INFORMATION TECHNOLOGIES

DOI: 10.15587/2312-8372.2018.147861

RESEARCH OF METHODS AND TECHNOLOGIES FOR DETERMINING THE POSITION OF THE MOBILE OBJECT IN SPACE

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The object of research is the process of tracking the position of a mobile object in space. One of the weakest points in tracking systems for the position of a mobile object in space is the problem of eliminating the ambiguity of determining key points when scanning the environment. This problem is especially important when several methods (or technologies) of position tracking are applied simultaneously. There is a need for additional calibration and adjustment.

The study used the results of the analysis of methods and technologies for automatically determining the position and orientation of three-dimensional objects using technical vision systems. Analysis of the considered popular systems and methods for measuring the spatial position of objects, as well as algorithms and navigation technologies of a mobile robot, has shown that each of the considered systems has its advantages and disadvantages. And it is used depending on the objectives of this system.

A comparative analysis of the main types of algorithms of the SLAM method has been carried out. The perspectives of this method – the use of artificial intelligence methods and an extended Kalman filter – improve the speed of the SLAM method. Proof of this is the huge number of open projects to create this type of navigation in various competitions:

– VSLAM – implementation of the SLAM method based on computer vision methods;

– RGBDSLAM – package for registering a cloud of points with RGBD sensors, such as Kinect or stereo cameras;

– Hector_mapping – SLAM for platforms without odometer – only based on data from LIDAR, etc.

Since most modern technologies are increasingly using standardized formats of Wi-Fi, Bluetooth, GPS signals, it can be argued that using and analyzing information from a large number of sensors will increase the accuracy of determining the coordinates of an object several times. Creating the necessary information field of navigation and routing will allow to map and localize a mobile object on the ground with great accuracy.

Keywords: SLAM method algorithms, positioning, mobile object, technical vision.

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DOI: 10.15587/2312-8372.2018.148567

DEVELOPMENT OF INFORMATION AND ANALYTICAL MODEL OF THE STIMULATING INTERNET MARKETING

page 10–15

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The object of research is Internet marketing in the modern information network space. Against the background of the rapid development of information technology, the Internet network increasingly occupies a leading position in the areas of promotion and sale of various goods. At the same time, with this classic methods and approaches of marketing are experiencing obvious loss of dominant positions. One of the most problematic places is the effective application of modern methods and approaches for the development of Internet marketing and, in particular, stimulating Internet marketing, which contributes to the promotion of products in accordance

with the preferences of potential consumers. There is also a need to balance the resources involved in the implementation of Internet marketing in accordance with the possible volume of the result.

The classic methods of marketing and the latest information technology are used to distribute and process information in network systems. In order to eliminate the shortcomings, a combination of classic and new approaches is put together, in order to provide stimulating Internet marketing in an easier way to manage.

Information model of stimulating online marketing is summarized. This model will consist of separate, interconnected blocks, aimed at meeting the needs of potential customers, as well as meeting the requirements of those who provide relevant Internet services. It is the consideration of the needs and requirements of all parties involved in stimulating Internet marketing in the form of separate interrelated blocks of the model, which makes it possible to reveal the peculiarities of such a process.

Therefore, it is possible to determine the analytical description of the information model of the stimulating Internet marketing. This allows to determine the development of incentive Internet marketing, the direction of optimizing its conduct. This provides such advantages as the flexibility of the process of conducting the stimulating Internet marketing and targeted delivery of information to the chosen target audience.

Keywords: information model, stimulating Internet marketing, number of referrals (site visits), target audience, search engine optimization.

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DOI: 10.15587/2312-8372.2018.147613

DEVELOPMENT OF INFORMATION TECHNOLOGY OF CORRELATION ANALYSIS OF TOURIST DEMAND

page 16–21

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The object of research is the process of automating information technology of the correlation analysis of tourist demand on the basis of a cognitive-statistical approach. One of the most problematic places is determination of the factors affecting tourism demand, so it is necessary to develop information technology of correlation analysis, which will allow to determine the factors that most affect tourism demand.

The paper substantiates the improvement of the method of correlation analysis of tourist demand is the calculation of the multiple correlation coefficient of tourist demand, a distinctive feature of which is to take into account both qualitative and quantitative parameters. The following factors are chosen for the analysis of tourist demand:

– the average wage per person in the tourism industry;
– tourism expenses;
– the number of collective accommodation facilities;
– the number of subjects of tourist activity;
– the number of recreation;
– release in basic prices and release by types of economic activity;
– capital investment by region;
– transport connection;
– ecological situation;
– infrastructure (subjective indicator).

A block of information technology for modeling and analysis is developed for the study of tourist demand which determines the correlation dependence between the factors influencing tourist demand. Information technology is developed in the *R* programming language, by the Shiny package, which enables the creation of interactive web applications and the simplicity of the developed technology for the average user.

The following factors affecting tourist demand are identified:

– the number of collective accommodation facilities;
– the number of subjects of tourist activity;
– the number of recreation;
– level of infrastructure based on subjective expertise.

As a result, based on the correlation analysis, a model of the process of formation of tourist demand on the basis of the cognitive-statistical method is built.

Thanks to this, it is possible to further develop the methodological foundations of the strategic planning of the development of subjects at the macro and micro levels, to develop regulatory, economic and socio-political mechanisms for the flexible development of tourism enterprises in certain regions based on qualitatively new principles.

Keywords: information technology modeling unit, tourist demand, correlation analysis, programming language *R*.

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DOI: 10.15587/2312-8372.2018.149680

THE INTRODUCTION OF INTELLECTUAL SYSTEM FOR EVALUATING PROFESSIONAL ABILITIES OF APPLICANTS INTO THE ACTIVITIES OF EDUCATIONAL INSTITUTIONS

page 22–26

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The object of research is the methods and means of professional identification of applicants. The research aims to provide applicants with scientifically based decision support for choosing a field of study. The introduction of intelligent decision support systems in the process of self-actualization of applicants will significantly improve the effectiveness of vocational guidance activities of educational institutions.

One of the biggest problems of the intellectualization of systems for assessing abilities and achievements is that the test results of applicants represent a lot of fuzzy data. At the same time, the correctness of data separation significantly depends on the construction of a fuzzy set of features for the conclusion of a diagnostic solution. In addition, the most common tests do not take into account the requirements for specialists of the construction industry.

The basis of the developed system is tests to determine the personality structure of the Integrated Professional Orientation Diagnostics «Applicant». This system contains reference information about the vocational category of training and tests for determining the structure of the individual. Conclusions are based on techniques that allow to predict the success of activities in various industries. The ability of a person to a certain professional activity reflects the ability to acquire special knowledge and skills in the learning process. That is why in the course of the study the «Applicant» tests were used. To improve the reliability of assessing the professional abilities of the applicant, it is proposed to use an intelligent system based on the Takagi-Sugeno-Kang fuzzy neural network. This choice is due to the fact that the Takagi-Sugeno-Kang network has a number of features that provide it with advantages in solving the problem of matching the abilities of an applicant to the possibility of acquiring knowledge and skills in a particular specialty. In particular, the ability of fuzzy neural networks to separate linearly inseparable data. This ensures the ability of the system to isolate the natural abilities of applicants from a mixture of data.

Compared to other means, the Takagi-Sugeno-Kang network makes it possible to solve the problem of classifying a very large amount of data by a network of smaller dimension.

Keywords: identification of abilities and achievements of a person, intellectual system, organization of processing fuzzy information.

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DOI: 10.15587/2312-8372.2018.150512

DEVELOPMENT OF A DISCRETE OPTIMIZATION OPERATION SOLUTION INFORMATION TECHNOLOGIES BASED ON SWARM INTELLIGENCE

page 27–32

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The object of this research is the procedure of building information technologies, the functioning of which is based on the methods of swarm intelligence, for solving problems of discrete optimization.

To solve any optimization problem in the plurality of swarm algorithms, there will surely be at least one algorithm that will give at least satisfactory results. However, there is not and can't be an algorithm that could provide high efficiency in solving all optimization problems. Therefore, for each of the swarm algorithms, classes of problems that it solves can be distinguished: algorithms are better than others; something like other algorithms; worse than other algorithms.

In the course of the research, information technologies were used to solve discrete optimization problems based on swarm algorithms. Methods for applying various classes of swarm intelligence algorithms for solving discrete optimization problems are obtained. Methods of swarm intelligence to solve a specific class of problems re combined. The optimal values of the parameters of certain methods of swarm intelligence are determined.

An information technology is developed to use swarm algorithms depending on the class of the discrete optimization problem, based on the characteristics of swarm algorithms (type of input parameters, neighborhood of populations, type of population formation, type of iteration processes). This makes it possible to choose the relevant swarm algorithm for solving applied problems and to classify these tasks depending on the characteristics of the swarm algorithms that are used to solve it.

An information technology is developed using a combination of different methods of swarm algorithms for solving a certain class of problems, which, unlike other approaches, is based on a hybrid approach using swarm algorithms depending on their characteristics. This allows to take advantage of a specific swarm algorithm and thereby increase the efficiency of solving certain classes of applied discrete optimization problems.

Keywords: discrete optimization, swarm intelligence, information technologies, decision support systems.

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DOI: 10.15587/2312-8372.2018.149962

DEVELOPMENT OF THE METHOD FOR FILTERING VERBAL NOISE WHILE SEARCH KEYWORDS FOR THE ENGLISH TEXT

page 33–41

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The object of research is the processing of verbal information to identify keywords in the text. The most important step in the search for key terms is the calculation of their weights in the document in question, which makes it possible to evaluate their significance relative to each other in this context. To solve this problem, there are many approaches that are conditionally divided into two groups: they require learning and do not require learning. Learning implies the need to pre-process the original body of texts in order to extract information about the frequency of occurrence of terms in the entire body. An alternative approach is using linguistic ontologies, which are more or less approximate models of the existing set of words in a given language. On the basis of both approaches, systems are created for the automatic extraction of key terms. Nevertheless, in the direction of searching for keywords, research is not stopped in order to improve the accuracy and completeness of the results, as well as to use methods of extracting information from the text to solve new problems.

Existing approaches to the definition of keywords are characterized. The best quality of text processing is achieved by linguistic methods or when their combinations are statistical. A system for automatically determining key phrases from natural language text should be developed using the morphological dictionary and syntax rules.

The study uses an approach to defining keywords based on finding syntactic links between word forms in sentences in English text using the instrumental capabilities of modern linguistic packages. In the framework of the general approach to reducing verbal noise in the method, it is proposed that it is achieved with the help of formalized operations: the replacement of pronouns with the corresponding nouns; removal of noise connections; removing noise words; withdrawal of stop words. The described operations can be used as additional modules that improve the results of finding keywords for both the developed method for determining keywords of English text and other algorithms for finding keywords.

Keywords: verbal noise filtering, English text keywords, linguistic package, DKPro Core, syntactic analysis.

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SYSTEMS AND CONTROL PROCESSES

DOI: 10.15587/2312-8372.2018.149539

ANALYSIS OF POSSIBILITIES TO USE NEURAL NETWORK FOR REMOTE CONTROL OF ELECTRONIC DEVICES

page 42–49

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The object of research in the work is the systems of remote control of electronic devices. There are wired and wireless means of implementing a remote communication channel between the slave and control devices. Analysis of existing means of creating a communication channel, found a low value of the ratio of system flexibility and data transfer rate within the created network. One of the reasons for the low ratio is the use of modules as part of a system with a high minimum operating time. Such modules are modules for filtering and decoding the received signal at the receiver side, encoding and modulation at the transmitter side. Replacing these modules with one with a significantly lower time spent will significantly improve the value of the ratio of system flexibility and data transfer rate. The ability to create a module that will have the necessary properties of time spent on work, provides a neural network.

The model of a remote control system obtained during the study has several advantages, in particular, the presence of a neural network, makes it possible to reduce the time spent and to improve the accuracy of the system during the entire system operation time. This is achieved thanks to the ability of the neural network to self-learning without human intervention and its ability to analyze any input signals with different background noise values. These properties allow the replacement of elements that do not allow to increase the rate of exchange for elements of the neural network that will perform the same functions with greater speed, reliability and accuracy.

The data obtained during the work proves the expediency of integrating the elements of the neural network into the remote control systems of electronic devices. Also, possible places for the integration of a neural network into the remote control system of electronic equipment have been proposed, which will improve the stability, accuracy, speed of the system.

Keywords: remote control, neural network, hardware interfaces to communicate, wireless communications.

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DOI: 10.15587/2312-8372.2018.150924

INVESTIGATION OF ROAD TRAIN DIVERGENT STABILITY LOSS WHEN MOVING ALONG A PROGRAM TRAJECTORY

page 50–55

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The object of research is transport driven multilink wheel systems. In the development of the realized possibility of controlled movement of a semi-trailer truck along a program trajectory, the possibility of constructing a bifurcation set by a velocity parameter is considered. The velocity value is calculated for each discrete value of the calculated real trajectory. The trajectory can be specified in an explicit, implicit, parametric form or by the law of variation of the curvature radius. The study of this parameter is one of the most problematic places for analyzing the stability of the movement of a road train.

Changes in this parameter at certain values, called bifurcation, lead to changes in the qualitative structure of the solutions of the system of differential equations and, as a result, divergent stability of the road train. For such an investigation of the phenomenon, the method of continuation by parameter and the first Lyapunov method are applied.

During the research, many bifurcation velocity values are obtained. This is due to the fact that the proposed approach has a number of features, in particular, an iteration is performed for all control parameters of the program trajectory, and for each such value, the velocity has been iterated until its bifurcation value is reached.

At each iteration, the roots of the characteristic equation are checked for the presence of at least one root with a positive real part, which corresponds to the bifurcation value of the parameter of the velocity of a road train according to Lyapunov. Due to this, it is possible to obtain this set by an exclusively analytical method using computer calculations, without resorting to the use of graphic-analytical methods.

Obtaining these bifurcation sets can practically be used both to limit the velocity of a road train and to warn of its excess. Compared with similar known methods, this provides such advantages as a significant acceleration of the construction of this set and, as a result, its use in real time.

Keywords: characteristic equation, first Lyapunov method, parameter continuation method, bifurcation set, divergent stability loss.

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