SUMMARY
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INFORMATION SYSTEMS, NETWORKS AND TECHNOLOGY

1. Басюк Т. М., Василюк А. С. Пошукове просування комерційних інтернет-ресурсів

SEARCH PROMOTION OF COMMERCIAL INTERNET RESOURCES

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The study aims to determine the main ways of search promotion of commercial Internet resources in the global environment. The study will provide means of increasing the visibility of commercial internet resources by raising the conversion, and thus contribute to increasing the number of potential buyers. To achieve this goal, it is necessary to solve the following main tasks:

‒ To conduct analysis of basic types of search promotion of commercial Internet resources;

‒ To identify factors that carry the greatest influence on conversion of Internet resource;

‒ To develop an algorithm for evaluation of conversion and analyze internal and external factors for its improvement;

‒ To analyze known reputation evaluation services of commercial internet resources and recommendations to attract targeted visitors.

The object of study is the promotion of commercial internet resources in the global network.

The subject of research are methods and tools for building commercial Internet resources.

Scientific innovation is to promote research features of promoting Internet resources in the commercial segment of the global network and develop a methodological approach to support decision making in this subject area.

The practical value of the work is to develop an algorithm of conversion evaluation and scheme construction of reputation management process, providing the necessary tools to promote resource in the commercial segment.

The authors developed a methodological framework for constructing decision making support systems in promoting commercial Internet resources through increased conversions and an increase in reputation:

‒ an analysis of the main types of search promotion of commercial Internet resources has allowed to identify the most popular types that are used in the commercial segment. The following main types were specified: consulting promotion, promotion for traffic and promotion for leads. Consulting promotion is the most common scheme of interaction between a client and SEO company, which focuses on the structure and filling online resource, and the priority of getting top positions in the rankings of search engines go to the second plan. It is the oldest scheme of interaction in which SEO company is motivated by obtaining maximum long-term outcome. However, the main index, which then should be considered, is the conversion of resources. Promotion in traffic is the second most popular type of search engine optimization of commercial online resources aimed at increasing the number of targeted visitors from search engines. This type of promotion is useful for large-scale online stores which are aimed at increasing the number of targeted visitors, and then take steps necessary for the owner (buying a product, signing up for the newsletter, etc.). Promotion of an online resource for traffic makes it possible to search for specific products, services or publications that the target audience is interested in. Progress for leads is considered to be the most advanced technology in the popularization of commercial resources, which provides high efficiency in a short period of time. The essence of this promotion is to pay for the unique order or a phone call from the studied Internet resource.

‒ factors are revealed exercising the greatest influence on conversion of an online resource, allowing analyzing and identifying the resources of its recommended level depending on the position in the search results. The analysis of diverse commercial resources with the use of the following means: SE Ranking (check positions of online resource in the most popular search engines) and search engine services (WordStat, Google Analytics) are presented in the study. The results can serve as a benchmark when analyzing researched online resource compared to the known Web sites of market segment.

‒ An evaluation algorithm of conversion level is developed and the analysis of internal and external factors for its improvement. The study showed that despite the sufficient level of conversion it is necessary to improve it, which is primarily connected with the competition in the subject and change of algorithms of search engines. External factors are the list of actions that occur with the visitor before he/she gets to the resource and these include: advertising of resource (affects the interest of the visitor and his/her impressions of life and further action) and seo (the higher is online resource in the search results the greater is the probability of transition to it). Internal factors determine the characteristics of the resource that can interest the user, making it a potential buyer: design (visual

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presentation of online resource); content (multimedia content of online resource); usability (ease of online resources use); site health (fast loading, correct work, no errors); semantic core (affects conversion of online resource).

‒ known services of reputation evaluation of commercial internet resources are analyzed, which helped to develop recommendations for their use in the analysis of the studied resources. Among the known systems the following are analyzed: Falcon Social (https://www.falcon.io/), Wobot (http://wobot.ru/), Youscan (http://youscan.io/), Safe Online Reputation (http://www.safeonlinereputation.ru/) and Socialbakers (https://www.socialbakers.com). The use of these resources provides tools of their choice to further purpose of tracking the "negative content", the result of which will be ahead of the competition and increase revenue from commercial Internet resources.

Key words: Internet resource, conversion, reputation, search promotion, search engine

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2. Цмоць І. Г., Батюк А. Є., Яворський А. В., Теслюк Т. В. Система моніторингу технологічних процесів "розумного підприємства"

MONITORING SYSTEM OF TECHNOLOGICAL PROCESSES OF "SMART ENTERPRISE"

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One of the most prior directions of development of modern enterprises is the development and use of highly effective intelligent systems for the management of economic, production and technological processes in real time. In order to provide such management, it is necessary to use databases and data warehouses, information and communication technologies and intelligent information technologies that, in conjunction with the Internet, provide monitoring of equipment and people in real time. Such control systems are the basis of the "Smart Enterprise" of the digital economy, the development of which is associated with information and communication technologies, the

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development of the information society and its consistent transition to a knowledge society. The basic concept of "Smart Enterprise" is to ensure the high efficiency and dynamism of implementing complex tasks at minimal cost. One of the directions of "Smart Enterprise" development is the automation of monitoring of equipment and personnel in real time. Monitoring tools should provide monitoring and forecasting of all stages of the production process in order to increase efficiency by making the necessary corrections in real time.

This article describes the development of a system for monitoring the state of equipment and personnel in real time using modern intelligence and information and communication technologies. Monitoring the technological processes of "Smart Enterprise" should solve such problems as real-time collection of technological data, preservation and preliminary processing of data using cloud technologies, analytical and intellectual processing of data, visualization of the accumulated data about technological processes and presentation of the results of the processed data in the form of charts and diagrams, formation of control signals for executive mechanisms, formation of control signals for executive mechanisms and creating reports about the state of the technological process.

The structure of a developed monitoring system includes both hardware and software solutions. The hardware part consists of two types of devices: devices for gathering information about the technological process - sensors, as well as devices that will receive the collected information, process it and transfer it to other levels of management. It is proposed to use both wired and wireless technologies for interaction between these components. The hardware components used to collect and pre-process data should provide real-time problem solving. The software component of the solution must be stable to support high-load computing, operate asynchronously and be built using open source software.

According to the principle of operation, the technical basis for monitoring of technological processes can be wireless sensor networks. In the context of the Internet of things, Sensor Networks have such important properties as self-organization and adaptability to changes in surrounding environments and infrastructure, furthermore hardware support for wireless nodes and network interconnection protocols between them are optimized for power consumption to provide a long-term operating system with autonomous power supplies. In general, the wireless sensor network is an autonomous self-organizing system that is distributed and consists of small, intelligent (not always) sensor devices that exchange information over wireless communication channels. The sensor network has four basic components:

1. set of sensors (spatially distributed or localized);
2. the network in which the used sensors are combined (usually, but not always, wireless);
3. central node for gathering information;
4. a set of computing resources for data comparison, analysis of events and information extraction.

In this context, computing elements are considered part of the sensor network: in fact, some calculations can be carried out directly within the nodes of the network - the sensors themselves or outside. Computing and communication infrastructure of sensor networks is often very specific, focused on a specific area of application.

The article presents the system for monitoring technological processes at enterprise which consists of data warehouse in cloud service, subsystem of data collection and analytical subsystem. The basis of subsystem for the collection of technological data is a distributed wireless sensor network, which consists of spatially distributed sensors, communications and microcontroller devices. Each node of the network has inside itself the necessary set of means for monitoring: various kinds of sensors/devices, as well as a node of information gathering and management, which coordinates the work of a specific node in the network. Specific hardware and software solution are described in the article too.

Key words: monitoring, real time, technological processes, "Smart enterprise", digital economy.

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3.   Бачинський Р. В., Купецький А. В. Система криптографічного захисту Bluetooth зв'язку між пристроєм інтернету речей та мобільним обчислювальним пристроєм

CRYPTO-PROTECTION SYSTEM OF BLE-BASED COMMUNICATION CHANNEL FOR IOT DEVICES AND MOBILE COMPUTATIONAL DEVICE

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One of the most significant problems of Internet of Things devices communication is considered in the proposed article. It is the methods of data transmission channels protection and authorized devices authentication to provide access to proposed by the IoT devices services. There are such main features of IoT devices:

- Autonomy. Usually IoT devices do not have wired connection to power supply and are powered by compact batteries. It causes the use of power efficient hardware resources in IoT devices which cannot provide great computational power. And one of the main tasks while hardware designing for IoT devices is increasing the life-time from the battery.   Therefore, power efficiency is crucial for IoT devices. It imposes some restrictions to communication protocols which could be used for IoT devices communication too.

- Mobility. It means that with IoT devices communication cannot be built on wired connections. The only option of wireless connection is applicable for providing communications between IoT devices. But wireless connections usually require a lot of power for providing long-distance communication. Since IoT devices are usually powered by the compact batteries, they restrict the possible wireless protocols, which could be used for IoT devices communication.

- Compactness. Since IoT devices could be part of wearable things, big and heavy batteries cannot be used for powering such devices.

Mentioned features of IoT devices restrict the possible hardware, used for IoT devices building, IoT devices powering and communication protocols.

One of the most popular hardware, used for IoT devices building, is based on the common purpose microcontroller. Smartphones are usually used as other participants of communication in the IoT devices network. A smartphone can provide IoT devices data processing and inform the user about the system status. So a common IoT device and a smartphone are chosen for IoT devices communication security investigation. Wireless transmission channel based on Bluetooth Low Energy (BLE) v4.0 was chosen as most popular and present in all modern smartphones. It is known that, BLE 4.0 security level is not robust and now it is compromised. It is the reason for higher level protection for BLE communication channel, which works without changes in BLE protocol. Methods of BLE channel data encrypting and keys distribution in unsecured environment is analyzed. The developed system for BLE channel protection is described in this article. .A symmetric encryption algorithm with secret key AES was chosen for encrypting data in the proposed system, because it is one of the most popular and robust and does not require complex computations and complex hardware. This feature is critical for low-power hardware of IoT devices. ECDH algorithm, based on elliptic curves mathematic, was chosen for secret key exchanging between two devices in the unsecured environment. This algorithm is complex and requires more computational resources in comparison to AES, but it is used at the initial phase of negotiation between two devices for calculating a common secure key, which will be used for real data encryption, transmitted in the proposed system. Functioning algorithms were developed for both devices: IoT device and for a smartphone, which is the second device in the proposed system. Methods of packet encryption in the system are described. System's structural schematic, functioning algorithm and class diagram for smartphone application are developed. The IoT device operational speed during encryption/decryption was measured.

Key words: Cypher, iOS, Bluetooth, authentification.

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4.   Бачинський Р. В., Шеренговський О. В. Геоконтекстний інтернет-сервіс пошуку та збору оперативних новин з використанням нейронної мережі

GEO-CONTEXTUAL SERVICE FOR OPERATIVE NEWS SEARCHING
AND GATHERING WITH NEURAL NETWORK USING

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News is a very important part of modern life. It allows us to be informed about events in the city, country or even in the world. One of the most important kinds of news is operative news. It is the news about different emergencies, car accidents, natural disasters, rebellions, acts of terrorism. This kind of news is especially important, because it could be vital and requires operative reaction.

So, a useful service for searching and collecting operative news is an important tool for informing people about unusual situations. The sooner people can find important information the faster they can react to it. Furthermore, collecting details about events and their reliability depend on information gathering module of operational speed and convenience.

Using neural networks as part of such service, lets in solving significant problems of information processing and increase efficiency of operational information searching and gathering.

A large amount of information on the Internet complicates search and selection of the required information. So, easy access to operative information in the concrete place could help to react timely and properly. Therefore, quick access to required information is required and an appropriate technique should be developed. Another important task is collecting important information and selecting an appropriate source for it. Currently people trust other people more than traditional news makers. So, a convinient service for news gathering and publicity, which could be adapted for users, is required.

It was decided to develop an Internet based service for searching and gathering operative news with the use of geo-location information and neuro-network for information access simplification and content adaption to user needs.

Following requirements to an Internet-based service are formulated based on the analysis above:
- displaying proposed news on the basis of user requirements;
- using geo-data for filtering information;
- providing information search with different filters;
- providing possibility of adding new content;
- searching for similar content by providing possibility of adding and extending current content with new data;
- providing cooperation with a user for machine learning implementation.

The proposed service of information search and gathering should provide smart information processing which allows information search with the following criteria:
- information head and text;
- biding geo-location to the news;
- news time and date;
- news category.

Neuro-network is used for searching results of filtration according to the user requirements. Neuro-network learn using user requests history and news category popularity.

The service also contains a mechanism of news gathering, based on using neuro-network for searching new information among the already gathered information. The proposed Internet service allows users to complement information during its creation with some proposed cases, which are selected, based on the history of added news and user preferences.

Key words: internet service, critical news.

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GEOINFORMATION TECHNOLOGY FOR CLOUDINESS ANALYSIS
ON THE TERRITORY OF WESTERN UKRAINE USING SATELLITE IMAGES

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Cloudiness is one of the most important parameters that has a significant impact on weather and climate. The coverage of a territory by clouds determines its suitability for production of renewable energy, and also causes impediments during remote sensing of the Earth. Satellites photographed images of the Earth's surface in different spectra and transmit them to the Earth, where they are processed and archived. However, analyzing images of such resolution and volume using conventional computer technology is an extremely difficult task. Nevertheless, the more difficult task is combining and analyzing images from different satellites.

The purpose of this work is to use the means of Google Earth Engine cloud platform and satellite images of the Landsat program to create a geoinformation technology for spatial analysis of cloudiness in the region of Western Ukraine and to use it to compare the average cloudiness parameters in Lviv and Zakarpattya regions, which border along the Carpathian ridge. The object of this research is the cloudiness on the territory of Western Ukraine, and a subject of the study is the geoinformation technology of spatial analysis of cloudiness using a cloud platform and the data of remote sensing.

The article presents the geoinformation technology of spatial analysis of cloudiness using Google Earth Engine cloud platform and space images from Landsat satellites. The specifics of remote sensing the Earth by the satellites of the Landsat program, and the spectrums of signals, which can be used for the analysis of cloudiness, are described. It is demonstrated how a cloud-based algorithm was used for calculation of cloudiness on the basis of images of Landsat 8 satellite. Also, using JavaScript programming language, built-in WebIDE, and means of Google Earth Engine cloud platform, the appropriate software tools have been created that made it possible to analyze the seasonal cloudiness dynamics, compare the cloudiness distribution on the territory of Western Ukraine, and deeper analyze the differences in the main parameters of cloudiness for Lviv and Zakarpattia regions, divided by the ridge of the Carpathian Mountains.

For the study of seasonal changes of cloudiness, an algorithm, that combines images taken during a month into one object with the calculation of average cloudiness by pixels and adds the result to the output set of images, has been created. As a result, this set contains 12 images that correspond to 12 months of the analyzed year. It is illustrated that the cloudiness increases during the autumn, from September (34 % cloudiness) to November (79% cloudiness), then it remains higher than 50% during the winter with a certain minimum in December, while in the spring the cloudiness is stable at 25% and reaches its minimum in the summer in August (9.5% cloudiness).

In order to study how the ridge of the Carpathian Mountains affects the average parameters of cloudiness, the distribution of the percentage of cloudiness to the number of pixels having such a percentage on the territory of Lviv and Zakarpattya regions was analyzed. The comparative histogram of distribution of the areas with the same cloudiness averaged over a year in the region is presented, from which it is clear that in the Zakarpattya province a much smaller area covers the average cloudiness above 45% in comparison with Lviv region, however the area with cloudiness in the range from 55% to 75% is greater in Zakarpattya region.

The results of this work demonstrated that Google Earth Engine cloud platform and Landsat satellite imagery enabled the development of an effective geoinformation technology for analysis of cloudiness in Western Ukraine. Using this technology, we processed a large amount of remote sensing data, obtained the distributions of areas with a corresponding average cloudiness, and investigated the monthly dynamics of cloudiness. The obtained results can be useful for the analysis of the efficiency of using solar energy, as a renewable energy source, on the territory of Western Ukraine.

Key words: geoinformation technology, Google Earth Engine, Landsat program, satellite image, cloudiness, geospatial data analysis.

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6.   Верес О. М., Кісь Я. П., Кугівчак В. А., Рішняк І. В. Вибір методів для пошуку однакових або схожих зображень

SELECTION OF METHODS FOR SEARCHING SOME OR SIMILAR IMAGES

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Graphic images are no less important than text, and sometimes it is impossible to reveal a topic without them. In addition, some types of images themselves are copyright objects and are protected by the copyright law of Ukraine. But it does not prevent you from copying or scanning images and publishing them on your own. The computer program is not able to evaluate the content of the image and draw a conclusion on the license under which the image is distributed, so the final decision should be made by an expert who verifies the work with the program.

You can use similar file search methods, MD5 signatures search for completely identical files or locally sensitive hashing to search for identical images. Among the approaches to processing, graphic information can be divided into two main areas: the definition of key points on the image and the use of locally sensitive hashing. These methods can be combined and, as a rule, give good results when looking for similar images. The most popular are

three methods for indexing images to find duplicate images, namely average hash; hashing difference; perceptual hash. To find similar images, a method is used to select key points. A key point, or point feature of an image, is a point whose placement stands out against the background of any other point. The basic methods used in the construction of detectors and descriptors are - FAST (Features from Accelerated Segment Test); SIFT (Scale Invariant Feature Transform); ORB (Oriented FAST and Rotated BRIEF); AKAZE (Accelerated KAZE); BRIEF (Binary Robust Independent Elementary Features); BRISK (Binary Robust Invariant Scalable Keypoints). To find snippets of an image or similar content of illustrations, you need to experiment with the methods of determining key points, each of which also has its own set of advantages and disadvantages.

Today there is no such information image analysis system that could ideally identify identical or similar images based on a self-created image database.

To design a reverse image retrieval, information system project, a threshold function has been investigated to find duplicates, using hashing on average and Hamming's measure. Also tested by algorithms for finding similar images based on key points. The research of algorithms for revealing the similarity of different images is carried out, and we check for errors in the work of each of the methods. Three groups of images were created for this purpose: identical images, similar images and various images. Each of this group contains two tests to verify the validity of each algorithm. It is investigated which of the algorithms has the least number of errors of operation.

The analysis of the conducted research allows to formulate requirements and execute the design of information system of reverse image search. To find the same images, we use the average value of the hash method. To calculate the measure of similarity is the Hamming distance. The detector is applied to determine the key points used. The descriptor is used to search for similar key points. For this, the ORB algorithm is used.

The developed information system provides the user with the opportunity to make a selection of images based on the input data, to perform their revision, to find the same and similar images, to add new images to the database, to view the data of the owner of the illustration in order to determine the plagiarism.

Key words: analysis, detector, descriptor, image, key point, method, pixel, hashing.

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7. Цегелик Г. Г., Краснюк Р. П. Проблема оптимальної обробки задач у вузлах розподіленої інформаційної системи

THE PROBLEM OF OPTIMAL TASKS PROCESSING IN NODES
OF THE DISTRIBUTED INFORMATION SYSTEM

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The design of distributed information systems, as well as the process of the development of algorithms and software that supports their functioning, must be focused on the development of mathematical models for optimizing the processes of the information system functionality. What concerns mathematical models and their usage in software, some of the requirements are put forward. Firstly, it is expected that the change in the structure and algorithms of model behavior does not entail a deterioration of its characteristics, which determine the ability of the model to adequately describe the subject area of research and meet the established or expected needs of application. A changing of the topology of a distributed computing system can cause a change in the data structure of the algorithms that are executed in this distributed computing environment. As a consequence, there is a need both for changing the algorithms and the corresponding data structures describing the behavior of the simulated objects. As a result, the construction and research of optimization models and efficient numerical algorithms for building solutions to optimization problems is an actual and important problem that is considered in the article.

The problem of optimal processing tasks in the nodes of a distributed information system on the basis of a mathematical model belonging to a class of two-clustering problems, for which an optimization problem with a fractional linear target function is formulated, was investigated. The procedure of linearization of the target function is carried out and the general scheme of the iterative process of constructing an optimization problem solution is presented, where at each step of the iteration the result can be obtained using both the exact method of branches and bounds and using the genetic algorithm. The variants of the corresponding methods were given, where the structure of the model was taken into account for branching strategies and calculating the upper limit in the method of branches and boundaries. For the genetic algorithm, it was proposed to use parameters concerning the self-training of algorithm, which provides correction of populations in the direction of the best adaptability.

The algorithms proposed in the work can be used for building solution for other nonlinear optimization problems by a small modification. The simplicity of implementation and computational efficiency of the generated algorithms is confirmed by numerical experiments. The subject of further research on this scientific problem is the integration of the optimization model and the proposed computational algorithms into software that manages the computing resources in distributed information systems.

Key words: optimization, mathematical modeling, two-clustering problem, distributed information systems, method of branches and bounds, genetic algorithm.

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8. Дудикевич В. Б., Микитин Г. В., Ребець А. І. Квінтесенція інформаційної безпеки кіберфізичної системи

THE QUINTESSENCE OF INFORMATION SECURITY
OF A CYBER-PHYSICAL SYSTEM

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The article analyzes the development of approaches to the construction of cyber-physics systems (CPS) and their security. In the context of CPS construction, studies are carried out regarding CPS architectural models and the principles of their realization, the principles of designing production of three-component CPS at different architecture levels, the universal platform for the construction of applied cyber-physics systems. Research areas of CPS information security are synthesized, including "defense in depth" structure design for networks of applied cyber-physical systems, a construction of CPS security platform based on a three-level protection, the development of mathematical platform for the secure creation and evaluation of CFS, analyzing security segments and CPS main attack vectors.

In order to form the theoretical and practical principles of the integrated CPS information security the authors propose the quintessence of CPS information security which is formed at the level of paradigm and concept of constructing a multi-level complex security system (CSS) of CPS and the CPS universal platform in the space "threats – profiles – tools"; it is also implemented in the part of CSS integral model of the cyber-physical system "iPhone – Wi-Fi, Bluetooth – sensors" and a cryptographic protection of CPS wireless communication environment based on the block data encryption of algorithm "Kalyna". A multilevel CPS is determined by the distribution of its main components in the cyberspace (CS), the communication environment (CE) and the physical space (PS), which control / process, transmit / receive and manage data accordingly.

The developed paradigm of CPS multilevel security is considered as the structure "architecture – features – requirements – use": physical space, communication environment, cyberspace – control, processing, management – dependability, OSI reference model, sensors precision – scalability, reconfiguration in the context of a multi-functional research of influence factors complex regarding heterogeneous objects of subject areas. According to the paradigm structure, complex security systems of CS, CE and PS are the subsystems of CPS protection.

The conception of creating a multilevel information security of CPS was disclosed, which is caused by the structure: classification of threats / attacks – formation of security criteria – creation of multilevel CSS of CPS – justification of security policy – choice of an assessment method of CPS security state. To classify threats by category, the STRIDE technique is used. A multi-level CSS of CPS is formed based on the universal platform "threats – profiles – tools", the integral model of CPS information security and methodological guidelines for technical task development on CSS creation.

The authors also considered the universal platform of CSS creation of CFS represented in the space "threat: STRIDE – profiles: confidentiality (C), integrity (I), availability (A), observability (O), guaranty (G) – tools: mechanisms, security technologies". The relevant services, security mechanisms are the tools for providing CPS security profiles.

The authors developed the CSS integral model of the cyber-physical system "iPhone – Wi-Fi, Bluetooth – sensors", which is formed of subsystems – complex security systems of CS (iPhone), CE (Wi-Fi, Bluetooth) and PE (sensors), which are characterized by appropriate security profiles. The most common threats for CPS levels were analyzed in accordance with the STRIDE classification method and the functional structure of the CSS "threats – profiles – protection technologies" for the CPS levels was presented.

As an example of the practical part of the CFS information security strategy is the block encryption of algorithm "Kalyna", which is implemented in the ECB (Electronic Code Book) mode with 512 bits key and block sizes using the programming language Java, which provides the highest level of data cryptographic strength.

Key words: information security, cyber-physical system, paradigm, concept, universal platform, integrated model, cryptographic protection.

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9.   Петро Кравець Ігровий метод формування коаліцій в мультиагентних системах

GAME METHOD OF COALITIONS FORMATION IN MULTI-AGENT SYSTEMS

The distributed problem-solving in multi-agent systems is based on the coordinated work of agent coalitions. Coordination is based on cooperation and interaction of agents. A coalition is a community of agents who, on the basis of negotiations, decide on cooperation to solve a problem or to reach a certain goal.

The problem of forming the coalitions of agents is similar to a problem of the data clustering. In both problems, it is necessary to create a grouping of objects so that the objects of one grouping were similar to each other and the objects of different groupings considerably differed among themselves. The search problem in a network of similar agents can be considered as a problem of association of agents in clusters.

The coalition formation in multi-agent systems is formulated as a competitive or cooperative problem of rating of the object to this or that cluster. Problems of the competition and cooperation of objects are studied by the theory of games, and in the conditions of uncertainty, they are studied by the theory of stochastic games. Therefore, actual from

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the scientific and practical points of view there are applications of methods of stochastic games for coalition formation in the conditions of uncertainty.

Construction of a game method for coalition formation under uncertainty conditions is the goal of this paper.

Let be a set of problems and a set of the agents assigned to solve them. Each problem is defined by a set of competencies, necessary for its solving. By analogy to the problems, each agent is defined by a set of abilities with a help of which he can solve these problems. Generally, the number of abilities of the agent can be more than the quantity of the competencies necessary for solving the task. It means that the same agent has abilities to solve several problems.

In order to solve the problem it is necessary to generate a group of the agents whose full abilities cover the set of competencies. Such group of the agents united for the problem solving we will name a coalition. A maximum quantity of coalitions is an equal quantity of solved problems.

Formation of coalitions we will execute by means of a method of a stochastic game which is defined by a set of players or agents, a set of pure strategies which define a membership for one of the coalitions, and loss functions of players.

The game essence consists in the random moving of players from one coalition to another. For this purpose, each player on the basis of the generator of random events independently of others chooses a pure strategy which defines its accessory to the corresponding coalition. After the realization of the combined strategy, players receive current random losses with a priori unknown stochastic characteristics.

The game goal consists in minimization of the system of functions of average losses in time. The game problem solutions will satisfy one of the conditions of collective balance, for example, on Nash or Pareto, depending on a method of formation of sequences of strategies.

Stochastic game solving we will execute by means of adaptive recurrent transformation of vectors of the mixed strategies. Construction of a method of stochastic game solving we will carry out on the basis of stochastic approximation of a complementary slackness condition of a determined game, correct for the mixed strategies in a balance point on Nash.

Convergence of a game method depends on the dimension of stochastic game and parameters of a game method. The order of convergence rate of a game method is defined by a ratio of his parameters. These parameters should satisfy fundamental conditions of stochastic approximation.

The offered game method belongs to a class of reactive methods which are based on the processing of reactions of the environment. This method has a relatively small (power-law) order of convergence rate due to a priori uncertainty of the system. The increase of convergence rate of this method is expected from use of the game of intelligent agents.

Key words: multiagent system; coalitions formation; stochastic game; adaptive game method.

10. Говорущенко Т. О., Медзатий Д. М., Семенюк В. С. Метод формування інформаційного портрета користувача в мережі інтернет

METHOD FOR THE FORMATION OF THE USER'S
INFORMATION PORTRAIT ON THE INTERNET

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The actual task is the identification of the user on the Internet and the formation of his information portrait with the purpose of perfecting the targeting of information and the formation of the image of the web personality. Identification (tracking, web tracking, fingerprinting) of the user on the Internet is the calculation and identification of the unique identifier for each browser, that visits the particular site, which are performed for the virtuous purposes.

Identification of the user on the Internet provides the formation of his information portrait. The term "user's information portrait" outlines the basic necessary information for verifying the data of the particular user. This term is tangent to the "web personality" term, that is introduced with the aim of formalizing the personification tool of the content. User's information portrait is a set of all user data and the results of its communicative activity. The web personality is a set of data, which relates to the particular person and can relate to any category or any combination of

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data categories, which are available on the Internet. Consequently, the components of the user's information portrait are Web content, that the user has created on the Internet, as well as his personal data.

In this article, the analysis of the known methods and tools was conducted. The conducted analysis showed that the analyzed methods and tools do not solve the task of formation of the user's information portrait on the Internet, which is aimed at perfecting the targeting of information and at the formation of the image of the web personality on the Internet.

The study of ways of identification of the user on the Internet has shown, that there are many different ways of the user tracking. Some of these ways cannot be neutralized without full changing the principles of functioning of the computer networks, web applications, browsers. Some ways, of course, can be countered, but other ways work imperceptibly for the user, and it is unlikely to protect from them. The conducted research has proven, that, even if the user uses private mode of browsing during work on the Internet, then all his movements can be still tracked.

The choice of characteristics that form the user's information portrait on the Internet, that is aimed at perfecting the targeting of information or at the formation of the image of the web personality on the Internet, has been conducted. This choice of the characteristics provides the possibility of the development of the method for the formation of the user's information portrait on the Internet. It is established that 45 characteristics form the user's information portrait, which will be used to perfecting the targeting of information, and 25 characteristics form the user's information portrait, which will be used to creating the image of the web personality on the Internet.

The first developed method for the formation of the user's information portrait on the Internet provides the determination of the characteristics, which form the user's information portrait with the purpose of perfecting the targeting of information or of creating the image of the web personality on the Internet.The important aspect of the developed method is taking into account the degree of trust in the web resource, from which the certain characteristic has been taken, during determining the characteristics, which form the user's information portrait for forming the image of the web personality on the Internet (only image characteristics, which are taken from web resources with the degree of trust of at least 50%, will be included in the user's information portrait).

Key words: identification (tracking, fingerprinting) of the user on the Internet, user's information portrait, web personality, targeting of information.

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11. Кужій Л. І., Хархаліс І.-Р. Р. Худий А. М. Побудова системи діалогу студент-ПК на базі природної мови обміну з використанням середовища Java

CONSTRUCTION OF DIALOGUE STUDENT-PC SYSTEM
ON THE BASIS OF NATURAL LANGUAGE EXCHANGE USING THE JAVA ENVIRONMENT

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In order to orientate in the classical approaches to solving the problem of NLP, only the products of the world's largest leaders are considered in this paper. In this sense, the tools for the Java language are of considerable interest, because in addition to the standard means for this language, many libraries have been written to provide powerful support to the NLP and allow to overcome complex problems.

For evaluating the means of the NLP, it is expedient to set the priority ranks of the main objectives of the NLP such as parsing, determining the parts of the language (POS-tagging) and tokenization. Such rank distribution allows you to select support that is effective for the subsequent extraction of information.

In order to get natural language processing as effective as possible, it is necessary that the processing system consists of six levels of analysis. In a linguistic approach, there are usually four levels: graphic - the allocation of sections, paragraphs, sentences, etc.; morphological - definition of the characteristics of a single word; syntactic - definition of the syntactic dependence of words in sentences. The fourth level is an analysis of semantics and pragmatics and it is particularly complex, due to the complexity of the human language. Since our ultimate goal is to build a branch specialized knowledge base in a modern unified format, we are interested in the last level, which requires the following tasks to be solved: finding parts of text; finding sentences; tokenization; parts of speech tagging – POS-tagging; extracting relationships; finding people and things; classifying text and documents.

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The problem of choosing basic support is complicated by a large number of requirements and properties, so it is advisable to formulate and solve a multicriteria assessment task for decision making. To solve it, we use the method of convolution of the criteria or the method of the complex criterion, its kind can be the Hermeier method. In this method, the final decision is made on the basis of the global criterion Q, and for its calculation, the function is used:

$$Q = \sum_i I_i(W_i) \cdot W_i,$$

where I_i is a coefficient of significance of the i-th (local) quality index (criterion W_i). Preferably conditions are met

$$\sum_i I_i(W_i) = 1$$

Usually I_i is determined by the method of expert estimates, which in this case is quite acceptable. Taking into account that in practice the weight of the criteria significantly decreases with their rank, it makes sense to use a quasihyperbolic dependence for correct evaluation $I_i(W_i)$.

The standard Java distributions that were present in the standard distribution have received a low rating because they are significantly limited. For example, solving parsing by means of Java requires a lot of efforts and for this situation it is practically inappropriate. There are no standard Java tools for determining parts of the language. Also, in this case, you should not rely on simple tokenization methods available in Java, because in real texts many specific terms and abbreviations can occur. Therefore, regular Java tools can only be used as auxiliary.

The assessment is reproduced by the fact that the most interesting in terms of achieving the goal of the work are the means such as LingPipe, Stanford NLP and Apache OpenNLP. They allow to build high-quality models and to ensure high accuracy of the solution of the priority tasks of NLP in difficult modern conditions.

To develop the system, you need to focus on the Stanford NLP, taking into account their advantages in solving basic tasks and features. This library has the most advanced set for solving the priority task of NLP - parsing, providing rich functional and high accuracy of analysis. Also, in the early stages of system development, it makes sense to focus on Apache OpenNLP, taking into account their advantages in the simplicity of development.

The GATE and UIMA tools are likely to be of higher rank, but as frameworks are not considered at this stage, because their rigid structure can prevent effective use for this case, although their power, tools for semantic analysis and standardization are of interest.

Key words: natural language processing, artificial intelligence, text engineering, student-computer dialogue.

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12. Камінський Р. М., Кунанець Н. Е., Пасічник В. В., Худий А. М. Відновлення пропусків в результатах тестування та ідентифікації операторського персоналу

RECOVERING GAPS IN TEST RESULTS AND IDENTIFICATION OF OPERATOR STAFF
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The article addresses the problem of the restoration of missed values in the results of testing the recipients given by the time series. As experimental data, the time series with spaces are given. Recovery efficiency is estimated by the relative error of the recovered value. Examples of restoration of missing data in the time series table and the individual time series are presented. It is used simple methods for replacing missed value by average, weighted average and median. For these time series, the good results provide the median of the output time series with the missing values and fill the values of the trend model - the polynomial of the third degree.

The problem of missing data values is very relevant in sociology, image recognition, cluster analysis, and so on. Most often it occurs in the process of identifying various objects when a priori information about the value of the parameters is incomplete. As a result, incomplete data is obtained, and in the case of time series, instead of the equidistant, a non-quantum time series is received, the processing of which is currently rather complex.

Complex systems are technical, economic, environmental, social and often require prompt decision-making based on data from relevant observations of their characteristics. In some cases, automatic observation using special sensors is used, in others it is done by specially trained personnel, a survey of experts and the search for information in the relevant documents. All this is carried out with a certain degree of responsibility, different methods of information collection, data consolidation is conducted in different ways. Therefore, there is an inevitable loss of information in the form of missed data or errors as values that are sharply distinguished among other elements of the samples and time series.

The presence of missed values in the data significantly limits the possibility of using different processing methods. An important problem is the frequency of occurrence of passes and the existence of passages of any regularities.

In practice, the two types of data are most often considered: tables and time series. Filling in the missing data, the quality of filling the passes is most important. It should be noted that in tasks of testing or identification of operator personnel using a computer simulator special is that in the first place there are individual time series and only in the second, for the whole group of recipients, the data is presented by the table "operator - time of recognition" of a specific test image. Therefore, if there are many data, and there are few passes, the characteristics of the data received will be slightly different from the true values for the aggregate of data, that is, in the absence of spaces. For such a case, finding a replacement for a missing value is not very difficult, since the known nature of data, at least statistical (distribution, descriptive statistics). Otherwise, it is necessary to use several methods and choose the best by the accepted quality criterion, for example, by the characteristics of descriptive statistics, the mean square deviation from the trend, etc. In addition, you can use different trend models.

In the case of filling in passes in time series, you can use methods to fill the gaps in the tables, in each case the filling method must be substantiated and the results interpreted. The fact is that, in contrast to the tables, if we consider the set of time series (for example, in the tasks of identifying several objects represented by time series), we have the same table, however, here the features are time series. They have the same nature, physical content, their values are measured on the same scale, they are dependent random variables with the same distribution and, most importantly, they are connected by an orderly sequence of moments of time in which their registration was made, with each level corresponding to a particular situation.

The problem of filling in passes in real experimental tables or individual time series that are elements of such tables can be solved by different methods, but it is always worth trying first of all the simplest ones, as well as selecting the appropriate selection criterion for both the best value and the best method. The most effective way to restore missed values is to create an artificial time series of the desired amount without missing values with similar characteristics to the original series, to skip and select data retrieval method on its data, as shown in the examples cited.

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In the sense of scientific novelty can be considered the result of using the same approach to the restoration of missed values for individual time series, and tables with time series of the same structure. The given results were obtained in the process of testing the recipients from the number of students who showed interest in this topic and participated in the tests. The obtained data on the parameters of descriptive statistics gave rise to the identification of the group of test participants using agglomeration hierarchical cluster analysis.

Key words: time series, data tables with spaces, missed values, resetting passes.

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13.   Савків Л. Г. Розроблення структур файлів для оптимального відображення первинних електромагнітних даних геофізичних досліджень

FILE STRUCTURES DEVELOPMENT FOR OPTIMAL VISUALIZATION OF ELECTROMAGNETIC DATA FOR GEOPHYSICAL STUDY

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Problems of geophysical data acquisition, data groups, their characteristics, types of problems for which such data are suitable are analyzed in this article as a component of information technology. It is noted that the solution of such problems is in determining the main electrical properties of the geological medium (electrical resistivity or conductivity) through the analysis of registered natural and artificially created electromagnetic fields or associated phenomena.

According to available publications for now the seismic data among other geophysical data have complied to standards and structurization requirements in the best way. For the electromagnetic data such standardization has not been realized yet because of series of reasons. Therefore, the development of the file structures for optimal mapping of primary electromagnetic data of geophysical research is relevant problem and the main goal of this article.

In the main part the most often applied techniques of geo-electromagnetic observations are described. They consist of the data acquisition in semi permanent sites, which relate to so called monitoring problems, as well as in the single measurements which are carried out in the field points, which relate to the soundings. The main purpose of permanent registration is the analyses of temporal changes of the fields and process under study at a specific point or point of observation. Hence, the obligatory conditions for monitoring are the permanent place and continuous data recording. Such mode of operation is provided by permanent geophysical stations, as well as by the geophysical observatories.

The studies are carried out irregularly in this field. The main objective of such studies is the exploration of the local geological environment, which can be realized in different areas and conditions.

The features of permanent and in field measurements are described in detail using exact examples and algorithms. Thus, the peculiarity of permanent continuous observations are represented on the base of continuous monitoring studies and dynamic of changes in the electromagnetic field at the permanent geophysical station "Nyzhne Selyshche" (Transcarpathian region) by the natural electric field variation method. Similar features of the in-field study are demonstrated on profile surveys of shallow geological layers by the transient electromagnetic method. The special attention is paid to the algorithms of data acquisition, data formatting, recording, storing and representation.

As a result, the file structures have been developed to reflect optimally the registered informational signals and the required service information, as well as the instructions for data transfer to a form suitable for further computer processing and automated analysis have been proposed.

Key words: permanent recording, in-field registration, geophysical data, self polarization method, file structures, specific presentational formats, transient electromagnetic method, transformation instructions.

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DECISION SUPPORT SYSTEM FOR FINANCIAL MARKETS' INVESTMENT RISKS ANALYSIS

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The article describes the features of the VaR methodology for assessing investment risks in the financial markets of securities. The basic possibilities of estimating the upper limit of possible losses within the confidence interval with the help of the usual and parametric VaR are described. Parametric assessment allows you to calculate

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the time of occurrence of risk (more precisely, the number of days on which losses are covered by investment capital) due to the size of losses (the size of the reserve capital) per company, the volatility and the amount of investment. In the case study, a practical example shows how it is possible to calculate losses (both expected and unexpected) and estimate what reserve capital should be used to cover investment risks. Forecasting of stock prices was carried out using linear regression, neural network and robust linear regression with Andrew Wave criterion, the quality of the model was tested according to the criteria of R^2 and the mean square error.

In addition, it shows how to calculate over at what period of time and with what probability the amount of losses will be within this reserve capital. This allows us to estimate the real return on investment operations for each share in the portfolio, as well as to set a loss limit, after which it is necessary to "exit from the position".

The developed decision support system is a universal tool for modeling investment risks using the VaR methodology. It is possible to vary the investment portfolio by varying the portfolio (there is a possibility to choose the desired shares) and calculate the amount of investment (in dollars or percent). The decision support system allows forecasting of expected and unexpected losses on an arbitrary block of shares, the data of which are downloaded into the system, predicting the volatility of each of the selected stocks, calculating both expected and unexpected losses for each share and for the portfolio as a whole. The system interface is simple and easy for the user, so it can be easy to use for investment analysts. In the future, it is envisaged the possibility of introducing weighting factors to provide large limits for the redistribution of shares in the portfolio and greater provision of the most volatile companies.

Key words: investment risks, expected and unexpected losses, decision support system, VaR-methodology.

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