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EVALUATION OF THE METHOD OF DESIGNING AND SYNTHESIS OF INFORMATION MODELS FOR DECISION MAKING'S SUPPORT

Abstract. The article considers the issue of evaluating the method of designing and synthesizing information models for decision support. The analysis and results of theoretical and practical research have confirmed the effectiveness of using a neural network designer for synthesizing significance assessment models. This article considers the issue of evaluating actual methods of designing and synthesizing information models for decision support. After conducting the research, we can draw conclusions, that they have confirmed the effectiveness of using a neural network designer for synthesizing significance assessment models. It has been established that decision-making in the modern world requires the analysis of a huge amount of diverse information, taking into account and separating significant factors from insignificant ones. It is substantiated that obtaining quantitative estimates of the significance of input data in decision-making is crucial for accurate analysis and optimal choice. The place and role of the ability to systematize and assess the significance of input data is proven. It has been determined that the use of expert systems is relevant because they allow you to systematically model and apply expert

knowledge, which is usually presented in the format of rules, heuristics or other logical structures. It is demonstrated that the created neural networks confirm the reliability of their predictions and the ability to adequately respond to other data that is input. Quantitative assessments of the significance of the input data are determined using models built within the neural network designer. The influence of each factor on the objective function and understanding of the relationships between them are proven. It has been established that the use of intelligent systems methods, such as cluster analysis, forecasting, and multivariate regression, is effective for solving expert system tasks, and allows taking into account the complexity of the task and determining optimal solutions based on the collected data and significance assessment models. The process of synthesizing models for assessing the significance of input data in decision-making is investigated. Practical approaches and tools for analyzing and assessing the importance of factors in decision-making are proposed, and the scope of their implementation and use is indicated.

Keywords: system, neural network technologies, model, information support for decision-making

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ОЦІНКА МЕТОДУ ПРОЕКТУВАННЯ І СИНТЕЗУ ІНФОРМАЦІЙНИХ МОДЕЛЕЙ ДЛЯ ПІДТРИМКИ ПРИЙНЯТТЯ РІШЕНЬ

Анотація. У статті розглянуто питання оцінки методу проектування і синтезу інформаційних моделей для підтримки прийняття рішень. Аналіз та результати проведених теоретичних та практичних досліджень підтвердили

ефективність застосування нейромережевого конструктора для синтезу моделей оцінки значущості. Встановлено, що прийняття рішень у сучасному світі потребує аналізу величезної кількості різноманітної інформації, з урахуванням та виокремленням значущих факторів та незначущих. Обгрунтовано, що отримання кількісних оцінок значущості вхідних даних в прийнятті рішень має вирішальне значення для точного аналізу та оптимального вибору. Доведено місце та роль здатності систематизації та оцінки значущості вхідних даних. Проаналізовано підходи оцінки значущості вхідних даних за допомогою експертних систем серед нейромережевого конструктора. Обгрунтовано роль та ефективність використання нейромережевого конструктору, як ефективного інструменту для створення та оптимізації штучних нейронних мереж, що використовуються для вирішення складних завдань. Використання нейромережевого конструктора в поєднанні з експертними системами дозволяє створювати інтелектуальні моделі, які здатні аналізувати та оцінювати значущість вхідних даних. Продемонстровано, що створені нейромережі пвдтверджують достовірність у своїх прогнозах та здатність адекватно реагувати на нові дані, введені користувачем. Визначено, кількісні оцінки значущості вхідних даних за допомогою моделей, побудованих у рамках нейромережевого конструктора. Доведено вплив кожного чинника на цільову функцію та розуміння взаємозв'язків між ними. Встановлено використання методів інтелектуальних систем, таких як кластерний аналіз, прогноз та багатовимірна регресія, є ефективним для розв'язання завдань експертних систем, та дозволило враховувати складність завдання та визначити оптимальні рішення на основі зібраних даних та моделей оцінки значущості. Досліджено процес синтезу моделей оцінки значущості вхідних даних при прийнятті рішень. Запропоновано практичні підходи та інструменти для аналізу та оцінки важливості факторів у прийнятті рішень і вказано простір їх впровадження та використання.

Ключові слова: система, нейромережеві технології, модель, інформаційна підтримка прийняття рішень

Introduction. Normal decision-making in today's world requires the analysis of a huge amount of diverse information. Often in this stream of data, it is important to distinguish significant factors from insignificant ones. Obtaining quantitative estimates of the significance of input data in decision-making is crucial for accurate analysis and optimal choice. The ability to systematize and provide estimates of the significance of input data is of great importance. Various approaches can be used for this, one of which is the synthesis of models for estimating the significance of input data using expert systems within a neural network designer. The application of expert systems is relevant because they allow modeling and applying expert knowledge in a

systematic way. Expert systems are based on a stored knowledge base that contains information accumulated from experts in a certain field. This knowledge can be represented in the form of rules, heuristics, or other logical structures. The neural network designer, on the other hand, is a powerful tool for creating and optimizing artificial neural networks used to solve complex problems. Using the neural network designer in combination with expert systems allows you to create intelligent models that are able to analyze and evaluate the significance of input data. Synthesis of input data significance assessment models through expert systems among neural network designers can be used for various purposes and tasks. For example, in business, such models can be used to analyze market competition, forecast demand for goods and services, optimize production processes, and much more.

Analysis of recent research and publications. The practical significance of the information approach to the description of complex systems was first drawn to the attention of leading scientists assumed that information is the basis of any purposeful activity. In this case, the nature of the subject and object, the objective side of the activity is not essential. This idea, together with the idea of feedback, became the conceptual basis of cybernetics. Cybernetics drew the attention of academic science to the active, productive nature of information, which helped to rethink the traditional ideas of practicing scientists about the problematic use of information categories for the analysis of complex technical, social, and biological systems. Quantitative assessment of information in technical telecommunication systems from several sources with different probability of its receipt follows from information theory and confirms Wiener's presumption about the decisive role of information in any purposeful activity of objects, invariant to its material content. The introduction of additional factors allows to obtain a new quality of the system and leads to the predicted growth of the integral criterion. This is evidenced by numerous studies of domestic and foreign scientists[1-3]. According to scientists, the exclusion of uninformative and noisy factors also leads to an increase in the productivity of the functioning of a complex object[4-6]. When making decisions by a group of experts, the weight of each vote is taken into account individually, and in real conditions of managing objects and processes, consensus is reached on the basis of generally accepted methods and rules[2, 5-8]. However, when developing automated decision support systems (hereinafter abbreviated as DSS), when the decision rule must be formalized, built into the data generation and updating algorithm, and provide optimal estimates, additional technology is required. This is especially evident when working with complex objects characterized by high-dimensional input factors and output states with poorly formalized and vaguely defined relationships[7-9]. Based on the theoretical and practical research conducted, reflected in a number of works, under these conditions the entropy of the system depends on the number of controlled states, and those, in turn, are determined by a set of parameters of a certain dimension[10-

11]. Under complex conditions, the system for recognizing the states of the object of study is forced to operate under conditions of high entropy with the help of a high dimensionality of the analyzed feature space. On the other hand, scientists argue that these states, for the specified conditions, acquire the character of equiprobability, which additionally emphasizes the existence of high uncertainty in decision-making[8-13].

The purpose of the article is to study the evaluation of the method of design and synthesis of information models to support decision-making.

Main part. The conceptual line of research is aimed at developing an approach to solving the problem of automating the management of complex systems by creating effective intelligent technical decision-making support systems based on advanced information technologies. The aim of the work is to study the assessment of the strength of input factors in a single information format of the given examples, to build a neural network model to solve the problem of factor analysis of input data and to adapt them to the information format on two data sets. The object of the study was the synthesis of models for assessing the significance of input data in decision-making. The following research methods were recorded: mathematical statistics, probability theory, mathematical analysis, neural network analysis, classification, regression, clustering[3,6,10,11,12].

Synthesis of input significance models requires several steps. First, it is necessary to collect the data that will be used in the model. This can be numerical data, textual descriptions, images, or any other format of information that has an impact on decision-making. The next step is to build expert systems. This involves defining rules, heuristics, or other logical structures that reflect expert knowledge in a chosen domain. It is important to consider the diversity of factors and their interrelationships to obtain more accurate significance estimates. Next, neural network algorithms are used to train and evaluate the model. This includes choosing the neural network architecture, weighting factors, and other parameters that allow optimizing the process of analyzing and assessing the significance of the input data. The result of the synthesis of input significance assessment models is a set of quantitative estimates that indicate the importance and impact of each input factor on decision making. These estimates can be used to rank factors, determine their weight and impact, as well as to solve specific tasks and make optimal decisions. Therefore, the synthesis of models for assessing the significance of input data through expert systems among neural network designers is a powerful tool for analysis and decision-making in various fields of activity. The use of these models allows making the decision-making process more objective, systematic and effective.

The purpose of this work is to study the assessment of the strength of input factors in a single information format of the given examples, to build a neural network model to solve the problem of factor analysis of input data and to adapt them to the

information format on two data sets. The objectives of the work are: to obtain quantitative estimates of the significance of input data by building models when synthesizing expert systems within a neural network designer. To practically apply the calculation of the influence of each factor on the target function in a single information base. To apply the practice of factor analysis to build models in a neural network format using a technical analysis package. To use the determining force of the input vector as an indicator of the significance of input data.

Let us consider a method for assessing the significance of input data in the decision-making process (MASIDDMP), based on the fact that the measure of assessing the appropriateness of information is considered here. MASIDDMP is a method of analyzing and evaluating the semantic content of texts or other objects, developed by O. Kharkevich.

This method is based on measuring the degree of significance of individual words or concepts in a text and determining their contribution to the overall meaning. The main principles of the MASIDDMP include: Measuring informational significance: MASIDDMP used mathematical models to assess the significance of words in a text. This allows us to determine how important certain words are for understanding the content of the text. Ranking and attitude: MASIDDMP measure can be used to assign rank scores to words or concepts in a text.

The rank reflects the degree of significance, where a higher rank indicates greater importance. Applications in various fields: MASIDDMP's approach can be applied in various fields, including linguistics, text analysis, semantic search, machine learning, and other areas where analysis and understanding of text semantics is important. It provides the ability to quantify semantic content and helps in understanding and analyzing texts.

When applied to expert system synthesis and neural network designer, this method can be used to determine the significance of input data and build evaluation models.

A promising information approach to the procedure for creating methods, algorithms, and software packages to support decision-making in quality management of complex objects is presented. One of the tasks of the research was to provide skills for quantitative assessment of MASIDDMP's semantic measure by building models during the synthesis of expert systems among the neural network designer: at this step, it is necessary to investigate MASIDDMP's semantic measure and develop models that can quantitatively assess this measure. Using a neural network constructor, we will build models that take into account expert knowledge and evaluate the semantic measure based on input data.

Apply a practically differentiated calculation of the impact of each factor on the target function in a single information base: In this step, we will determine the impact of each factor on the objective function using differential calculation methods.

This will allow us to obtain a quantitative assessment of the significance of each factor and determine how it affects the results of our model.

Use typical intelligent systems tasks such as cluster analysis, forecasting, and multivariate regression: In this step, we will apply various typical intelligent systems tasks to our model for analysis and forecasting.

We can apply cluster analysis to group semantic measures, forecasting to predict future values of a measure, or multivariate regression to model the relationship between various factors and the objective function.

Apply the practice of factor analysis to build models in neural network format using the software product for comprehensive statistical analysis, Neural Networks technical analysis package.

In this step, we will apply the practice of factor analysis to build models in neural network format.

Using the software product for comprehensive statistical analysis,Neural Networks technical analysis package, we will be able to build neural network models that are able to analyze and evaluate significant factors[14-15].

Use performance metrics of input strength assessment models, such as "Rank" and "Attitude", and show how these metrics correlate with MASIDDMP's information measure: in this step, we will use the "Rank" and "Attitude" metrics to assess the strength of input factors in our model, where we will analyze how these criteria correlate with MASIDDMP's information campaign and how they can help in assessing the significance of factors.

Comparing the numerical values of the criteria using different model training methods: In this step, we should compare the numerical values of the "Rank" and "Attitude" criteria using different model training methods. Therefore, we will be able to use different approaches to model training and compare their effectiveness in determining the significance of factors.

Solve the tasks in the Statsoft technical analysis package: in this step, we will solve all the tasks using the Statsoft technical analysis package, where it is possible to perform calculations, analyze data, and develop models using the functionality of the package.

Interpret the results for several examples and justify the performance of the informative factor assessment based on the experiments conducted: in this step, we will interpret the obtained results for several examples.

It is necessary to analyze the performance of factor evaluation using the indicators "Rank" and "Attitude" and justify this performance based on the experiments conducted.

Thus, it is necessary to work with different methods, models and tools for assessing the significance of input data and solving expert system tasks in the context of MASIDDMP's semantic measure looks as shown in Figure 1 [14-15].

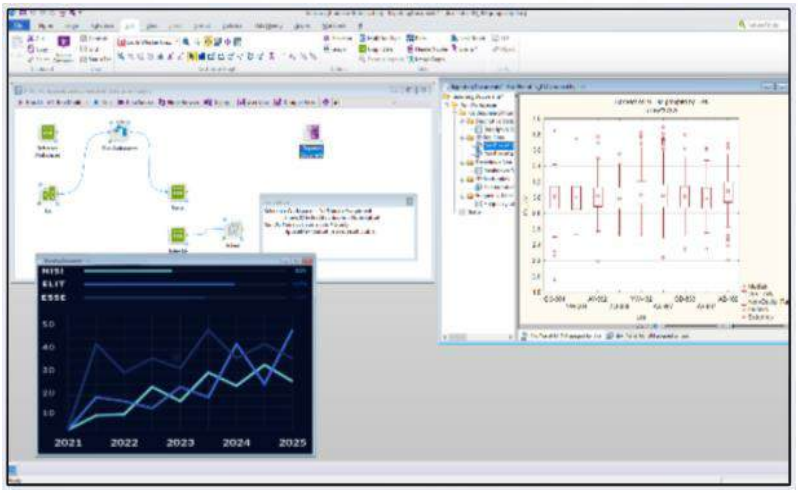

Fig. 1. Basic business modeling methods

A neural network should be a special mandatory element of the working toolkit for studying the quality of functioning of a complex STS. Building a model of an object control system requires finding information-analytical dependencies between factors and states by any means, that is, approximating some communication functions. Neural networks are ideal approximators, and today this task is successfully solved by them, especially since the time of iterative procedures, taking into account the peculiarities of different STSs, can be quite long. The next important circumstance is that modern mathematical tools for implementing a function of many variables require only the operations of summation and composition of a function of one variable, which is important for practical solutions and use.

Based on the analysis, it can be assumed that it is advisable to approach the study of a complex socio-technical system from the point of view of information theory as a noisy, in a certain way, telecommunication channel, in which basic processes, as images, are described in the language of their informative features, are decomposed, and transformed into information-matrix spaces of factor and state profiles. This is the source material for forming a training sample, brought to a single format through MASIDDMP's semantic measure of appropriateness and ranked by the determining force of influence. Next, the architecture, composition and iteration procedure of the neural network are justified, and data is entered into the database of precedents, the model is synthesized and optimized, its adequacy is checked and stability is tested. A model is formed for the stages of training, adaptation and optimization, and the training results are interpreted.

Since the controlling factors are initially transformed by the information measure, their dimension corresponds to the dimension of the information. Therefore, effective management of a complex socio-technical system, in this case, is identical to the procedure of reducing the conditional entropy of an object in its movement to the target state under the influence of these factors and is the result of solving the

inverse problem of the communication channel: based on the received message, determine which influence should be sent, which determines this state. To find the best solutions, you can apply the hypothesis testing procedure for the maximum reduction in conditional entropy due to each factor relative to the composition of conditional entropies of the entire array of factors.

As a result of the work carried out on assessing the significance of input data in decision-making, several important conclusions were reached. Thus, training and data analysis confirmed the effectiveness of using a neural network designer to synthesize significance assessment models. The created neural networks demonstrated reliability in their predictions and the ability to adequately respond to new data entered by the user. It is the results of the experiments and the analysis of their results that made it possible to determine quantitative estimates of the significance of the input data using models built within the framework of the neural network designer.. The use of intelligent systems methods, such as cluster analysis, forecasting, and multivariate regression, has proven effective in solving expert system problems in the context of semantic measurement. These methods allow us to take into account the complexity of the problem and find optimal solutions based on the collected data and significance assessment models. The process of synthesizing models for assessing the significance of input data in decision-making was studied, which made it possible to formulate practical approaches and tools for analyzing and assessing the importance of factors in decision-making and can be applied in various areas where objective assessment and analysis of data is important.

Conclusions. In the tasks of managing complex objects, the fundamental nature of the connection of pragmatic properties of information with the category of the target state of the system is very important when solving applied problems in the study of the behavior of objects of various nature under multifactorial influence on the transition of the system to one state or another. It is obvious that decision support by an analytical system is the selection of some, best, control influence from the initial set of all possible control influences, which ensures the most effective achievement of management goals. This means that information theory is applicable for the synthesis of decisive decision-making rules and modeling of the processes of the object under study, which in practice provides the ability to quantitatively assess the power and direction of controlling factors through the magnitude and sign of the information that determines them. It should be emphasized that the works do not contain any fundamental restrictions on the nature of the management object, the determining force and the number of influencing factors, which is essential in substantiating the application of an information approach to modeling a decision support system in management, and therefore requires further and thorough research.

Thus, the analysis of the degree of development of the problem shows that the specificity of the systems considered as objects of research allows us to approach

them as a generalized information-measuring socio-technical system; It is advisable to fully summarize and use the existing theoretical and practical developments to develop a methodology, algorithms and decision support programs in managing the quality of such a system; modern information, mathematical and neural network tools satisfy the tasks being solved and allow achieving the final result.

The conducted teleretic research is the basis for further research, which will address the need to improve methods for assessing the significance of input data, contributing to increasing the efficiency of expert systems and making rational decisions based on reliable information.

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