

№	Статья и ссылка	Аннотация
1	<p>Buribayev, Z. ., Shaikalamova, S., Yerkos, A. . ., &amp; Imanbek, R. . . (2024). EKMGS: A HYBRID CLASS BALANCING METHOD FOR MEDICAL DATA PROCESSING. <i>Scientific Journal of Astana IT University</i>, 18, 5–16. <a href="https://doi.org/10.37943/18PUYJ4315">https://doi.org/10.37943/18PUYJ4315</a></p>	<p>The field of medicine is witnessing rapid development of AI, highlighting the importance of proper data processing. However, when working with medical data, there is a problem of class imbalance, where the amount of data about healthy patients significantly exceeds the amount of data about sick ones. This leads to incorrect classification of the minority class, resulting in inefficient operation of machine learning algorithms. In this study, a hybrid method was developed to address the problem of class imbalance, combining oversampling (GenSMOTE) and undersampling (ENN) algorithms. GenSMOTE used frequency oversampling optimization based on a genetic algorithm, selecting the optimal value using a fitness function. The next stage implemented an ensemble method based on stacking, consisting of three base (k-NN, SVM, LR) and one meta-model (Decision Tree). The hyperparameters of the meta-model were optimized using the GridSearchCV algorithm. During the study, datasets on diabetes, liver diseases, and brain glioma were used. The developed hybrid class balancing method significantly improved the quality of the model: the F1-score increased by 10-75%, and accuracy by 5-30%. Each stage of the hybrid algorithm was visualized using a nonlinear UMAP algorithm. The ensemble method based on stacking, in combination with the hybrid class balancing method, demonstrated high efficiency in solving classification tasks in medicine. This approach can be applied for diagnosing various diseases, which will increase the accuracy and reliability of forecasts. It is planned to expand the application of this approach to large volumes of data and improve the oversampling algorithm using additional capabilities of the genetic algorithm.</p> <p><b>Keywords:</b></p>

		imbalance, genetic algorithm (GA), oversampling, undersampling, hybrid, data analysis
2	<p>Moldabayev, D., Suchkov, M., Abdiakhmetova, Z., &amp; Kartbayev, A. (2024). DEVELOPING GAME THEORY-BASED METHODS FOR MODELING INFORMATION CONFRONTATION IN SOCIAL NETWORKS. <i>Scientific Journal of Astana IT University</i>, 18, 17–29. <a href="https://doi.org/10.37943/18FONX7380">https://doi.org/10.37943/18FONX7380</a></p>	<p>This paper explores the essential dynamics of social networks, specifically examining the phenomenon of information confrontation among users. The goal of the research is the development of a novel simulation methodology that integrates game-theoretic principles with probabilistic techniques to provide a robust model for these interactions. The theoretical framework of the study is founded on the conceptualization of user conflicts as a strategic game between two players. The primary objective for each player in this game is to exert influence and control over as many nodes within the network as possible. To capture the essence of these strategic interactions, we have introduced an innovative algorithm that facilitates dynamic strategy adaptation. This algorithm is pivotal in allowing players to modify their decision-making processes in real-time, based on the continually changing conditions of the network. For practical implementation and validation of the methodology, we used the Facebook Researcher open dataset, with a particular focus on its Kazakhstani segment. This dataset provides a rich source of empirical data, reflecting diverse user interactions and network configurations, which are essential for testing the model. This approach stands out by offering significant improvements in computational efficiency and resource management. By dynamically tracking and updating the network's status, the proposed method reduces the computational resources required, thereby enhancing the scalability of the simulation. In comparing our methodology with other existing models in the field, it becomes evident that it not only matches but in several respects surpasses these methodologies in terms of flexibility. This study makes substantial contributions to the field of social network analysis by providing a sophisticated tool that can be effectively employed to navigate and analyze the complexities of</p>

		<p>information confrontation in digital social spaces.</p> <p><b>Keywords:</b> game theory; strategy adaptation; social networks; information conflict; simulation algorithm; probabilistic approach; analytical systems.</p>
3	<p>Nurgaliyev, . K., Tokhmetov, A., &amp; Tanchenko, . L. (2024). AN EVALUATION METHOD OF AN ENERGY CONSUMPTION AS AN OPERATION PARAMETER IN A CYBER-PHYSICAL SYSTEM. <i>Scientific Journal of Astana IT University</i>, 18, 30–40.  <a href="https://doi.org/10.37943/18XCMY8200">https://doi.org/10.37943/18XCMY8200</a></p>	<p>The research of energy consumption in an Internet of Things network and its analytical evaluation is the goal of this work. The authors of this work concentrate on developing a model for calculating the actual gain in power consumption in order to estimate the actual energy required. The method suggests measuring the difference in energy usage under three primary battery-powered working modes to maximize a device's lifetime. Due to the fact that each CPS device state has its own energy metrics, it is feasible to choose the best operation course for entire network. The presented technique is certainly viable, as demonstrated by the experimental examination of Zigbee and BLE devices. The comparison of power levels using a temperature sensor in three basic scenarios (power modes) dictates how the CPS device lifetime can be optimized. Multi-regime consumption models, in which the rates of charging and discharging are dependent upon the energy level, are analyzed in this paper. This work aimed to state an optimal energy consumption by finding the right balance between operational power and battery lifetime through mathematical modeling. Therefore, it is easy to determine the energy cost of power stage, for instance, to send data by setting the minimal duration of each working condition in terms of power consumption. Moreover, a reasonable balance of power consumption and battery lifetime which impacts the data collection from sensors is vital to the development of data extraction algorithms. The practical results depict how device should be accessible to be able to lose less power even during switching on/off or how operate more effective if it used for a short period of time. A long-term network could</p>

		<p>become a reality once battery life is optimized enough to not disturb a user.</p> <p><b>Keywords:</b> cyber-physical system, battery management, power consumption, power mode, gain</p>
4	<p>Nurgazina, D., Kudubayeva, S., &amp; Ismailov, A. (2024). SCIENTIFIC ASPECTS OF MODERN APPROACHES TO MACHINE TRANSLATION FOR SIGN LANGUAGE. <i>Scientific Journal of Astana IT University</i>, 18, 41–54. <a href="https://doi.org/10.37943/18DQXX2356">https://doi.org/10.37943/18DQXX2356</a></p>	<p>Scientific research in the field of automated sign language translation represents a crucial stage in the development of technologies supporting the hearing-impaired and deaf communities. This article presents a comprehensive approach to addressing semantic and technical challenges associated with the uniqueness of sign language. The research goal is to create an innovative system that combines semantic analysis, sign synthesis, and facial mimicry for the most accurate conveyance of emotional context. The study focuses on the unique features of the Kazakh language and cultural contexts that influence sign communication. The research centers on the development of a semantic system capable of adequately interpreting metaphors, idioms, and classifier predicates of sign language. The three-dimensional nature of signs is analyzed, and a solution to the formal description problem is proposed. The article introduces a database, analysis algorithm, and a prototype 3D avatar capable of translating textual data into sign language. Special attention is given to the processing of idioms and variability in expressing emotions in sign language. Utilizing machine learning principles and computational linguistics algorithms, the authors present an integrated approach to sign language translation, considering linguistic, cultural, and emotional aspects. The proposed algorithms and formulas facilitate effective interaction between textual information and sign expression. The research results not only provide an overview of current challenges in automated sign language translation but also offer practical approaches to addressing them. The developed approach could be a key step towards creating more efficient communication systems for the hearing-impaired and deaf. Which in the</p>

		<p>future may solve numerous issues with Kazakh sign language.</p> <p><b>Keywords:</b>  automated translator, 3D avatar, sign language, machine translation algorithm, deaf translation</p>
5	<p>Mukhanbet, A., Azatbekuly , N., &amp; Daribayev, B. (2024). OPTIMIZING QUANTUM ALGORITHMS FOR SOLVING THE POISSON EQUATION. <i>Scientific Journal of Astana IT University</i>, 18, 55–65.  <a href="https://doi.org/10.37943/18REAT9767">https://doi.org/10.37943/18REAT9767</a></p>	<p>Contemporary quantum computers open up novel possibilities for tackling intricate problems, encompassing quantum system modeling and solving partial differential equations (PDEs). This paper explores the optimization of quantum algorithms aimed at resolving PDEs, presenting a significant challenge within the realm of computational science. The work delves into the application of the Variational Quantum Eigensolver (VQE) for addressing equations such as Poisson's equation. It employs a Hamiltonian constructed using a modified Feynman-Kitaev formalism for a VQE, which represents a quantum system and encapsulates information pertaining to the classical system. By optimizing the parameters of the quantum circuit that implements this Hamiltonian, it becomes feasible to achieve minimization, which corresponds to the solution of the original classical system. The modification optimizes quantum circuits by minimizing the cost function associated with the VQE. The efficacy of this approach is demonstrated through the illustrative example of solving the Poisson equation. The prospects for its application to the integration of more generalized PDEs are discussed in detail. This study provides an in-depth analysis of the potential advantages of quantum algorithms in the domain of numerical solutions for the Poisson equation and emphasizes the significance of continued research in this direction. By leveraging quantum computing capabilities, the development of more efficient methodologies for solving these equations is possible, which could significantly transform current computational practices. The findings of this work underscore not only the practical advantages but also the transformative potential of quantum computing in</p>

		<p>addressing complex PDEs. Moreover, the results obtained highlight the critical need for ongoing research to refine these techniques and extend their applicability to a broader class of PDEs, ultimately paving the way for advancements in various scientific and engineering domains.</p> <p><b>Keywords:</b> partial differential equation, poisson equation, quantum computing, variational quantum eigensolver, optimization</p>
6	<p>Toxanov , S., Sharipova, S., Biloshchytskyi, A., Abzhanova, D., &amp; Bakytkeriuly , B. (2024). ANALYSIS OF THE IMPACT OF SHARDING ON THE SCALABILITY AND EFFICIENCY OF BLOCKCHAIN TECHNOLOGIES FOR THE CREATION OF INFORMATION-ANALYTICAL SYSTEMS FOR ENVIRONMENTAL MONITORING OF EMISSIONS INTO THE ENVIRONMENT. <i>Scientific Journal of Astana IT University</i>, 18, 66–74. <a href="https://doi.org/10.37943/18VIFS4010">https://doi.org/10.37943/18VIFS4010</a></p>	<p>This study examines the impact of sharding on the scalability and efficiency of blockchain systems, specifically in the development of a complex of intelligent information and communication systems for environmental monitoring of emissions into the environment for decision-making in the context of carbon neutrality. Utilizing the Ikarus Network infrastructure, sharding was implemented on masternodes as a key technology to optimize transaction processing. Sharding enables the blockchain to be divided into multiple parallel chains, significantly increasing throughput and reducing the load on individual nodes. The results demonstrate a 70% increase in transaction processing speed, allowing the system to handle up to 5000 transactions per second, compared to the previous 3000 transactions per second. Network throughput increased by 50%, ensuring more efficient load distribution and stable operation even with high data volumes. Statistical analysis using ANOVA confirmed significant improvements in transaction processing speed, confirmation time, and resource usage post-sharding implementation. The F-value for transaction processing speed was 4567 with a P-value of 0.0001, indicating substantial improvements. Visual data analysis further confirmed these results, showing noticeable performance enhancements in the blockchain system. Distribution charts and histograms of transaction processing speed and confirmation time revealed an increase in the average number of transactions per second and greater system stability post-sharding. Sharding not only increased throughput but also enhanced</p>

		<p>system security by decentralizing data among shards, complicating potential cyberattacks. The study aimed to determine how sharding can improve the scalability and efficiency of blockchain systems. These improvements position the Ikarus Network as a promising solution for scalable and secure blockchain-based applications, especially for tasks related to carbon emission monitoring and management. These findings can underpin further study and the development of more efficient blockchain technologies.</p> <p><b>Keywords:</b> blockchain; emission; smart contract; zero emissions; internet of things</p>
7	<p>Mukhanov, S., Uskenbayeva, R., Rakhim, A. A., Young, I. C., Yemberdiyeva, A., &amp; Bekaulova, Z. (2024). DEEP AND MACHINE LEARNING MODELS FOR RECOGNIZING STATIC AND DYNAMIC GESTURES OF THE KAZAKH ALPHABET. <i>Scientific Journal of Astana IT University</i>, 18, 75–95.  <a href="https://doi.org/10.37943/18JYLU4904">https://doi.org/10.37943/18JYLU4904</a></p>	<p>Currently, an increasing amount of research is directed towards solving tasks using computer vision libraries and artificial intelligence tools. Most common are the solutions and approaches utilizing machine and deep learning models of artificial neural networks for recognizing gestures of the Kazakh sign language based on supervised learning methods and deep learning for processing sequential data. The research object is the Kazakh sign language alphabet aimed at facilitating communication for individuals with limited abilities. The research subject comprises machine learning methods and models of artificial neural networks and deep learning for gesture classification and recognition. The research areas encompass Machine Learning, Deep Learning, Neural Networks, and Computer Vision.</p> <p>The main challenge lies in recognizing dynamic hand gestures. In the Kazakh sign language alphabet, there are 42 letters, with 12 of them being dynamic. Processing, capturing, and recognizing gestures in motion, particularly in dynamics, pose a highly complex task. It is imperative to employ modern technologies and unconventional approaches by combining various recognition methods/algorithms to develop and construct a hybrid neural network model for gesture recognition. Gesture recognition is a classification task, which is one of the directions of pattern recognition. The fundamental basis of</p>



		<p>recognition is the theory of pattern recognition. The paper discusses pattern recognition systems, the environment and application areas of these systems, and the requirements for their development and improvement. It presents tasks such as license plate recognition, facial recognition, and gesture recognition. The field of computer vision in image recognition, specifically hand gestures, is also addressed. The development of software will enable the testing of the trained model's effectiveness and its application for laboratory purposes, allowing for adjustments to improve the model.</p> <p><b>Keywords:</b> Hand gesture recognition, neural networks, SVM, LSTM, CNN, MediaPipe.</p>
8	<p>Sarinova , A., Neftissov, A., Rzayeva , L., Yessenov , A., Kirichenko , L., &amp; Kazambayev , I. (2024). DEVELOPMENT OF AEROSPACE IMAGES PRELIMINARY PROCESSING METHOD FOR SUBSEQUENT RECOGNITION AND IDENTIFICATION OF VARIOUS OBJECTS. <i>Scientific Journal of Astana IT University</i>, 18, 96–106. <a href="https://doi.org/10.37943/18BIAC9844">https://doi.org/10.37943/18BIAC9844</a></p>	<p>Nowadays, the application of hyperspectral images is vital for every section of the humanity life such as agrotechnical research for the field condition state and water security. This article presents a new lossless data compression algorithm focused on the processing of hyperspectral aerospace images. The algorithm takes into account inter-band correlation and difference transformations to effectively reduce the range of initial values. correlation allows you to find the best reference channel that defines the sequence of operations in the algorithm, which contributes to a significant increase in the compression ratio while maintaining high data quality. The practical implementation of the algorithm lies in the process of the transfer the lower size file with high efficiency for unmanned aerial vehicle and satellites to save more computational resources. This method demonstrates high computational efficiency and can be applied to various tasks that require efficient storage and transmission of hyperspectral images. The importance of processing hyperspectral data and the problems associated with their volume and complexity of analysis were described. Current approaches to data compression are considered and their limitations are identified, which justifies the need to</p>



		<p>develop new methods. The relevance and necessity of effective compression algorithms for aerospace applications is emphasized. An analysis of existing methods and algorithms for compressing hyperspectral data was carried out. Particular attention is paid to approaches that use cross-channel correlation and difference transformations. The effectiveness of current methods is evaluated and their shortcomings are identified, which serves as a justification for the development of a new algorithm. A developed lossless data compression algorithm based on the use of inter-band correlation and difference transformations was described. The stages of forming groups of channels and the selection of optimal compression parameters are considered in detail. The method of determining the reference channel, which sets the sequence of operations in the algorithm, which provides more efficient data compression, is especially noted. The advantages and possible limitations of the new approach, as well as its potential for practical use, are discussed. It was noted that the developed method successfully solves the problems associated with the volume of hyperspectral data, providing a high compression ratio without quality loss. The prospects for further development of the algorithm and its application in various fields of science and technology are discussed.</p> <p><b>Keywords:</b> data compression, hyperspectral images, interband correlation, difference transformations, lossless, compression algorithm</p>
9	<p>Khompysh, A., Algazy , K., Kapalova , N., Sakan, K., &amp; Dyusenbayev , D. (2024). STATISTICAL PROPERTIES OF THE PSEUDORANDOM SEQUENCE GENERATION ALGORITHM. <i>Scientific Journal of Astana IT University</i>, 18, 107–119. <a href="https://doi.org/10.37943/18LYCW2723">https://doi.org/10.37943/18LYCW2723</a></p>	<p>One of the most important issues in the design of cryptographic algorithms is studying their cryptographic strength. Among the factors determining the reliability of cryptographic algorithms, a good pseudorandom sequence generator, which is used for key generation, holds particular significance. The main goal of this work is to verify the normal distribution of pseudorandom sequences obtained using the generation algorithm</p>

		<p>and demonstrate that there is no mutual statistical correlation between the values of the resulting sequence. If these requirements are met, we will consider such a generator reliable. This article describes the pseudorandom sequence generation algorithm and outlines the steps for each operation involved in this algorithm. To verify the properties of the pseudorandom sequence generated by the proposed algorithm, it was programmatically implemented in the Microsoft Visual C++ integrated development environment. To assess the statistical security of the pseudorandom sequence generation algorithm, 1000 files with a block length of 10000 bits and an initial data length of 256 bits were selected. Statistical analysis was conducted using tests by D. Knuth and NIST. As shown in the works of researchers, the pseudorandom sequence generation algorithm, verified by these tests, can be considered among the reliable algorithms. The results of each graphical test by D. Knuth are presented separately. The graphical tests were evaluated using values obtained from each test, while the chi-squared criterion with degrees of freedom was used to analyze the evaluation tests. The success or failure of the test was determined using a program developed by the Information Security Laboratory. Analysis of the data from the D. Knuth tests showed good results. In the NIST tests, the P-value for the selected sequence was calculated, and corresponding evaluations were made. The output data obtained from the NIST tests also showed very good results. The proposed pseudorandom sequence generation algorithm allows generating and selecting a high-quality pseudorandom sequence of a specified length for use in the field of information security.</p> <p><b>Keywords:</b>  cryptography; algorithms; random sequence; pseudorandom sequence; statistical testing.</p>
10	Toxanov, S., Abzhanova, D., Mukhatayev, A. ., Biloshchytskyi, A., &	The article presents the results and analysis of an experimental study on the

	<p>Kassenov, K. (2024). METHODOLOGY FOR ASSESSING THE LEVEL OF METHODOLOGICAL COMPETENCE OF IT TEACHERS. <i>Scientific Journal of Astana IT University</i>, 18, 120–130. <a href="https://doi.org/10.37943/18BTZP2235">https://doi.org/10.37943/18BTZP2235</a></p>	<p>development of methodological competence of teachers of IT disciplines in the framework of their advanced training on the online. The purpose of the article is to disseminate certain results of the study from the point of view of theoretical and methodological aspects. The task of the experiment stage was to diagnose the level of formation of methodological competence of teachers of IT disciplines of the control and experimental groups according to four key criteria of methodological competence: didactic, design, monitoring and personal. The determination of the level of formation of methodological competence skills was made using five levels: advanced, high, medium, acceptable and low, for each key criterion of the teacher's methodological competence. The experimental part of the study was conducted with teachers of IT disciplines of universities in Kazakhstan during the 2023-2024 academic year. As a result of the experimental work, a diagnosis of the development of methodological competence of teachers of IT disciplines was developed, which is of a complex nature: substantive - in the form of tests, tests of various nature on the content of course training; activity - in the form of assessment for each type of practical work of a methodological orientation (drawing up work programs for the subject, technological map of the lesson, problem tasks, etc.) ; communicative – on the basis of questionnaires, tests, analysis and self-analysis (on the development of speech culture, behavior in society, skills to organize attention, students' activities, work in pairs and groups, etc.). In the formation of a set of diagnostic methods, the emphasis was placed on methods based on self-diagnosis, which contributes to the process of self-knowledge and self-analysis of a particular person. The authors also note that despite the variety of definitions, all studies have a common semantic basis - correlation with the labor market and social policy of society. These two parameters play an important role in determining the content of competencies, based on the psychological and biological</p>
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		<p>characteristics of the individual. In the course of the study, the validity of the methods used was checked, and the results were presented, which indicate the need to develop recommendations aimed at improving the level of methodological competence of teachers of IT disciplines.</p> <p><b>Keywords:</b> digitalization, methodological competence, information system, professional development, IT education, continuing education, professional training</p>
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