a pseudo-parabolic equation of special type is investigated. A modification of the Euler polygonal method is applied to a semi-periodic boundary-value problem for a non-classical differential equation of third order. By introducing new unknown functions, the problem under consideration is reduced to an equivalent problem consisting of a family of periodic boundary value problems for a system of two ordinary differential equations and some integral relations. We obtain the conditions for the unique solvability of the problem. The estimates of convergence of approximate solution of the equivalent problem to the exact solution of the original problem are established. © 2020, Springer Nature Switzerland AG.	Assanova, A.T., Kabdrakhova, S.S. Modification of the Euler Polygonal Method for Solving a Semi-periodic Boundary Value Problem for Pseudo-parabolic Equation of Special Type (2020) Mediterranean Journal of Mathematics, 17 (4), статья № 109, . DOI: 10.1007/s00009-020-01540-4
32.	Numerical simulation of multiphase multicomponent flow in porous media: Efficiency analysis of newton-based method	DOI: 10.3390/fluids6100355	Newton's method has been widely used in simulation multiphase, multicomponent flow in porous media. In addition, to solve systems of linear equations in such problems, the generalized minimal residual method (GMRES) is often used. This paper analyzed the one-dimensional problem of multicomponent fluid flow in a porous medium and solved the system of the algebraic equation with the Newton-GMRES method. We calculated the linear equations with the GMRES, the GMRES with restarts after every m steps—GMRES(m) and preconditioned with Incomplete Lower-Upper factorization, where the factors L and U have the same sparsity pattern as the original matrix—the ILU(0)-GMRES algorithms, respectively, and compared the computation time and convergence. In the course of the research, the influence of the preconditioner and restarts of the GMRES(m) algorithm on the computation time was revealed; in particular, they were able to speed up the program. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.	Imankulov, T., Lebedev, D., Matkerim, B., Daribayev, B., Kassymbek, N. Numerical simulation of multiphase multicomponent flow in porous media: Efficiency analysis of newton-based method (2021) Fluids, 6 (10), статья № 355, . DOI: 10.3390/fluids6100355
33.	Numerical Solution of the Inverse Pharmacokinetic Problem for the Three- Compartment Model		This article considers the numerical solution of the inverse pharmacokinetics problem for a three-compartment linear model. First, the article presents some reviews of the pharmacokinetics problem and the three-compartment model. The following describes the formulation of the pharmacokinetics problem for a three-compartment linear model. The direct problem is the Cauchy problem for systems of ordinary differential equations. Solving the direct problem analytically, we find the concentration for the first	Kasenov, S., Urmashev, B., Temirbekov, A., Amantayeva, A. Numerical Solution of the Inverse Pharmacokinetic Problem for the Three-Compartment Model (2020) Journal of Engineering Science and Technology Review, (Special Issue), pp. 122-126.

			compartment, since it is the object of the study. The formulation of the inverse problem is reduced to a nonlinear operator equation. For the inverse problem, seven coefficients concentration for the first compartment should be found for some additional information of a given concentration. The inverse problem is reduced to minimizing the objective functional. For the numerical solution, an adaptive search method is used genetic algorithm. The numerical results of this problem are given. © 2020 School of Science, IHU. All Rights Reserved.	
34.	On One Algorithm To Find a Solution to a Linear Two-Point Boundary Value Problem	DOI: 10.1134/S1995080221030173	A two-parameter family of algorithms for finding an approximatesolution to a linear two-point boundary value problem for a systemof ordinary differential equations is offered. The convergenceconditions for the algorithms are obtained. The necessary andsufficient coefficient conditions for the well-posedness ofconsidered problem are established. © 2021, Pleiades Publishing, Ltd.	Temesheva, S.M., Dzhumabaev, D.S., Kabdrakhova, S.S. (2021) Lobachevskii Journal of Mathematics, 42 (3), pp. 606-612.
35.	Optimization model of adaptive decision taking support system for distributed systems cyber security facilities placement	DOI: 10.24425-ijet.2020.134004/724	An article herein presents an optimization model, designated for computational core of decision-taking support system (DTSS). DTSS is necessary for system analysis and search of optimal versions for cyber security facilities placement and information protection of an enterprise or organization distributed computational network (DCN). DTSS and a model allow automize the analysis of information protection and cyber security systems in different versions. It is possible to consider, how separate elements, influence at DCN protection factors and their combinations. Offered model, in distinction from existing, has allowed implementing both the principles of information protection equivalency to a concrete threat and a system complex approach to forming a highly effective protection system for DCN. Hereby we have presented the outcomes of computational experiments on selecting the rational program algorithm of implementing the developed optimization model. It has been offered to use genetic algorithm modification (GAM). Based on the offered model, there has been implemented the module for adaptive DTSS. DTSS module might be applied upon designing protected DCN, based on preset architecture and available sets of	Kalizhanova, A., Akhmetov, S., Lakhno, V., Wojcik, W., Nabiyeva, G. Optimization model of adaptive decision taking support system for distributed systems cyber security facilities placement (2020) International Journal of Electronics and Telecommunications, 66 (3), pp. 493-498. DOI: 10.24425-ijet.2020.134004/724

			information protection and cyber security systems in the network. © 2020 The Author(s).	
36.	Parallel CUDA implementation of a numerical algorithm for solving the Navier-Stokes equations using the pressure uniqueness condition	DOI: 10.1063/5.0041039	In this paper, we study numerical methods for solving the Navier-Stokes equations in doubly connected domains. Two methods for solving the problem are considered. The first method is based on constructing a difference problem in variables of the stream function and the vortex of velocity using the uniqueness condition for pressure. The numerical solution of the elliptic equation for stream functions is found as the sum of the solutions of two simple problems of an elliptic type. One problem is with homogeneous boundary conditions, and the other is with a homogeneous equation. An alternative approach to solving the problem is the fictitious domain method with the continuation of the least coefficient. This method does not require satisfying the pressure uniqueness condition, and is simple to implement. An important direction in the development of numerical simulation methods is the study of approximate methods for solving problems of mathematical physics in complex multidimensional areas. To solve many applied problems in irregular areas, the fictitious domain method is widely used, which is characterized by a high degree of automation of programming. The main idea of the fictitious domain method is that the problem is solved not in the original complex domain, but in some other, simpler domain. This allows to create software immediately for a fairly wide class of problems with arbitrary computational domains. The possibilities of applying the fictitious domain method to the problems of hydrodynamics in the variables "stream function, vortex of velocity"are considered in many works. In this paper, we study a numerical method for solving the Navier-Stokes equations in doubly connected domains. A computational finite difference algorithm for solving an auxiliary problem of the fictitious domain method has been developed. The results of numerical modeling of the two-dimensional Navier-Stokes equations by the fictitious domain method with continuation by the lowest coefficient are presented. For this problem, a parallel algorithm was developed using the CUDA architecture, which was tested on various grid dimensions. © 2021 Author(s).	Temirbekov, A., Baigereyev, D., Temirbekov, N., Urmashev, B., Amantayeva, A. Parallel CUDA implementation of a numerical algorithm for solving the Navier-Stokes equations using the pressure uniqueness condition (2021) AIP Conference Proceedings, 2325, статья № 020063, . DOI: 10.1063/5.0041039

37.	Parallel programs execution optimization using behavior control in LuNA system	DOI: 10.1007/s11227-021-03654-2	In the paper, the problem of efficient parallel execution of numerical algorithms for supercomputers in the LuNA system is concerned. With LuNA, an application algorithm is represented in a hardware-independent high-level form. This allows implementing the algorithm by automatic construction of various parallel programs, which possess different non-functional properties, such as execution time, memory consumption, network workload. In the LuNA system, the efficiency problem of automatically constructed parallel programs is dealt with through the behavior concept. The presented approach allows controlling parallel program behavior without low-level programming of the desired behavior. © 2021, The Author(s), under exclusive licence to Springer Science+Business Media, LLC part of Springer Nature.	Malyshkin, V., Akhmed-Zaki, D., Perepelkin, V. Parallel programs execution optimization using behavior control in LuNA system (2021) Journal of Supercomputing, 77 (9), pp. 9771-9779. DOI: 10.1007/s11227-021-03654-2
38.	Possibilities of automated diagnostics of odontogenic sinusitis according to the computer tomography data	DOI: 10.3390/s21041198	Individual anatomical features of the paranasal sinuses and dentoalveolar system, the complexity of physiological and pathophysiological processes in this area, and the absence of ac-tual standards of the norm and typical pathologies lead to the fact that differential diagnosis and assessment of the severity of the course of odontogenic sinusitis significantly depend on the measurement methods of significant indicators and have significant variability. Therefore, an ur-gent task is to expand the diagnostic capabilities of existing research methods, study the signifi-cance of the measured indicators, and substantiate the expediency of their use in the diagnosis of specific pathologies in an automated mode. Methods of digital filtering, image segmentation and analysis, fluid dynamics, and statistical and discriminant analysis were used. Preliminary differential diagnosis of odontogenic sinusitis can be performed by densitemetric analysis of tomo-graphic images of the maxillary sinuses, performed using frontal multiplanar reconstructions according to a given algorithm. The very manifestation of the characteristic changes in the densito-graphy of the maxillary sinus allows for the initiation of certain pathological processes and permits the development of the effectiveness of the diagnosis of the pathology of the sinus sinuses, which can be realized automatically in real life. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.	Avrunin, O.G., Nosova, Y.V., Abdelhamid, I.Y., Pavlov, S.V., Shushliapina, N.O., Wójcik, W., Kisała, P., Kalizhanova, A. Possibilities of automated diagnostics of odontogenic sinusitis according to the computer tomography data (2021) Sensors (Switzerland), 21 (4), статья № 1198, pp. 1-22. DOI: 10.3390/s21041198

39.	Predicting associations of mirnas and candidate gastric cancer genes for nanomedicine	DOI: 10.3390/nano11030691	Nanoscale miRNAs regulate the synthesis of most human proteins involved in differentiation, proliferation, cell cycle, apoptosis, and other processes associated with the growth and the development of an organism. miRNAs also play a number of important roles in the development of gastric cancer. In this work, we studied the quantitative characteristics of miRNA interactions with 69 candidate gastric cancer genes using bioinformatics approaches. To this end, the MirTarget program was used, which determines the characteristics of miRNA binding to mRNA in the 5′UTR, CDS, and 3'UTR. Associations of miRNAs with alternative target genes and associations of genes with alternative miRNAs were established. The cluster organization of miRNA binding sites (BSs) in mRNA was revealed, leading to the emergence of miRNA competition for binding to the mRNA of a target gene. Groups of target genes with clusters of overlapping BSs include miR-5095,miR-619-5p, miR-1273 family, miR-466, ID01030.3p-miR, ID00436.3p-miR, miR-574-5p, and ID00470.5p-miR. In the defined associations of target genes and miRNAs, miRNA BSs are organized into clusters of multiple BSs, which facilitate the design and the development of a system of chips that can be used to control the state of miRNA and target genes associations in gastric cancer. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.	Akimniyazova, A., Pyrkova, A., Uversky, V., Ivashchenko, A. Predicting associations of mirnas and candidate gastric cancer genes for nanomedicine (2021) Nanomaterials, 11 (3), статья № 691, pp. 1-16. DOI: 10.3390/nano11030691
40.	Predicting Characteristics of the Potentially Binding Sites for miRNA in the mRNA of the TCP Transcription Factor Genes of Plants	DOI: 10.1134/S1021443720040147	The expression of the TCP transcription factor family genes depends on miRNA, whose effect on the translation of their mRNA is poorly studied. Interactions between miRNA and mRNA were studied with the MirTarget program, which allows estimating of quantitative characteristics of binding of the whole nucleotide sequence of miRNA to mRNA. The analysis of binding of 125 miRNAs to mRNAs of 28 genes of the TCP family of Triticum aestivum L. revealed eight target genes for miR319-3p, miR444a-3p, miR5086-5p, miR9666a-3p, and miR9780-3p. miRNA binding sites in mRNA of the TCP family genes of T. aestivum were located in the CDS only. Only 12 of 22 mRNAs of the TCP family genes of Oryza sativa L. bounded to the miR1437b-5p, miR1846a-5p, miR1848-5p, miR1858a-5p, miR1858b-5p, miR1861d-5p, miR1861h-5p, miR2102-3p, miR2102-5p, miR2919, miR2925-5p,	Rakhmetullina, A.K., Pyrkova, A.Y., Goncharova, A.V., Ivashchenko, A.T. Predicting Characteristics of the Potentially Binding Sites for miRNA in the mRNA of the TCP Transcription Factor Genes of Plants (2020) Russian Journal of Plant Physiology, 67 (4), pp. 606-617. DOI: 10.1134/S1021443720040147

			miR319a-3, miR408-3p, miR5075-3p, and miR5819-5p out of 738 miRNAs in total. miRNA binding sites were located in the 5'UTR and CDS regions of mRNAs of the TCP family genes of O. sativa. Only 10 of 46 TCP family genes of Zea mays L. were shown to be targets for the miR164g-3p, miR164h-5p, miR166a-5p, miR168a-5p, miR171d-5p, miR399d-3p, and miR408a-3p out of 325 miRNAs of Z. mays. The zma-miR166a-5p was bound to mRNAs of the genes GRMZM2G031905_P01, GRMZM2G055024_P01, GRMZM2G062711_P01, and GRMZM2G170232_P01. Two miRNAs were shown to bind to mRNAs of the genes AC213524.3_FGP003, AC233950.1_FGP002, and GRMZM2G034638_P01. Only one miRNA was bound to mRNAs of the genes GRMZM2G035944_P01, AC190734.2_FGP003, and AC205574.3_FGP006. miRNA binding sites were located in the 5'UTR and CDS regions of mRNAs of the TCP family genes of Z. mays. Ten of 27 TCP family genes of Arabidopsis thaliana (L.) Heynh. were shown to be targets for the miR319-3p, miR4228-5p, miR4228-3p, miR5021-5p, miR5658-5p, and miR8181-5p out of 429 miRNAs of A. thaliana. mRNAs of the AT1G53230 and AT2G31070 genes had binding sites for the miR319c-3p, miR5021-5p, and miR5658-5p, while mRNA of the AT3G15030 gene had binding site for the miR319a-3p and miR4228-3p. Two miRNAs bounded to mRNAs of the genes AT1G69690, AT3G02150, and AT3G47620. One miRNA bounded to mRNAs of the genes AT1G30210, AT4G18390, and AT5G08330. miRNA binding sites were located in the 5'UTR, CDS and 3'UTR regions of mRNA of the TCP gene family of A. thaliana. mRNAs of six groups of the TCP family genes had binding sites for the miR319-3p, miR444a-3p, miR5021-5p, miR5658-5p, and miR2102-5p, which encode the oligopeptides QRGPLQS, STSETS, SSSSSS, HHHHHH, GGGGGG, and AAAAAA conservative in the TCP family proteins of different plant species. Quantitative characteristics of miRNA binding to mRNAs of plant transcription factors of the TCP family, which participate in regulation of growth and development of plants, have been predicted.	

41.	Prediction of characteristics of interactions of miRNA with mRNA of GRAS, ERF, C2H2 genes of A. thaliana, O. sativa and Z. mays	DOI: 10.1016/j.cpb.2021.100224	Modern methods of increasing plant productivity are based on knowledge of the molecular basis of plant growth and development. The key regulators of these processes are transcription factors (TF) that control the expression of the genome at all stages of ontogenesis. The expression of significant part of the TF genes depends on miRNAs, therefore, it is necessary to find out which miRNAs and to what extent they can affect TFs. In the present work, using the MirTarget program, we identified miRNAs capable of affecting the expression of GRAS (gibberellic-acid insensitive, repressor of gai and scarecrow), ERF (ethylene responsive factor), C2H2 (cysteine and histidine residues in their secondary structures) TF genes of A. thaliana, O. sativa, and Z. mays. The obtained characteristics of the interaction of miRNA with mRNA TF genes revealed effective associations of miRNA and TF of GRAS, ERF, and C2H2 families. During the interaction of 428 ath-miRNAs with mRNAs of 37 GRAS family genes of A. thaliana, only 11 target genes were found for eight ath-miRNAs. Of the 60 genes of the GRAS family of O. sativa, 18 genes were targets only for 16 osa-miRNAs out of 738 osa-miRNAs. Of 325 zma-miRNAs and 86 genes of the GRAS family of Z. mays, only 14 genes were targets for eight zma-miRNAs. Of 428 ath-miRNAs of A. thaliana with 123 mRNA genes of the ERF family, 25 target genes were identified for eight ath-miRNAs. Out of 738 osa-miRNAs only 13 osa-miRNAs efficiently bind to mRNA of 16 ERF genes. Of 325 zma-miRNAs with mRNAs of 186 genes of the ERF family of Z. mays, only two genes were targets for two zma-miRNAs. Of 428 ath-miRNAs and 87 genes of C2H2 family of A. thaliana, only 17 genes were targets of nine ath-miRNAs. Ten osa-miRNAs could interact with mRNA of 17 genes of the C2H2 family of O. sativa. An important role of osa-miRNA in the regulation of rice growth and development is suggested by influencing the C2H2 family TF genes of O. sativa. The ath-miR5021–5p, ath-miR5658–5p, osa-miR2102–5p, and osa-miR5075–3p interacted with several TF target genes of the C2H2, ERF, and GRAS families and had conserved binding sites that encode conserved oligopeptides. © 2021 The Authors	Rakhmetullina, A., Zielenkiewicz, P., Pyrkova, A., Uteulin, K., Ivashchenko, A. Prediction of characteristics of interactions of miRNA with mRNA of GRAS, ERF, C2H2 genes of A. thaliana, O. sativa and Z. mays (2021) Current Plant Biology, 28, статья № 100224, . DOI: 10.1016/j.cpb.2021.100224

42.	Reaction Rate of Radiative p 13N Capture	DOI: 10.1007/s11182-021-02415-1	Within the framework of the modified potential cluster model with forbidden states, we have considered the astrophysical S-factor of radiative p13N capture at low energies. The S-factor is calculated on the basis of the E1 transition to the bound 3P0 state of the 14O nucleus in the p13N channel from the 3S1 wave of p13N scattering in the energy range from 30 keV to 7 MeV, which includes a resonance at 0.545 (1–) MeV (c.m.). The S-factor in the energy range 30–70 keV proved to be practically stable and equal to 7.3(2) keV·b. Next, we obtained the reaction rate in the temperature range from 0.01 T9 to 10 T9, which is in general agreement with the results of works by Li (2006), Tang (2004), and Magnus (1994). However, the obtained reaction rate at some temperatures is up to two times greater than the results of Decrock (1993). The reaction rate is approximated by a simple analytical expression. © 2021, Springer Science+Business Media, LLC, part of Springer Nature.	Dubovichenko, S.B., Dzhazairov-Kakhramanov, A.V., Shmygaleva, T.A. Reaction Rate of Radiative p 13N Capture (2021) Russian Physics Journal, . DOI: 10.1007/s11182-021-02415-1
43.	Restoration Of The Southern Bug River Ecosystem By Removing The Biomass Of Higher Water Plants		The purpose of the study is to analyze the parameters of higher aquatic plants of the Southern Bug River using multispectral methods and a quadcopter, as well as to develop environmental protection measures to improve the ecological state of the river. The location of the Southern Bug River (Ukraine) in the zone of intensive economic activity, the illegal development of a natural backwater strip near the river causes an increased anthropogenic pressure on aquatic ecosystems, which leads to their aggravated eutrophication, one of the features of which is a growing concentration of nutrients. The bioindication of surface water quality using higher aquatic plants, a comprehensive assessment of the impact of all hydromorphological, chemical and physicochemical indicators on their development was carried out. The assessment of the ecological state of water bodies using bioindication with the multispectral method and a quadcopter was carried out. After correcting the measurement results, the parameters of higher water plants in the water body were obtained. By segmenting the water body according to selected indicators, it is possible to determine the integral effect of pollutants in a	Kvaterniuk, S.M., Petruk, V.G., Frolov, V.F., Onyschuk, V.E., Wójcik, W., Pawłowski, L., Smailova, S., Kalizhanova, A. Restoration Of The Southern Bug River Ecosystem By Removing The Biomass Of Higher Water Plants (2021) International Journal of Conservation Science, 12 (SpecialIssue 1), pp. 755-764.

			specific section of the water body © 2021, International Journal of Conservation Science. All Rights Reserved.	
44.	Robotics in the international educational space: Integration and the experience	DOI: 10.1007/s10639-020-10257-6	Nowadays robotics is one of promising avenues in the sphere of emerging technologies. In the teaching/learning environment we deal with educational robotics, which is a mixture of theory and practice, knowledge of computer technology, Mathematics and Physics. The two vectors are combined in educational robotics: the educational vector and the technological vector. As an academic discipline and an area of practical application, Robotics means a very broad spectrum of modern knowledge of diverse academic engineering specialties (fields of expertise). That means that Robotics is interdisciplinary in nature. The work provides an overview of the research aimed at studying Robot – Man interaction. Besides, the work considers some promising international cooperation between children from around the world on the development of robotics, and the experience and benefits gained from such cooperation. As an example of the international cooperation in the sphere of Robotics, the two countries, Russia and Kazakhstan, are considered. The article gives an example of the international cooperation of some educational centers, describes the experience of the work on robotics with children of various ages, and the cooperation of various schools working in this field in Kazakhstan and Russia. The working experience in the sphere of social robotics aimed at helping people has become a priority for the children from the interdisciplinary teams from Russia and Kazakhstan. Interaction and cooperation in the sphere of robotics was also used for introducing unconventional curricula, which included courses on robotic technologies as tools for considering social aspects of robotics and artificial intelligence. © 2020, Springer Science+Business Media, LLC, part of Springer Nature.	Kerimbayev, N., Beisov, N., Kovtun, A., Nurym, N., Akramova, A. Robotics in the international educational space: Integration and the experience (2020) Education and Information Technologies, 25 (6), pp. 5835-5851. DOI: 10.1007/s10639-020-10257-6
45.	SIGN LANGUAGE DACTYL RECOGNITION BASED ON MACHINE	DOI: 10.15587/1729-4061.2021.239253	In the course of our research work, the American, Russian and Turkish sign languages were analyzed. The program of recognition of the Kazakh dactylic sign language with the use of machine learning methods is implemented. A dataset of 5000 images was formed for each gesture, gesture recognition algorithms were applied, such as Random Forest, Support Vector Machine,	Kenshimov, C., Buribayev, Z., Master, Amirgaliyev, Y., Ataniyazova, A., Masters Student, Aitimov, A. SIGN LANGUAGE DACTYL RECOGNITION BASED ON

	LEARNING ALGORITHMS		Extreme Gradient Boosting, while two data types were combined into one database, which caused a change in the architecture of the system as a whole. The quality of the algorithms was also evaluated. The research work was carried out due to the fact that scientific work in the field of developing a system for recognizing the Kazakh language of sign dactyls is currently insufficient for a complete representation of the language. There are specific letters in the Kazakh language, because of the peculiarities of the spelling of the language, problems arise when developing recognition systems for the Kazakh sign language. The results of the work showed that the Support Vector Machine and Extreme Gradient Boosting algorithms are superior in real-time performance, but the Random Forest algorithm has high recognition accuracy. As a result, the accuracy of the classification algorithms was 98.86 % for Random Forest, 98.68 % for Support Vector Machine and 98.54 % for Extreme Gradient Boosting. Also, the evaluation of the quality of the work of classical algorithms has high indicators. The practical significance of this work lies in the fact that scientific research in the field of gesture recognition with the updated alphabet of the Kazakh language has not yet been conducted and the results of this work can be used by other researchers to conduct further research related to the recognition of the Kazakh dactyl sign language, as well as by researchers, engaged in the development of the international sign language	MACHINE LEARNING ALGORITHMS (2021) Eastern-European Journal of Enterprise Technologies, 4 (2-112), pp. 58-72. DOI: 10.15587/1729-4061.2021.239253
46.	Statement and solution of multicriteria tasks of database modular block-schemes development	DOI: 10.24425/ijet.2020.131869	The paper considers developed and offered an effective algorithm for solving the block-symmetrical tasks of polynomial computational complexity of data processing modular block-schemes designing. Currently, there are a large number of technologies and tools that allow you to create information systems of any class and purpose. To solve the problems of designing effective information systems, various models and methods are used, in particular, mathematical discrete programming methods. At the same time, it is known that such tasks have exponential computational complexity and can not always be used to solve practical problems. In this regard, there is a need to develop models and methods of the new class, which	Wojcik, W., Kalizhanova, A., Akhmetov, S., Nabiyeva, G., Kozbakova, A. Statement and solution of multicriteria tasks of database modular block-schemes development (2020) International Journal of Electronics and Telecommunications, 66 (1), pp. 237-242. DOI: 10.24425/ijet.2020.131869

			provide the solution of applied problems of discrete programming, aimed at solving problems of large dimensions. The work has developed and proposed block-symmetric models and methods as a new class of discrete programming problems that allow us to set and solve applied problems from various spheres of human activity. The issues of using the developed models are considered. and methods for computer-aided design of information systems (IS). © The Author(s).	
47.	Study on multi-section continuum robot wire-tension feedback control and load manipulability	DOI: 10.1108/IR-03-2020-0054	Purpose: The purpose of this paper is to present a novel hybrid pre-tension mechanism for continuum manipulators to prevent wire slack and improve continuum robot payload capacity, as well as to present a new method to control continuum manipulators' shape. Design/methodology/approach: This research explains the hardware design of a hybrid pre-tension mechanism device and proposes a mathematic formulation wire-tension based on robot design. Also, the wire-tension control method and payload estimation model would be discussed. Findings: Wire-tension is directly related to the continuum manipulators' rigidity and accuracy. However, in the case of robot motion, wires lose their tension and such an issue leads to the inaccuracy and twist deformation. Therefore, the proposed design assists in preventing any wire slack and derailing the problem of the wires. Originality/value: The novelty of this research is proposed pre-tension mechanism device design and control schematics. Proposed pre-tension mechanism designed to maintain up to eight wires simultaneously. © 2020, Emerald Publishing Limited.	Yeshmukhametov, A.N., Koganezawa, K., Buribayev, Z., Amirgaliyev, Y., Yamamoto, Y. Study on multi-section continuum robot wire-tension feedback control and load manipulability (2020) Industrial Robot, 47 (6), pp. 837-845. DOI: 10.1108/IR-03-2020-0054
48.	Technology of personnel protection from the electromagnetic field in electrical installations of ultrahigh voltage classes	DOI: 10.15199/48.2020.10.19	The risk formation mechanisms of occupationally determined diseases of personnel from the action of electromagnetic field of industrial frequency in electrical installations of ultrahigh voltage classes (UHVC) for its estimation are investigated. The main possible causes of electric injury and occupationally determined diseases during repair work on the hot air lines of UHVC are considered. The model of "fault tree" in the case of the protective clothing destruction in the course of work is proposed. The substantiation of the maximum permissible parameters of electrical safety is given, taking into account the value of the maximum permissible electric energy. A system of continuous	BONDARENKO, E.A., KUTIN, V.M., KUTINA, M.V., YANCHENKO, O.B., RUDA, L.P., SMOLARZ, A., RAKHMETULLINA, S., AMIRGALIYEV, Y. Technology of personnel protection from the electromagnetic field in electrical installations of ultrahigh voltage classes (2020) Przeglad Elektrotechniczny, 96 (10), pp. 106-109.

			monitoring of the permissible energy levels absorbed by the body of personnel and signaling in case of exceeding the permissible level is proposed. © 2020 Wydawnictwo SIGMA-NOT. All rights reserved.	DOI: 10.15199/48.2020.10.19
49.	The Conceptual Foundations of Lifelong Learning in Kazakhstan: Process Modeling	DOI: 10.3991/ijet.v16i17.23685	Considering the increased interest in ensuring the well-being of a person, lifelong learning takes a leading place in society. The aim of the research is to build the concept of LLL system for Kazakhstan based on the methodology of education and international best practices. The key idea of the research is to justify the LLL system, that provides coverage of the country's population with formal, non-formal and informal education to increase its competitiveness and basic competencies to the level of the OECD countries. To do this, we propose mechanisms that allow us to fully recognize the learning outcomes of formal, non-formal and informal education. The ideas were proposed by the authors to the Kazakhstan's Government on the creation of the Concept of Lifelong Learning. © 2021. All Rights Reserved.	Omirbayev, S., Akhmed-Zaki, D., Mukhatayev, A., Biloshchytskyi, A., Kassenov, K., Faizullin, A. The Conceptual Foundations of Lifelong Learning in Kazakhstan: Process Modeling (2021) International Journal of Emerging Technologies in Learning, 16 (17), pp. 60-75. DOI: 10.3991/ijet.v16i17.23685
50.	The heat equation with strongly singular potentials	DOI: 10.1016/j.amc.2021.126006	In this paper we consider the heat equation with strongly singular potentials and prove that it has a ”very weak solution”. Moreover, we show the uniqueness and consistency results in some appropriate sense. The cases of positive and negative potentials are studied. Numerical simulations are done: one suggests so-called ”laser heating and cooling” effects depending on a sign of the potential. The latter is justified by the physical observations. © 2021 Elsevier Inc.	Altybay, A., Ruzhansky, M., Sebih, M.E., Tokmagambetov, N. The heat equation with strongly singular potentials (2021) Applied Mathematics and Computation, 399, статья № 126006, . DOI: 10.1016/j.amc.2021.126006
51.	The solution to the problem of processing big data using the example of assessing the solvency of borrowers		This article provides a literature review and comparative analysis of methods for solving the problem of building a credit scoring model; gives definitions of the concepts of large volumes of data (Big Data); and provides an overview of existing tools for processing and storing large volumes of data. The main problems and tasks of building credit scoring are identified. The general statement of the problem is presented. Analysis of the actual problems of assessing bank credit risk, and predicting the credit worthiness of the borrower, etc. is given. The mathematical model of mortgage lending based on the processing of large amounts of data is studied. This article discusses various technologies, including forecasting using modern technologies. This contributes	Balakayeva, G., Darkenbayev, D. The solution to the problem of processing big data using the example of assessing the solvency of borrowers (2020) Journal of Theoretical and Applied Information Technology, 98 (13), pp. 2659-2670.

			to the storage of big data, as well as the passage of a parallel process. We consider the problems that arise when working with big data, and identify the need for further research, to include the use of big data processing methods for real business processes in organizations that are faced with the need to process large amounts of data. In addition, further analysis of the problems associated with modeling the processing of big data is identified. © 2005 - ongoing JATIT & LLS.	
52.	Using machine learning methods for oil recovery prediction	DOI: 10.3997/2214-4609.202035233	In recent years, machine learning methods have been widely used in various fields of science for big data processing. The application of machine learning in the oil industry is also actively expanding. To solve oil recovery problems, it is necessary to use geological models of reservoir fields. With increasing of the reservoir model complexity (size), the computing time also increases. Therefore, it takes longer to predict oil recovery. There are two approaches to solve this problem. The first approach is to develop an effective parallel algorithm taking into account the heterogeneity of computing systems. Many scientists from all over the world are developing parallel algorithms in this field. In particular, we have written many scientific papers. The disadvantage of using this approach is that when you change the initial data for the oil recovery prediction, you need to make calculations on supercomputers every time, which takes a lot of time and resources. The second approach is to use machine learning methods, which is the purpose of this paper. This paper discusses approaches to using effective machine learning methods for oil recovery prediction. To train the system, we used historical data from the oil field and synthetic data obtained from surrogate models based on two wells (injection and production). Synthetic data were generated based on mathematical models (oil displacement models, enhanced oil recovery models) by varying the different geological parameters. This problem belongs to the "supervised learning" - type of machine learning. Supervised learning requires a complete set of marked data for training the model at all stages of its construction. When implementing the algorithm, we considered machine learning methods for solving the regression and classification problems. As a result, it was	Daribayev, B., Akhmed-Zaki, D., Imankulov, T., Nurakhov, Y., Kenzhebek, Y. Using machine learning methods for oil recovery prediction (2020) ECMOR 2020 - 17th European Conference on the Mathematics of Oil Recovery, . DOI: 10.3997/2214-4609.202035233

			discovered that compared to traditional computational experiments on a regular grid, calculations using machine learning methods are more productive. Copyright © ECMOR 2020. All rights reserved.	
53.	Using the Cuda Technology to Speed up Computations in Problems of Chemical Kinetics	DOI: 10.1007/s10559-020-00284-z	The paper focuses on the problem of chemical kinetics, calculation of variations in the concentration of substances in the reactions over time, and creation of a mass kinetic solver to solve the problem using modern parallelization technologies. A mathematical model of variation in the concentration of substances in a system with a one-dimensional approximation and the possibility of accelerating the calculations using the CUDA technology is described. The calculation performed on NVIDIA graphic processor shows that an increase in the number of reactions much reduces the computing time as compared with the computing time on the central processors. © 2020, Springer Science+Business Media, LLC, part of Springer Nature.	Sarsembayev, M., Urmashev, B., Mladenovic, N., Zaslavskyi, V.A. Using the Cuda Technology to Speed up Computations in Problems of Chemical Kinetics (2020) Cybernetics and Systems Analysis, 56 (4), pp. 675-682. https://www.scopus.com/inward/record.uri?eid=2-s2. DOI: 10.1007/s10559-020-00284-z
54.	Virtual educational environment: interactive communication using LMS Moodle	DOI: 10.1007/s10639-019-10067-5	The study considers the problems relating to vocational training of specialists in the virtual educational environment of a higher education institution. The use of advanced information and communication systems (electronic mail, electronic teleconferences, electronic and information resources including text, visual, audio and video information) and virtual technology (Daydream, Vive VR, technology of virtual games) in the educational process of a higher education institution enables to realize an interactive communication of the participants of this process. The article presents the experience on introduction of the virtual educational environment using LMS Moodle, and the authors consider the influence of such environment on the interactive engagement of the students and teachers from the universities in Kazakhstan and Slovakia. We have tried to demonstrate how the LMS Moodle platform helps arrange e-learning, conduct lessons in electronic classrooms, take online courses, and conduct synchronous and asynchronous learning. The developed online tasks allowed for the monitoring of the students' progress in all the educational activities. The results of the experiment helped guide the choice of follow-up study in this area. © 2019, Springer Science+Business Media, LLC, part of Springer Nature.	Kerimbayev, N., Nurym, N., Akramova, A., Abdykarimova, S. Virtual educational environment: interactive communication using LMS Moodle (2020) Education and Information Technologies, 25 (3), pp. 1965-1982. https://www.scopus.com/inward/record.uri?eid=2-s2. DOI: 10.1007/s10639-019-10067-5