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ANALYSIS OF METHODS AND TECHNOLOGIES OF HUMAN FACE RECOGNITION

page 4–10

Nechyporenko Olga, *PhD, Associate Professor, Department of Robotics and Specialized Computer Systems, Cherkassy State Technological University, Ukraine, e-mail: olne@ukr.net, ORCID: http://orcid.org/0000-0002-3954-3796*

Korpan Yaroslav, *PhD, Associate Professor, Department of Robotics and Specialized Computer Systems, Cherkassy State Technological University, Ukraine, e-mail: populusdocti@gmail.com, ORCID: http://orcid.org/0000-0002-1455-5977*

The object of research is the processes of biometric identification and human authentication based on the image of his face for computer vision systems. One of the most problematic places in biometric identification systems using computer vision is the problem of eliminating ambiguity of «scanning». Such ambiguity arises when designing three-dimensional objects of the real world on flat images.

In the course of the research, the results of the analysis of the effects of requirements and factors on the features and characteristics of the object of the biometric face recognition system are used. First of all, it is the variability of visual images, the design of three-dimensional objects, the number and location of light sources, the color and intensity of radiation, shadows or reflections from surrounding objects. The solution to the problem of detecting objects on the image lies in the correct choice of the description of objects, for the detection and recognition of which the system is created.

Analysis of the features of classes and the properties of face recognition tasks shows that it is sufficient for a database of authentication systems to store a small set of predefined key characteristics, as much as possible characterize the images. Thus, by configuring the system to reduce the probability of incorrect identification, it is possible to use several images belonging to one person. For such purposes, a video sequence of certain specific head movements and facial muscles of the face is sufficient.

A generalized algorithm for automatic face detection and recognition is developed. The presented scheme of the generalized algorithm consists of nine simple steps and takes into account the identification features using photo and video images. The advantage of the algorithm is the simplicity of implementation, it allows already at the design stage of the identification system, to quickly evaluate the system's operability by analyzing the internal interaction of its elements.

Keywords: face recognition, personality identification, biometric face recognition system.

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DEVELOPMENT OF THE COMPUTER MODEL OF THREE DIMENSIONAL SURFACES RECONSTRUCTION SYSTEM

page 11–16

Lymarenko Yuliia, *PhD, Associate Professor, Department of Computerized System Software, Zaporizhzhya State Engineering Academy, Ukraine, ORCID: http://orcid.org/0000-0002-1643-6939*

Tatievskyi Dmitry, *Postgraduate Student, Department of Computerized System Software, Zaporizhzhya State Engineering Academy, Ukraine, e-mail: dtdissert@gmail.com, ORCID: http://orcid.org/0000-0002-7841-9560*

The object of research is a system for scanning three-dimensional surfaces using the method of structured illumination. The method of structured illumination is considered one of the most reliable methods for relief reconstruction of objects. Therefore, using this method, it is necessary to build a computer model simulating the operation of both the software and the hardware (projector and camera) of the 3D surface reconstruction system.

During the research, modern 3D scanners are used. In many of them, a combined system for obtaining the coordinates of a 3D object using the triangulation method is applied. In addition to the laser emitters or DLP projector, a digital camera is used that provided coordinate and texture information about the object. To test the adequacy of the computer model based on the above principles, the scenario for reconstruction of the ball surface is used.

A full-fledged simulation model for structured illumination (binary codification method) within the virtual system «projector-camera» is realized. In the system, there is a functional of the rotary table for fixing the relief over the entire outer area of the object (from all angles).

According to the research results of the resulting cloud of points, it can be concluded that the maximum error in the distance of the obtained point of the ball surface from its virtual center is 10 % of the length of the radius, and an average error of 4.5 %.

The developed computer model of the reconstruction system of three-dimensional surfaces allows to emulate the whole cycle of operation of a physical 3D scanner, with the possibility of implementing any type of structured illumination, without constructing a real physical model.

Keywords: binary codification, three-dimensional surface reconstruction, computer vision, computer modeling, structured illumination.

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MODELING OF THE PROCESS OF TERRITORIAL COMMUNITIES FORMATION USING SWARM INTELLIGENCE ALGORITHMS

page 17–33

Lytvyn Vasyl, *Doctor of Technical Sciences, Professor, Department of Information Systems and Networks, National University «Lviv Polytechnic», Ukraine, e-mail: vasyl.v.lytvyn@lpnu.ua, ORCID: http://orcid.org/0000-0002-9676-0180*

Uhryn Dmytro, *PhD, Associate Professor, Department of Information Systems, Chernivtsi Faculty of the National Technical University «Kharkiv Polytechnic Institute», Chernivtsi, Ukraine, e-mail: ugrund38@gmail.com, ORCID: http://orcid.org/0000-0003-4858-4511*

Nadiein Nazarii, *Department of Information Systems, Chernivtsi Faculty of the National Technical University «Kharkiv Polytechnic Institute», Chernivtsi, Ukraine, e-mail: nazarnadein@gmail.com, ORCID: http://orcid.org/0000-0001-9577-7995*

Klichuk Oleg, *PhD, Associate Professor, Department of Information Systems, Chernivtsi Faculty of the National Technical University «Kharkiv Polytechnic Institute», Chernivtsi, Ukraine, e-mail: Kolegr500@gmail.com, ORCID: http://orcid.org/0000-0002-7528-2968*

The process of TC formation is considered, using algorithms of swarm intelligence. The main aim of TC formation is reducing the budget and saving the public funds. The approved methodology and the process of formation of capable communities are studied when in the human settlements that form the society is the administrative

building, the health care institution, the general education school of the third degree, the kindergarten, the institutions of social protection, housing and communal services, taking into account the financial security and daily migration of residents in the zone of accessibility of the administrative center. The minimum distance from the center of the community to other settlements is taken for the purpose of forming territorial communities. A mathematical model of such problem is developed, using specific limitations that arise from the formulation of the problem itself. To build effective algorithms for formation of territorial communities, the concept of independence of communities, as well as the contiguity of individual councils is introduced. Stochastic algorithms of ant colony and migrating birds have been adapted to solve the established multicriteria optimization problem. The proposed approach is investigated.

Keywords: ant colony algorithm, migrating bird algorithm, multicriteria optimization, territorial community, human settlement.

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DEVELOPMENT OF THE APPROACH FOR DESIGNING, MODELLING AND RESEARCH OF CRITICAL IT INFRASTRUCTURE

page 34–41

Dorogyy Yaroslav, *PhD, Associate Professor, Department of Automation and Control in Technical Systems, National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Ukraine, e-mail: cisco.rna@gmail.com, ORCID: http://orcid.org/0000-0003-3848-9852*

The object of research is a critical IT infrastructure. One of the most problematic places in the study of critical IT infrastructures is the complete lack of approaches, methodology and tools for designing, modeling and researching critical IT infrastructures that could be used in the form in which they are offered.

On the basis of expanded open hybrid automata, an approach is proposed that will allow to compactly describe the components, critical IT infrastructure systems and their interrelations, both internal and external. Its peculiarity is the use of an extended set of parameters, which makes it possible to provide probabilistic and qualitative features to models of components and systems of a critical IT infrastructure.

In the course of the research, the Matlab software package is used, which allows to check the proposed approach and models for workability.

The resulting models are fairly compact and completely reflect the necessary logic of the work of the relevant components and critical IT infrastructure systems. It is shown that this is achieved due to the flexibility of the proposed mathematical apparatus, namely the possibility of creating compositions from simple models for the formation of more complex ones.

In the future, the proposed approach and the creation of a library of models for all major systems and critical IT infrastructure components will provide a convenient tool for a wide range of researchers whose work is related to all aspects of researching critical IT infrastructures.

Keywords: critical IT infrastructure, hybrid extended open automaton, level of model abstraction.

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SYSTEMS AND CONTROL PROCESSES

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AUDIT OF CATERING NETWORK STATE IN KHARKIV CITY

page 42–48

Anisimov Genadiy, *Department of Food Technologies and Hotel and Restaurant Business, Kharkiv Institute of Trade and Economics of the Kyiv National University of Trade and Economics, Ukraine, e-mail: avgyr1957@gmail.com, ORCID: http://orcid.org/0000-0002-0707-8666*

Zhukov Yevhenii, *PhD, Department of Food Technologies and Hotel and Restaurant Business, Kharkiv Institute of Trade and Economics of the Kyiv National University of Trade and Economics, Ukraine, e-mail: qsm@yandex.com, ORCID: http://orcid.org/0000-0002-8445-3490*

Lipovoy Denis, *Department of Food Technologies and Hotel and Restaurant Business, Kharkiv Institute of Trade and Economics of the Kyiv National University of Trade and Economics, Ukraine, e-mail: xteid@ukr.net, ORCID: http://orcid.org/0000-0002-9143-4896*

The object of research is the network of catering enterprises in Kharkiv (Ukraine). One of the most problematic places is the forecast of the prospects for managing existing and newly created catering enterprises. From the organizational and technical point of view, this problem is related to the uncertainty of the types of enterprises and the capacity of their trading halls.

The study uses statistical information on the state of the city network of catering enterprises for the period 2013–2016. The main organizational and technical indicators of the audit object are stratified according to the types of enterprises and the capacity of their trading halls. Tabulation and graphical representation of stratified data make it possible to identify trends in the development of the audit object.

It is established that the urban network is characterized by a constant increase in the number of enterprises and an increase in the total capacity. At the same time, the integral share of the capacity of enterprises selling food and drinks to consumers, united by professional features, is 49.4 %. This is due to the fact that at the moment the Kharkiv food network is equally directed both to the provision of food services during working hours and to the provision of services outside of working hours.

At the same time, the average capacity of catering enterprises is decreasing. The most common types of catering enterprises are cafes and bars with small shopping halls (on average 37 and 21 places respectively). This is due to the fact that the peculiarity of such types of enterprises is the availability of small trading halls, oriented to creating a cozy atmosphere during leisure.

Due to the revealed tendencies, it is possible to make effective organizational decisions when designing new and reconstructing existing catering enterprises. This can create competitive advantages both for enterprises within the framework of network structures, and for individual catering enterprises.

Keywords: catering enterprise, enterprise network, enterprise type, enterprise capacity, population provision.

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RATIONALE FOR LOGISTICS OPERATOR INFRASTRUCTURE PARAMETERS

page 49–54

Gladkovska Valentyna, *Postgraduate Student, Assistant, Department of Exploitation of Marine Ports, Odessa National Marine University, Ukraine, ORCID: http://orcid.org/0000-0003-4077-6711*

The object of research is the infrastructure of the logistics operator. One of the most problematic places in the design of a logistics infrastructure is that the freight forwarding company must take into account the many interrelated factors that can affect it.

As a result of lack of detail, the interval T considered in the research is divided into stages. This will determine the phased formation of the infrastructure of the logistics operator, as well as the gradual increase in the intensity of servicing material flows, and phased financing of a logistics infrastructure creation.

The developed economic-mathematical model allows to obtain a solution to the problem of designing the infrastructure of a logistics operator. The model belongs to the class of non-linear programming problems and can be solved with the help of standard software. Parameters of the model management are the capacity and level of equipment of warehouses in the regions, the composition of the fleet, the number and type of trucks. This will allow the transport and forwarding company to determine the prospects for its presence in the regional markets in question as a logistics operator and enter the new markets in the development process and also become part of the logistics infrastructure of the regions. In the future, this model will contribute to the optimal organization of cargo transportation and the provision of services, which will lead to increased competitiveness of the freight forwarding company by attracting additional cargo volumes.

Keywords: logistics infrastructure of regions, logistics operator, material flow, freight forwarding company.

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INFLUENCE OF FEATURES OF THE TRANSPORT NETWORK PATTERN ON THE HAUL CYCLE LENGTH BETWEEN ITS NODES ON THE EXAMPLE OF THE TRANSPORT NETWORK OF UKRAINE

page 54–58

Dolya Constantine*, PhD, Senior Lecturer, Department of GIS, Land and Real Estate Appraisal, O. M. Beketov National University of Urban Economy in Kharkiv, Ukraine, e-mail: c.dolya@ukr.net, ORCID: http://orcid.org/0000-0002-4693-9158*

Lyfenko Sergey, *Department of Transport System and Logistics, O. M. Beketov National University of Urban Economy in Kharkiv, Ukraine, e-mail: sergiilyfenko@ukr.net, ORCID: http://orcid.org/0000-0002-1983-6962*

Nesterenko Sergey, *PhD, Assistant, Department of Land Administration and GIS, O. M. Beketov National University of Urban Economy in Kharkiv, Ukraine, ORCID: http://orcid.org/0000-0001-5124-9728*

Vyatkin Konstantin, *PhD, Assistant, Department of Urban Development, O. M. Beketov National University of Urban Economy in Kharkiv, Ukraine, ORCID: http://orcid.org/0000-0002-3002-5669*

The object of research is the road network based on the example of the existing network in Ukraine. During the audit of the main parameters affecting the performance of the transport systems, the mileage of vehicles is determined. It is established that road networks stipulate not only the actual distance between its nodes, but also the potential parameters of the characteristics of traffic of vehicles over the network. Disadvantages of road networks are their cost, limited bandwidth and pattern. In the course of the research of the road network pattern, the methods of network analysis and graph theory are used. A matrix of the shortest distances between regional centers of Ukraine is calculated. As a result of the research it is shown that transportation to Kherson, Odesa or Simferopol is carried out on routes that are on average 44 %, 46 % and 64 % more than possible if there is an appropriate road network. It is determined that the quality of the transport network pattern can be described by the straightness coefficient. The definition of the straightness coefficient of the road network is given. Calculations of the values have established that in the considered network this coefficient takes values from 0.24 to 0.64. The investigated road network offers the organization of communication between the cities of Kharkiv and Cherkasy with the straightness coefficient of the road network – 0.6.

Keywords: road network, efficiency of transport process, straightness coefficient of the road network.

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