

ABSTRACT AND REFERENCES

INFORMATION TECHNOLOGY, INDUSTRY CONTROL SYSTEMS

THE ANALYSIS OF INTRODUCTION OF INNOVATIVE EDUCATIONAL MEANS AT VOCATIONAL TRAINING OF ENGINEERS-DESIGNERS (p. 4-10)

Denis Borysenko

New educational means, involved in didactic design work their way up from the universal to narrowly targeted educational means. Multipurpose means that are characterized by mobility, representativeness, adequacy and efficiency occupy a special place. At their use, a trainer should consider the didactic principles, among which a special place is given to the principles of compensation, informatization, integration, visibility, virtuality-visualization, interactivity, instrumentality, and adaptability. Practical research of the features of innovative transformations during the comparative analysis of the two study groups was carried out in the paper.

The paper placed the emphasis on the study of the effect of information technologies on training future engineers-designers. During the pedagogical experiment, practical side of using innovative educational means in the study of special subjects was found, assessment of differences between control and experimental groups of students with further statistical analysis was performed. In the statistical analysis of the results of pedagogical research, an increase in the student's activity, interest in performing practical tasks in the course of the modern organization of educational process, especially the development of the creative solution of practical problems, above all, when developing the design product was revealed. Information educational means are characterized by flexibility and focus on the advanced format of the educational process organization, the formation of future specialists with modern information competence. Information concept of educational environment becomes one of the strategic ways of developing a modern social system and ensures efficient achievement of goals.

Keywords: information concept, information support, innovative educational means, engineer-designer, design product.

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DEVELOPMENT OF MODIFIED METHOD FOR TEXT RECOGNITION IN STANDARDIZED PICTURE (p. 11-17)

Kostiantyn Kasian, Volodymyr Bratchykov, Vadym Shkarupylo

Text recognition in images is a very urgent problem in modern search engines. There are many different methods and techniques for text recognition. The paper is a method for text recognition in a standardized image. Standardized image means an image that has the same font, character size, certain writing order, such as the serial number or license plate of the car.

In the paper, we developed an improved method for text recognition in the image. The method consists in a preliminary search of the same characters and memorizing their positions. Identical symbols are recognized only once. After recognition, symbols are arranged in the desired position. Image processing and isolation of character boundaries is performed using JavaCV.

The modified method was developed based on the template method. Both methods were implemented in Java language. To create a text-recognition software, a neural network based on a single-layer perceptron was built. The results of tests have shown the superiority of the modified method compared to the original one. At best, the performance of the modified method is 300 % of the performance of the original one. At worst, it is slower only by 5–10 %. In addition, the modified algorithm requires 3 times fewer iterations.

The modified algorithm allows to accelerate the text recognition process in standardized images if they have recurring characters.

Keywords: text recognition, template method, standard, neural network, perceptron, license plate, OpenCV.

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CONSTRUCTION OF LOGIC AND LINGUISTIC MODELS OF TYPICAL NATURAL LANGUAGE STRUCTURES (p. 18-22)

Anastasia Vavilenkova

As simple sentence in formal logic is an atomic predicate, the complex (compound) sentence is a complex logical expression, set of atomic predicates combined logical connectives. The logic and linguistic model is exactly a relationship between elements of formal logic and syntactic structure of natural language sentences. The analysis of natural language sentences revealed conceptual attitude, control and fit, based on what it was formed the logic and linguistic model of functional relationships.

The article discovered possible types of relations in natural language sentences that appear in logic and linguistic models using logical operations of conjunction, disjunction and implication.

The article suggests a generalized form of logic and linguistic model; it derives logic and linguistic model's typical templates for specific types of natural language sentences. Depending on the conceptual relations between simple sentences that are parts of a complex one, logic and linguistic model's parts are interpreted as complex or simple expressions that allow to return recursively to the general form of the formula and to apply it to the specific situation until all the parts of natural language sentence of are clearly interpreted.

Keywords: natural language, logic and linguistic model, text information, text processing, formalization.

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STATIC PLANNING MODELS SYNTHESIS OF QUALITY IMPROVEMENT OF SOFTWARE DEVELOPMENT PROCESS (p. 23-29)

Mykhaylo Godlevskiy, Anna Goloskokova

The task of quality improvement planning of the software development process is presented in the form of the problem of rolling scheduling, which involves the formation of static and dynamic models. The synthesis of the static problem, which is multicriteria and based on the formalization of maturity model was considered in the paper. The utility functions of the extent of achieving the target profile and resource provision, necessary to accomplish the goal were used as criteria. Resource provision is determined by two generalized indicators. The first is finance, which are distributed among the individual structural components (practice and focus areas) of the software development process. The second – a resource indicator, is associated with the time the company employees must spend on advancing the software development process to a higher maturity level, that is, the time the employees are distracted from the company's core activities. Three models that are focused on the following tasks: searching for a compromise with respect to various categories of the CMMI (Capability Maturity Model – Integrated) model and two sets of utility functions; defining a compromise with respect to the target integrated utility functions of two groups of criteria; searching for the optimal value of the generalized objective utility function were formed. The models are mathematical programming tasks with integer and Boolean variables.

Keywords: quality, software development process, maturity model, utility function.

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PRINCIPLES AND OBJECTIVES OF INFORMATION AND ANALYTICAL SUPPORT FOR PRENATAL CARE (p. 29-35)

Oksana Mulesa, Vitaliy Snytyuk, Svjatoslav Gerzanich

IT-based prenatal care and outpatient counseling of pregnant women are aimed at more effective medical decisions and, therefore, a lower risk of medical errors and their consequences. A system analysis of contemporary clinical examination of pregnant women signals of lack of adequate valid information and analytical support for the medical sector. The technological models of hospitals and research institutions as well as the role of scientists in solving the problems of reproductive health require revision and normative regulation.

The study has proved that the system of clinical examination and counseling of pregnant women has a complex structure; it is a multi-stage long process of interrelated decisions. We have decomposed the process into separate objectives and classified the latter. In general, all the relevant objectives may be classified as follows: objectives of classifying and clustering the objects, objective of structural and parametric identification of unknown dependencies, objectives of prognosis, and objectives of pre-processing the data and identifying informative features. We have provided the above stated objectives with correspondent mathematical models and analyzed the possibility of applying familiar methods. It is proved that objectives using subjective conclusions as input data should exploit an apparatus of the theory of fuzzy sets as well as relevant fuzzy models and methods of their solution.

Keywords: information technologies (IT), system approach, prenatal care, prognosis, clustering, identification, fuzziness.

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METHODS OF PROCESSING MEDICAL IMAGES FOR THE DETECTION OF PATHOLOGIES IN CRANIOFACIAL SURGERY (p. 35-41)

Oksana Shkurat, Andrey Solomin

Analyzing the algorithms for filtering digital images, we have pointed out dimensional image processing techniques. We have studied the performance of smoothing filters, the work of differential operators, and the efficiency of the Canny method. We have determined the peculiarities of applying the algorithms for identifying CT scans boundaries. We have researched the possibility of applying the Serra mathematical morphology operations for determining the most significant and muting uninformative image objects. While specifying the boundaries, we have visually assessed the quality of noise reduction operations, the efficiency of various operators and techniques as well as the rate of performance and the minimum average quadratic deviation.

As a result of the study, we have suggested an algorithm for obtaining the morphological features of pathologies at the stage of diagnostics in craniofacial surgery. The essence of the algorithm lies in distinguishing the original information from the resulting model. Obtaining the original information means getting rid of the noise from a set of tomographic slices with the Gaussian filter, identifying the most informative image objects by means of the operation of mathematical morphology Close, and, depending on to the type of pathology, outlining the shot boundaries with the Sobel, Roberts and Laplace differential operators as well as by the Canny method. The model construction includes mirroring the healthy side and processing the obtained information with the help of the above listed methods.

Keywords: smoothing filters, differential operators, distinguishing the boundaries, the Serra mathematical morphology.

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DEVELOPMENT OF FUZZY ALGORITHMS FOR THE CONTROL OF THE GROCERY DEPARTMENT OF THE SUGAR FACTORY (p. 48-53)

Rostislav Sokol, Yaroslav Smityuh

The automation problem of the grocery department of the sugar factory using intelligent control systems, the variety of which is fuzzy modeling was considered in the paper. In contrast to the classical control methods, fuzzy modeling is the most useful when in the technical system description there is uncertainty that complicates or eliminates the use of precise quantitative methods and approaches.

To analyze the functioning of the grocery department as a complex dynamic control system, IDEF0 methodology was applied. Using IDEF0 diagrams has allowed to identify the main controlling and managing variables of the fillmass boiling process in the A-vacuum pan. A set of factors that affect the implementation of simple management purposes was defined. These factors influence the vacuum pan operating modes and A-fillmass boiling process optimization.

Linguistic approximation of membership functions of defined variables was conducted, and their variation ranges taking into account expert information obtained as a result of the expert survey were determined. Based on the membership functions, the knowledge base, which is a fuzzy scenario model was built.

Based on the knowledge base, fuzzy logic surfaces that allow to assess the inferring algorithm adjustment and the vacuum pan control adequacy were obtained.

The resulting fuzzy model for the vacuum pan control will allow to significantly improve the regulation indicators compared with the classical system. These indicators include reducing the overcontrol and transient process time, taking into account uncertainties and adequate response to disturbance.

Keywords: intelligent decision-making systems, fuzzy logic, logical-linguistic model, linguistic variables.

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USING SITUATIONAL APPROACH TO FORMING CONTROL ALGORITHMS FOR BATCH VACUUM PANS (p. 42-47)

Yuri Prokopenko, Anatoly Ladanyuk

Forming new criteria for sugar production processes poses the problem of developing and introducing innovative control methods and systems. Using situational control methods is promising.

In the paper, the problem of the batch vacuum pan control using the situational approach, taking into account new process criteria: temperature, level of syrup in the vacuum pan, operation modes was considered. Based on the predication graph constructed and linguistic interpretation of the system description by the expert planer, a system of commands for the situational control of the batch vacuum pan was developed. Using the developed system of commands, the situational control algorithm for the batch vacuum pan was built, shortcomings and future research directions were discussed.

The results allow to conclude about the prospects of further works on introducing the situational control for developing hierarchical multi-level control systems for manufacturing facilities, take into account such important factor as operator intervention in the production process.

Keywords: situational control, vacuum pan, situation calculus, predication graph.

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**RESEARCH OF DYNAMIC PROPERTIES
OF CONTROL SYSTEM FOR REVERSIBLE
HYDROPOWER SUPPLY UNITS WITH VARIABLE
ROTATIONAL SPEED ON HYDROELECTRIC
PUMPED STORAGE POWER PLANT (p. 60-65)**

Ivan Chervonenko

The research of performance and dynamics of a new automatic control system of reversible hydropower supply units in standard operation modes and in the pressure efficiency correction mode was performed. The efficiency of such a system and the possibility of its use for reversible hydraulic turbines of all types of HPSP, including underground and mine HPSP was shown. This is determined by the adjustment accuracy of pressure parameters and, therefore, the need to open the guide apparatus, corresponding to optimal efficiency, as well as full compliance with the quality control requirements.

It is assumed that the hydropower supply unit, operating with the variable rotational speed, will include an asynchronized generator instead of synchronous one.

The effect of pressure setpoint level on the control smoothness and the nature of transients was investigated. It was proved that with a decreasing level of setpoints, transients are virtually eliminated. Based on the stability region obtained, the selection of controller parameters was made.

The curves of transients during the turbine operation with synchronous rotational speed and in the efficiency correction mode, during the operation with variable rotational speed were analyzed. It was shown that the value of overspeeds and the number of overshoots during the load drops do not exceed the requirements placed on the quality control of serial hydraulic turbines.

Keywords: reversible hydraulic unit, variable rotational speed, automatic control system, pressure efficiency.

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