DEVELOPMENT OF A METHOD FOR THE CREATION OF 3D ADVERTISING PRINTING PRODUCTS (p. 6-18)

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The analysis of characteristic features of 3D advertising design is carried out. It was found that since the input information concerning the task of structuring the stages of creation of 3D advertising printing products is qualitative, an expert approach should be used for its solution. As experts, the technologists of the leading Ukrainian publishing and printing companies were presented. Using the expert approach on the basis of these features, the structuring of development stages of 3D advertising printing products was formed. The list and content of the parameters of such structuring are conditioned by specific types of 3D advertising.

To take into account the separate categories and properties of 3D advertising, a technology for choosing the options for implementing 3D advertising installations was developed. This technology is based on the use of simulation tools.

The choice of acceptable alternatives is based on the use of the proposed basic recurrence scheme. The list of estimating parameters that influence the efficiency of advertising installations and allow evaluating the quality of the logo created by calligraphy means is proposed.

A mathematical model for creating a projection of an advertising image is developed. This model provides features of graphic processing of illustrations such as distortion of the original 3D advertising image horizontally, distortion of the original 3D advertising image vertically, converting the pixel coordinate in the desired direction, calculating the size of the 3D advertising image. Based on the developed mathematical model, a program was created that allows forming the distorted appearance of any image, which can be applied to the surface. The method of creating 3D advertising was implemented in the BPWin software product. Software implementation allows optimizing the 3D advertising development process.

Keywords: 3D advertising printing products, advertising installation, recurrent scheme, logo, distorted image.

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ANALYSIS OF THE DEVELOPED QUANTITATIVE METHOD FOR AUTOMATIC ATTRIBUTION OF SCIENTIFIC AND TECHNICAL TEXT CONTENT WRITTEN IN UKRAINIAN (p. 19-31)

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A formal approach was proposed to implement text content attribution. The study was conducted with Ukrainian scientific and technical texts. The results of application of the designed algorithms of automatic attribution of the text content based on the NLP and stylemetry methods were analyzed. Prospects and features of application of stylemetry information technologies for attribution of the text content were considered. Quantitative content analysis of scientific and technical text content takes advantage of content monitoring and text content analysis based on NLP, Web-Mining and stylemetry methods to identify the multitude of authors whose talking style is similar to that of the analyzed text fragment. This narrows the range of search for further use in the stylemetry methods to determine the degree of belonging of the analyzed text to a particular author.

Decomposition of the attribution method was carried out based on analysis of such talking coefficients as lexical diversity, degree (measure) of syntactic complexity, talking coherence, indexes of exclusivity and concentration of the text. At the same time, author's style parameters such as the number of words in a certain text, the total number of words of this text, the number of sentences, the number of prepositions, the number of conjunctions, the number of words with occurrence frequency 1, the number of words with occurrence frequency 10 or more were analyzed. Further experimental study requires testing of the proposed method in identifying keywords of texts of other categories: scientific humanitarian, artistic, journalistic, etc.

Keywords: NLP, content monitoring, stop words, content analysis, statistical linguistic analysis, quantitative linguistics.

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ELABORATION OF STRUCTURAL REPRESENTATION OF REGIONS OF SCANNED DOCUMENT IMAGES FOR MRC MODEL (p. 32-38)

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The Mixed Raster Content (MRC) model is a common form of representation of a scanned document image. The further development of this model, which consists in the structural representation of homogeneous regions on each layer of the MRC image has been completed. The aim of such representation is to detect regions of interest in the image and identify it to solve the problem of segmentation of scanned document images.

The layer containing graphic and photographic images was represented as a union of several regions using a piecewise constant function of the intensity of the image region. For this, the graphic and photographic images were represented in the form of a partition into segments containing pixels of uniform intensity. To determine these regions in order to separate the graphic from the photo images, the edges at the segment boundaries were considered.

The layer containing the text was represented as an image of the regions of the structural texture on a uniform background. These regions contained fragments of normal text and heading with the same pixel intensity and differing in the shape and size of symbols, as well as the distance between them. Such a representation of the layer made it possible to take into account the spatial relationships between symbol image pixels and further to extract text from the background.

The proposed model for the representation of the scanned document image allows to extracting the image layers that contain homogeneous regions, and reducing the process of segmentation of the entire image to the segmentation of separate layers of the image. This allows increasing the performance speed while maintaining a high quality of image segmentation.

Keywords: scanned document image, mixed raster content model, text extraction, image layer.

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Peculiarities of the use of competing cellular automata for problems of recognition of complex captcha systems have been explored. For this purpose, the concept of competing cellular automata has been introduced and a mathematical model of their functioning and interaction has been developed. The mathematical model of competing cellular automata based on the set theory has been described to specify moving cellular automata, which shift to the neighboring states of characters and implement their transition rules in such a way. Based on this mathematical model, a recognition system for captcha images implemented in the code by means of JavaFX 2.0 technology has been developed, which allowed reaching the cross-platformness and correct functioning on different operating systems.

The libraries of cellular automata have been developed for the English language. Each symbol of the alphabet is represented in the form of a state system, which is aligned with a cellular automaton with states describing the given symbol.

We used Java programming language for development and OpenCV library for the ability to handle images which allowed us to achieve high-quality recognition results. The architecture of the developed system of recognition of complex captcha images in the form of diagrams of classes of the main blocks with detailed descriptions of each class has been considered. Computer experiments have been carried out with different sets of distorted characters used in actual captcha systems and recognition quality indices of the developed software obtained.

It has been shown that the probability of obtaining the correct result of captcha image recognition exceeds 80 % with a degree of deformation of characters up to 20 %. With a degree of deformation of characters over 30 %, there is a high probability of false character recognition.

The advantages of the method of text character recognition based on competing cellular automata include simplicity of rules of engagement, ability to parallelize the process of recognition easily, capability of recognition of distorted and partially overlapping characters that are the basis of modern captcha systems.

Keywords: competing cellular automaton, movable cellular automaton, captcha systems.

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DEVELOPMENT OF INFORMATION TECHNOLOGY OF TERM EXTRACTION FROM DOCUMENTS IN NATURAL LANGUAGE (p. 44-51)

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It is shown that domain dictionaries are widely used at various stages of design and operation of software products. The process of dictionary development, especially term extraction, is very labor-intensive, requiring high qualification of the expert. Studies are conducted to identify the most important characteristics of multi-word terms (MWT), such as: the probability of the presence of terms containing different numbers of words in the document; arrangement of nouns in MWT; possible number of nouns in MWT. The context of the use of terms is analyzed and possible limits of terms in the text are identified. The procedure is proposed for preliminary document grouping, thus avoiding the "loss" of terms included in short documents. The dependence of errors of term extraction on the size of the analyzed document is determined.

The mathematical model of term representation, based on the definition of the set of word chains grouped around a head-word – a noun is proposed. Filtration of chains is performed depending on the frequency of their occurrence in the text based on a comparison of normalized representations of MWT.

Mechanisms for filling the domain dictionary with new records and adjusting existing ones in the process of analyzing the input document are developed. The solution to adjust the frequency of occurrence of terms based on the identification of inter-phrase relations is proposed. All processes and models are combined into a single information technology of construction of the domain dictionary. The problem of term interpretation is not considered in this paper, since it requires a separate solution. The software product al-lowing to automate substantially the process of term extraction from text documents is developed. The results of testing of the proposed solutions showed the absence of "lost terms" and, as a result, the reduction of the time of term extraction from texts of 10,000 words by 1.5 hours by freeing the expert from analyzing the original document. The research results can be used at various stages of design and operation of software products.

Keywords: domain dictionary, multi-word term, morphological analysis, mathematical model of the term, text document.

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AN INTEGRATED WEBSITE OF ELECTRONIC DATA INTERCHANGE AND COMPUTER-AIDED PROCESS PLANNING IN PRODUCTION OUTSOURCING (p. 52-60)

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The assembly industry implements production outsourcing to meet the needs of assembly product components. The outsourcing of assembly product components is based on a relationship model between the contractor and the industry, between the industry with assembly parts and other processes, and more recently between the assembly parts and sales. In production outsourcing, there are generally no communication patterns established between the contractor/supplier and the assembly team regarding problems that may appear during the assembly process. Electronic data interchange (EDI) technology as a method to promote electronic communication between companies can be implemented for assembly teams and suppliers so that the former can relay component assembly problems during the assembly process. In order to improve coordination and communication with external business partners, the production outsourcing activities need EDI technology so they can communicate rapidly and accurately.

To make EDI technology more useful, this method can be integrated with a manufacturing, planning system called computer-aided process planning (CAPP). CAPP is a link between design and manufacturing in a computer-integrated manufacturing environment. Commonly used by manufacturing engineers, CAPP can be used to develop a product manufacturing plan. The purpose of the present study was to design and develop a web-based software application integration initiative between EDI and CAPP that can be used as a communication means between the assembly team and the supplier, which will specifically help the assembly team to plan component assembly process so they can eliminate or reduce manual intervention in assembly planning.

Keywords: assembly, CAPP, communication, EDI, production outsourcing, supplier.

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A METHOD FOR DETERMINING INFORMATION DIFFUSION CASCADES ON SOCIAL NETWORKS
(p. 61-69)

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Information diffusion on social networks has many potential real-world applications such as online marketing, e-government campaigns, and predicting large social events. Modeling information diffusion is therefore a crucial task in order both to understand its diffusion mechanism and to better control it. Our research aims at finding what factors might influence people in adopting a piece of information that is being shared on a social network. In this study, the traditional independent cascade model for information diffusion is extended with discrete time steps. The proposed model is capable of incorporating three different sources of diffusion influence: user-user influence, user-content preference, and external influence. Specifically, these sources of influence are quantified into real values of diffusion probability. To calculate user-user influence, we adopt and extend the disease transmission model according to the role of the user who diffuses the content. User-content preference, which measures the correlation between user preference and the adopted contents, is calculated based on a topic-based model. External influence is detected in a diffusion time step and is quantified and incorporated into our model for the next diffusion time step by applying and solving a logistic function. Moreover, the process of information diffusion is characterized by constructing a tree of information adoption and the diffusion scale is quantified by predicting the number of infected nodes. It is found that these sources of influence, especially external influence, play a significant role in information diffusion and eventually affect the shape and size of the diffusion cascade. The model is validated on both synthetic and real-world datasets. Experimental results confirm the advantage of our proposed method, which significantly improves over the previous models in terms of prediction accuracy.

Keywords: information diffusion, social network, independent cascade model, diffusion probability.

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IMPROVING THE QUALITY OF ELECTRIC ENERGY AT HYDROGENERATOR UNITS BY UPGRADING CONTROL SYSTEMS (p. 70-78)

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We have solved an important scientific-technical task on improving the quality of electric energy produced by hydrogenerator units. The relevance of this topic is predetermined by the fact that existing systems that control frequency and power of hydrogenerator plants do not fully meet international standards regarding the quality of electric energy. The set task is resolved based on the structural-parametric synthesis and optimization of automated systems that control rotation frequency and power based on solving inverse problems on the dynamics of a hydrogenerator unit with the improved system of metrological assurance. In order to analyze and synthesize a precision controller, we have refined a mathematical model of the hydrogenerator and the controlling element of an electro-hydraulic regulating system. The improvement makes it possible to register leaks, overflows, as well as the non-linearity in characteristics of the servomotor.

A structural diagram of the astatic controller is represented, which corresponds to the improved mathematical model, as well as the numerical values for parameters of the structural diagram, defined based on the results of experimental study. We have applied the principle of multiple control. This has made it possible to simplify the structures, parametric synthesis, and parameter setting of the controller. The paper shows the analysis of experimental studies carried out at the operating equipment of hydroelectric power stations (Bajtun, Panama). We give a comparative analysis of work of controllers, based on the principles of PID control, a controller made by Emerson company, and a regulator built on solving the inverse problems of dynamics. The proposed system of automated control over hydrogenerator plants ensures a two-fold increase in the accuracy of control over rotation frequency and power, which improves the quality of electric energy that is generated at hydroelectric power plants.

Keywords: hydrogenerator unit, automated control system, electric energy quality, inverse problems of dynamics.

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