Реферати

UDC 535.3; 539.213; 539.232; 546.492; 548.3

Rubish V.M., Gasinets S.M., Durkot M.O., Makar L.I., Pisak R.P., Stefanovych V.O., Yasinko T.I., Kostyukevych S.A., Kostyukevych K.V. Influence of laser radiation and mercury vapors on the structure of se$_{100-x}$te$_x$ amorphous films. *Data Rec., Storage & Processing*. 2022. Vol. 24, No. 2. P. 3–10. — Ukr.

The structure of nominally pure and sustained in mercury vapor Se$_{100-x}$Te$_x$ amorphous films ($0 \leq x \leq 15$) was studied by Raman spectroscopy. It is established that the matrix of nominally pure films is constructed mainly by structural groups of Se$_8$ and contains helical chains of Se$_n$ of different length in which part of the Se atoms is replaced by Te atoms. The process of substituting Se for Te is accompanied by a shift of the band at 236 cm^{-1} in the Raman spectrum of the Se amorphous film in the region of 210–214 cm^{-1} in the spectra of Se$_{100-x}$Te$_x$ films. Under certain modes of laser irradiation ($\lambda = 532$ nm), the films of the selenium-tellurium system crystallize. At the same time, the most intense bands at 251–253 and 210–214 cm^{-1} are shifted to the short-wavelength part of the spectrum by 3–9 cm^{-1}. In some cases, the pumpihg of the intensities of these bands is observed. In addition, the spectra of the films show well-defined features at 84–88 cm^{-1} and 165–170 cm^{-1}. The obtained results allow us to make an assumption that the crystalline inclusions of trigonal and α-monoclinic modification are formed in the Se$_{100-x}$Te$_x$ amorphous matrix. Modification of Se$_{100-x}$Te$_x$ amorphous films with mercury leads to the formation in their matrix of mercury selenide crystalline inclusions. Fig.: 5. Refs: 14 titles.

Key words: chalcogenide amorphous films, Raman spectra, structure, structural transformations, sensor elements.

UDC 004.89

Fedorchenko Ie.M., Oliinyk A.O., Stepanenko O.O., Fedoronchak T.V., Chornobuk M.O., Kornienko S.K. A hybrid convolutional network for image processing x-ray images for detection of the disease of COVID-19. *Data Rec., Storage & Processing*. 2022. Vol. 24, No. 2. P. 11–23. — Ukr.

The study is devoted to researching the solutions used to detect COVID-19 from X-rays of the lungs. The investigation analyzes various models of machine learning, in particular decision trees, the method of support vectors, neural networks, including convolutional neural networks.

Models based on decision trees, the support vector method, and simple neural networks were built using the Accord.NET library for the C# language. The proposed model based on a convolutional neural network is built using the Keras library for the Python language, which is an extension of another library — Tensor Flow. Based on the review, a decision was made to develop a model based on a hybrid convolutional neural network. For training and testing the model, a publicly available dataset of X-ray images of patients' lungs was used, consisting of images belonging to three classes: lesions of COVID-19, normal state of the lungs, other diseases. Two other datasets were generated from the public dataset by random sampling: a smaller dataset of 450 images and a larger dataset of 1500 images.

As a result, a hybrid convolutional neural network was developed, which achieved a classification accuracy of about 70 % on a smaller data set, and 87 % on a larger one. On an extended dataset of 10,500 images, the model achieved 91 % accuracy. Thus, the proposed model outperformed other considered machine learning algorithms in terms of classification accuracy. This model can be used as an auxiliary diagnostic tool for medical personnel, which will lead to a decrease in the probability of medication errors. Tabl.: 6. Fig.: 5. Refs: 35 titles.

Key words: Keras library, decision tree, support vector machine, classification, neural network, perception.

UDC 004.5

Dodonov O.G., Putyatyn V.G., Kutsenko S.A., Senchenko V.R., Dodonov E.O. Application of scenario approach in development of management decisions (A scenario of ship formation management) *Data Rec., Storage & Processing*. 2022. Vol. 24, No. 2. P. 24–42. — Ukr.

The study deals with problematic issues related to the use of the principles of system analysis in solving the problems of preparing management decisions. Among the methods of system analysis, it is advisable to utilize the scenario approach, because it allows one to build alternative options for the development of processes. Working with scenarios allows one to develop management decisions, implement them in strategies, quantitatively assess the effectiveness of any decision and the dependence on the sequence of events that may occur after the decision is made.

Modern organizational and methodological principles and provisions of the scenario approach are presented on the example of the development and modeling of a scenario for the development of managerial decisions by the control bodies of a Ship group (SG). A SG is an operational formation of ships intended to solve a wide range of tasks, from protecting sea communications and ports to supporting

ground forces and protecting coastal facilities from air strikes. The SG is formed as a temporary or permanent formation to perform the assigned operational task. According to the scenario, the SG operates under conditions of intense enemy opposition, territorial distribution of command and control facilities, strict time limits in the use of its forces and means of destruction, as well as means of destruction of the enemy.

To calculate probabilistic estimates of the development of scenario options, among many existing methods, the Bayesian method was chosen. The Bayesian network allows you to reflect in the process model causal relationships between various factors (events) of the process and environmental changes and, unlike regression models, allows you to take into account not only the direct dependencies of the risk level on the occurrence of certain events, but also the dependencies between risk factors (conditional probabilities).

To simulate the scenario for the development of managerial decisions of the SG, a Modeling complex is used. The complex is a set of mathematical methods (including Bayesian methods and networks), analytical and simulation models, algorithms, hardware and software modules that implement functional subsystems, task complexes and functional tasks of SG control.

The modeling results demonstrated that the scenario approach provides the possibility of variability of the tasks worked out on the Modeling complex in order to improve the quality and efficiency of the development, adoption and implementation of management decisions. This problem is of particular relevance for Ukraine now, in the current conditions of armed confrontation. Tabl.: 2. Fig.: 12. Refs: 20 titles.

Key words: scenarios, scenario approach, Bayesian method, management decision, ship connection, sea-borne troops operation.

The possibilities of constructing modern noise generators for suppressing spurious electromagnetic radiation and interference, which is fundamentally different from analog noise signal generators using semiconductor noise elements, are taken into account. The structure of a modern broadband noise generator for combating spurious electromagnetic radiation and interference, which generates a random digital code and converts it into a continuous signal, is considered. The efficiency of such a generator was studied through the quality indicators of spurious radiation detection by a specialized enemy reconnaissance tool. The influence of the generator signal on the false alarm probability of the enemy reconnaissance equipment, coordinated with the signal of spurious radiation and pickups from monitor screens on liquid crystal structures, is studied. It has been proven that the effect on a specialized reconnaissance tool is proportional to the dispersion of the noise signal with an amplitude distribution that is not necessarily Gaussian. The dispersions of the amplitudes of noise signals distributed not according to the Gaussian law are studied. It is shown that random signals with uniformly distributed amplitudes have a greater dispersion than for a truncated Gaussian distribution. To confirm this, studies of the signal of the Mars vibroacoustic noise generator in the Excel software product are given, which are similar in structure to a modern noise generator for combating spurious electromagnetic radiation. Assuming that the ideal noise signal is close to uniformly distributed, a representation of the amplitude distribution is found next to the even Legendre polynomials of the first kind, the maximum dispersion of which depends only on the first two even coefficients of the series. It is concluded that the parabolic distribution of the amplitude of the noise generator is the best, since a signal with maximum dispersion is generated for fixed noise voltage boundaries. It is shown that in case of complication of the computational problem of searching for random codes, they can be replaced by harmonics with discrete uniformly distributed phases, or discrete uniformly distributed random variables. Fig.: 6. Refs: 7 titles.

Key words: spurious electromagnetic radiation and interference, monitors based on liquid crystal structures, white Gaussian noise, systems of orthogonal polynomials, Legendre polynomials of the first kind.

UDC 62:681.5:004

Voloshko A.V., Dzheria T.E. Decision tree method for identification and classification of information signals. *Data Rec., Storage & Processing*. 2022. Vol. 24, No. 2. P. 53–61. — Ukr.

Recently, the issue of the development of intelligent active-adaptive electrical networks in the energy industry is often considered. Smart electrical networks have many different aspects. The uncertainty of information is one of them and is characterized by insufficiency, unreliability, ambiguity and uncertainty, and, in addition to physical factors, is associated with economic and temporal factors. During the functioning of electrical networks, it is necessary to qualitatively and correctly assess the degree of uncertainty in solving various problems of the energy sector.

The article deals with the issue of correct classification of information signals using the decision tree method. The decision tree method allows you to understand and explain why a specific object belongs to one or another class. Packet wavelets are used to build a balanced wavelet transform tree. The algorithm of the method is indicated with a description and graphic drawings. The advantages of the chosen method and an example analysis are presented. The relevance of the question is determined by the fact that the process of assigning the electrical load schedule to a certain class is significantly accelerated with the help of the decision tree method.

In the conclusion, an analysis of the work performed is carried out and a vector of future research is determined for optimization and more accurate results. The research, which was carried out using wavelet analysis, made it possible to model the multidimensional information flow with a complete and incomplete original data set. Fig.: 7. Refs: 5 titles.

Key words: electrical load graph, information signal, multidimensional modeling, power consumption, decision tree, wavelet transform, wavelet basis.

UDC 004.942:621.311

Kuzmychov A.I., Chernetska Y.V., Shestakov V.A. A search and sensitivity analysis of time optimal plans of energy resources supply using SolverTable add-in. Data Rec., Storage & Processing. 2022. Vol. 24, No. 2. P. 62–71. — Ukr.

Any optimization technique should be adapted to concrete management task, and this study focuses on practical issues of resource allocation modeling used for energy management.

The principal aspect is uneven consumption of energy resources over time (within a day, a week, a year) that requires the development of optimization models for decision-making about their supply, considering time-related energy consumption predictions and operational features of energy sources. The proposed resource allocation model, built in Excel to use its standard optimization tool Solver, has unusual structure with time periods to overcome the issue and identify the time optimal plan of energy resources supply.

Another important aspect is flexibility and stability requirement of optimization model in the situation of possible change of inputs. SolverTable add-in is applied to succeed in dealing with the issue; it is a specialized tool for sensitivity analysis, which complements the functionality of the standard Excel Solver and helps to interpretate the results of repeated computational experiments that are crucial for rational decisions.

The proposed resource allocation model detailed for the case of electricity supply. Electricity distribution system has a grid structure that allows use matrix model with a number of electricity sources and a number of consumers, represented by their hourly electricity demand. Objective function is the total cost of electricity for consumers with the same supplier. Two groups of constraints for the optimal day-ahead hourly scheduling: limited proposals of electricity sources and equation between the demand and supply. Sensitivity analysis of the model allowed to identify an electricity source, which limit changes can improve the result of objective function.

The model is tested on actual data to choose a time optimal plan for electricity supply; the publication contains just an illustrative numerical example. The proposed model can be modified to solve other problems of optimal allocation of energy resources. Tabl.: 3. Fig.: 6. Refs: 5 titles.

Key words: spreadsheet modeling, optimization modeling, resource allocation modeling, sensitivity analysis, SolverTable, Excel Solver, energy management.