Реферати

UDC 004.08;353. 3; 539.213;541.67;548.3

Hreshchuk O.M., Durkot M.O., Makar L.I., Mudry S.I., Rubish V.M., Trykur I.I., Shtablavyi I.I., Yurkin I.M., Yukhymchuk V.O. Structural and morphological properties of annealed films of the As_2S_3-Sb_2S_3-SbI_3 system. *Data Rec., Storage & Processing*. 2023. Vol. 25, No. 2. P. 3–9. — Ukr.

The results of investigations of the structure and surface morphology of annealed $(As_2S_3)_x(Sb_2S_3)_y(SbI_3)_z$ ($x = 45, 40, 35$ і 30; $y =27.5, 30, 32.5$ і 35; $z = 27.5,30,32.5$ і 35) films are presents. Amorphous $(As_2S_3)_x(Sb_2S_3)_y(SbI_3)_z$ films with a thickness ~ 500 nm were obtained by vacuum evaporation of glasses corresponding compositions from quasi-closed effusion cells on to unheated glass substrates. The films were annealed at a temperature of 398 K for 1 hour. The structure of the annealed films was studied by the Raman spectroscopy method. For the investigations of the surface morphology of films a field emission scanning electron microscopy (FESEM) analysis was performed.

Based on the analysis of the positions and intensities of the main vibrational bands of the Raman spectra and SEM-images of the surfaces of the annealed films of the As_2S_3-Sb_2S_3-SbI_3 system, it was established that their matrix mainly contains crystalline SbI_3 inclusions that have a layered (two-dimensional) structure. Other weak features in the spectra of annealed films are related to the presence of $As(Sb)S_3$, As_4S_4, As_4S_3, S_n, and S_8 structural fragments in the matrix. Fig.: 4. Refs: 25 titles.

Key words: chalcogenide films, Raman spectroscopy, scanning electron microscopy, structure, surface morphology.

UDC 004.75

Telenyk S.F., Pogorilyy S.D., Kramov A.A., Vovk Ye.A. Identifying the intentions of a user communicating with a bot *Data Rec., Storage & Processing*. 2023. Vol. 25, No. 2. P. 10–26. — Ukr.

The challenge of the classification of the intents of a user during the interaction with a chat-bot has been considered. The comparative analysis of the existing intent classification dataset and corresponding methods based on machine learning and deep learning techniques has been performed. Moreover, the task of the detection of intents with the performing of the zero-shot classification using NLI models has been defined. Different intent classification approaches, NLI models, and hypothesis templates for the detection of a user's intent have been suggested. The experimental verification of the effectiveness of the suggested approaches and models for the zero-shot classification on the corpora of different domains has been performed. In addition, the analysis of the results of the mentioned experimental configurations and existing intent classification methods based on pre-trained and large language models (GPT-3.5) has been implemented. The results obtained may indicate the advisability of the usage of different NLI models and their hypothesis templates in order to increase the accuracy of the zero-shot intent classification on the corpora of different domains. However, the highest accuracy metrics that were obtained by the NLI models don't exceed the corresponding values of pre-trained models and GPT-3.5 which allows drawing a conclusion about the advisability of the conducting of further research devoted to the increase of the zero-shot intent classification with the usage of NLI models or other models within the natural language processing area. Tabl.: 4. Fig.: 1. Refs: 50 titles.

Key words: zero-shot classifications, detection of user intentions, chatbot, NLI models.

UDC 004.5

Nikiforov O.V., Putyatin V.G., Kutsenko S.A. Mathematical models and methods for solving some problems on the information security. *Data Rec., Storage & Processing*. 2023. Vol. 25, No. 2. P. 27–65. — Ukr.

Various mathematical models, methods and approaches are used to solve scientific problems in the field of information security of territorially distributed information computer systems (TDICS). The information security modelling toolkit is represented by the following three main directions: development of methods and models for monitoring the current state of the system and decision-making for operational management of information security; development of methods and models of decision-making support regarding organizational management and design of information security systems; development of methods and models of system self-organization. On the basis of the first group of methods and models (neural networks, data mining methods, matrix method and problem-oriented methods and models), a wide variety of corporate automated systems, commercial software platforms for information security management have been created. At the same time, there is a strong dependence of the software on the features of the object of protection and the subject area in which the information protection processes are modelled and evaluated. The second group of methods (cognitive maps, finite state machines, Markov and Bayesian networks,

ontological models, Petri nets, and the matrix method) is presented to a greater extent in the field of systematic research on the development of information protection systems and the justification of requirements for them. The main scientific problem for this group is the problem of justifying the rational decomposition and linearization of problems when conducting research. It significantly depends on the nature of the subject area where research is conducted. The direction of TRIX research that adapts, changes its structure and parameters depending on external conditions and the transformation of the subject area, represented by the methods of conceptual design. On the basis of these methods, it is possible to solve problems of synthesis of structures of objects (systems) with defined properties. Tabl.: 1. Fig.: 10. Refs: 100 titles.

Key words: algorithm, information protection, information security, networks, methods and models, neural networks, ontology.

The investigation presents a systematic methodology for effective sign language recognition on video streams which considers the importance of using neural networks and transformers for automatic detection and gestures recognition in real time. This methodology combines such fields as computer vision and natural language processing and also uses transformers as artificial intelligence models in aim to effectively model long-term dependencies in data sequences.

The study describes the main stages of the methodology development, correct problem statement definition and the main descriptions of system methodology. A review of existing approaches and methodologies for the task solving was also carried out by authors focusing on increasing the accuracy and speed of video streams processing, as well as the task of conducting the recognition process in real time. The work provides an analysis of the proposed methodology stability with respect to problems and challenges that may arise during implementation and application to real data.

The meaning of the proposed methodology lies in its unique approach which simultaneously works both in the domain of computer vision and in natural language processing. The use of transformers allows one to effectively take into account complex structures and dependencies between gestures which lead to increasing the accuracy and speed recognition.

This study is an important contribution to the development of sign language recognition systems and is noted for its innovative potential for further development, validation and as next practical usage in various fields, including human-machine interfaces, security systems and virtual reality. Fig.: 4. Refs: 14 titles.

Key words: system methodology, system analysis, neural networks, transformers, sign language, recognition, recurrent neural networks, convolutional neural networks.

A modified genetic method has been developed to solve routing problems with weighted constraints and multiple transportation means. The fundamental difference of this developed genetic method from existing modifications lies in the use of a diploid set of chromosomes in the population of evolving individuals. This modification makes the dependence of an individual's phenotype on its genotype less deterministic and, as a result, promotes the preservation of population genetic diversity and phenotypic variability throughout the execution of the method. The result of such modification is the maintenance of a sufficiently high variability of traits (genes) in the population (gene pool of the population) during evolution, which, at the same time, may have a minor impact on the individual's phenotype. A modification of the genetic mutation operator has been proposed. Unlike the classical method, individuals subjected to the mutation operator are selected not randomly, but according to their mutation resistance, corresponding to the value of the individual's fitness function. Thus, «weaker» individuals mutate, while the genome of «strong» individuals remains unchanged. In this case, the likelihood of losing the achieved extremum of the function during the action of the mutation operator decreases, and the transition to a new extremum occurs in case of accumulation of sufficient specific weight of «better» traits in the population. This modification of the operator allows for the search of values approximating the optimal ones, excluding the loss of acquired advantages during the search for better solutions. Tabl.: 1. Fig.: 3. Refs: 36 titles.

Key words: metaheuristic algorithms, genetic algorithm, optimization, tabu search algorithm, vehicle routing problem.

Decision support systems can be partially decentralized using blockchain technology like almost any other systems where it makes sense. Partial decentralization, or, in other words, moving a part of the system responsibilities onto existing public decentralized data platforms such as Ethereum provides new useful properties in the area of security, verification, and makes some information publicly auditable. Particular systems such as decision support systems may benefit from this, as they now have a practical way to verify the data input with no way to change it retroactively.

However, decentralization increases the nominal cost of maintaining the system, as part of the data will now be stored in a decentralized public registry. Compared to running a classical computer system where institutions or researchers can bring their own hardware to run things on, there's always a non-zero extra cost associated with using the public decentralized data platform.

This study reviews and offers approaches that can reduce the cost of storing information in decentralized data registries by combining methods of data minimization together with the specific system architecture design. Provided numerical examples of the method of storing information in the decentralized Ethereum registry, which allows reducing the cost of data recorded in the decentralized registry by more than 80 % by changing the way how transactions are sent to the decentralized network. Substantiated the feasibility of transferring the proposed data storage methods to other Ethereum-compatible (EVM) decentralized data platforms for further reduction of data storage costs in decentralized registries. Reviewed the real cost example of a system running on top of popular, EVM-compatible decentralized data platforms at the specific moment in time, where demonstrated that Ethereum is the most expensive choice among other decentralized networks. Tabl.: 1. Fig.: 6. Refs: 12 titles.

Key words: decentralized data platforms, blockchain, Ethereum, EVM, decision support systems, data size optimization.

The vehicle routing problem (VRP) is concerned with optimizing a set of routes, all beginning and ending at a given node (called the depot, center park or warehouse), to serve a given set of customers. The VRP was first introduced by Dantzig and Ramser (1959). It is a multivehicle version of the traveling salesman problem (TSP), and is therefore more applicable in practice since most organizations with substantial delivery operations use multiple vehicles simultaneously. Of course, it is also more difficult than the TSP since it involves decisions about how to assign customers to routes, in addition to how to optimize the sequence of nodes on each route. As a result, today's «hard» VRP instances tend to involve, say, hundreds of nodes, whereas hard instances of the TSP involve thousands or tens of thousands of nodes. The VRP is used to model, in which a single vehicle delivers goods to multiple customer nodes with returning to the depot. The vehicle routing problem is a combinatorial optimization problem of integer programming. The goal: to organize an optimal set of local vehicle routes, several or one, according to their number, configuration and loading, to minimize the total transport costs for the delivery of orders from a single center to customers at their given location coordinates. VRP is a typical component of transport logistics and supply chains, the sphere of providing services for current maintenance of objects, prompt repair and elimination of accidents in network organizational structures. To solve this problem, the MILP model was developed and tested on specific examples using available Excel analytical tools in educational and research practice. The classic VRP (with orders) has a strictly decreasing sequence of flow values, which is relatively easy to divide into a certain number of subcircuits with the same decreasing sequence depending on the value of the TK potential. However, a VRP with customer resource reserves cannot have such a sequence, there is a simultaneous increase and decrease of current values in the chain of flows, so a single circuit is possible here by choosing a sufficient potential of TK, or, depending on the situation, the formation of several artificial sub-circuits from unreached groups of nodes. Fig.: 9. Refs: 8 titles.

Key words: network organizational structures, network optimization modeling, transport logistics, supply chains, spreadsheet modeling, optimization methods and models in Excel.