

IMAGE PROCESSING FOR MEDICAL AND INDUSTRIAL APPLICATIONS

Wojciech Bieniecki, Artur Gródecki, Szymon Grabowski, Katarzyna Kościelska-Kasprzak, Dominika Drulis-Fajdasz, Oktawia Mazanowska, Marian Klinger: **The Application of Hit-Miss Algorithm to the Segmentation of Color Microscope Images in ELISPOT Examination** • Automatyka 2008, t. 12, z. 3

A color microscope ELISPOT image segmentation approach based on the hit-miss method is presented. The original method is intended for binary images only. The authors propose an extension, which enables monochrome and color image processing. The algorithm has been successfully tested from the viewpoint of accuracy. The drawback of such approach is high computation complexity. The algorithm is part of the computer vision system SpotView, developed for Wrocław Medical University, where the research on kidney graft rejection risk is conducted.

Keywords: ELISPOT, color image segmentation, hit-miss

Wojciech Bieniecki, Michał Węgrzyn, Szymon Grabowski, Katarzyna Kościelska-Kasprzak, Dominika Drulis-Fajdasz, Oktawia Mazanowska, Marian Klinger: **Application of Adaptive Thresholding Algorithms to Color Microscope Image Segmentation in ELISPOT Examination** • Automatyka 2008, t. 12, z. 3

An approach to segmentation of color microscope images, obtained in ELISPOT examination, which utilizes color components thresholding, is presented. Three methods of adaptive thresholding have been taken into account: Bernsen and two variants of Peaks & Valleys. Primarily, the algorithms were intended for monochrome images and the authors proposed their extension to RGB color space. The properties of the algorithms have been discussed basing on the tests carried out on images provided by the Wrocław Medical Academy.

Keywords: ELISPOT, color image segmentation, adaptive thresholding

Zbigniew Bubleński, Mirosław Jabłoński: **SIMD Extensions in Digital Image Processing** • Automatyka 2008, t. 12, z. 3

The paper presents an attempt to utilize the SIMD extensions, available in modern processor architectures, in order to minimize image processing time. In particular, the effect of MMX and SSE

instructions on the digital image brightness (intensity) modification algorithm was investigated in detail. All experiments were performed in “VirtualDub” environment. The results, i.e. processing times, were compared with those obtained from an algorithm written in plain C language.

Keywords: *SIMD extensions, MMX and SSE instructions, time optimization of image processing algorithms, digital image processing, assembly language programming*

Agnieszka Dąbrowska-Boruch, Kazimierz Wiatr: **Implementation of MPEG-2 Standard Codec in FPGA Chips** • Automatyka 2008, t. 12, z. 3

The compression method applied in MPEG-2 standard is a combination of different standards, namely JPEG and H.261. There is possible to use similar compression techniques how in case of the JPEG standard, because the video signal is a sequence of still pictures. Paper presents implementation results of video signal processing path compatible with ISO/IEC 13818 standard specification in XC2VP100(-6)FF1704 Xilinx chip.

Keywords: *motion estimation, hardware implementation, MPEG-2, FPGA*

Anna Fabijańska, Dominik Sankowski: **Optical Filters in Vision System for High-Temperature Measurements of Metal and Alloy Surface Properties** • Automatyka 2008, t. 12, z. 3

This paper considers problem of optical filters selection for vision system for high temperature measurements of metal and alloy surface properties. Especially consequences of incorrect filters selection are discussed. Moreover, analysis of properties of images obtained for different configurations of the vision system is presented. Finally algorithm of optical filters self-acting change is proposed.

Keywords: *vision system, optical filters, image quality, surface properties*

Jarosław Gocławski, Joanna Sekulska-Nalewajko, Patryk Anioł: **The Method of Mitotic Index Automated Evaluation for Onion Cells Population Using Decision Tree** • Automatyka 2008, t. 12, z. 3

The evaluation of mitotic index is the method of estimation of cell division ability in cell populations treated by growth inhibitors or accelerators. The image processing algorithms for the segmenta-

tion of onion cells and their nuclei elements appearing in the process of mitosis is proposed.

Then a set of geometrical, textural and topological features of nuclei elements was extracted, which can distinguish interphase from the stages of mitosis. A decision tree was built according to C4.5 method using the maximum of information gain ratio of the feature values. To evaluate classification error, a series of 10-fold cross-validations were performed. The feature space was reduced by applying PCA method. The value of mitotic index for the tested onion cell population as well as the estimator index error was evaluated. The errors were compared with an average classification error.

Keywords: *mitosis, mitotic index, cell segmentation, feature extraction, decision tree, classification error, information gain ratio, C4.5 algorithm*

Mirosław Jabłoński, Zbigniew Bubleński: **Video Pipeline Integration on Reconfigurable Platform** • *Automatyka* 2008, t. 12, z. 3

The research includes the review and classification of computing platforms types suitable for stream-based operation and embedded vision system. Experimental, integrated vision pipeline includes advanced image sensor and reprogrammable circuit. Criteria for evaluation of stream based video processing system have been defined and applied to edge detector application.

Keywords: *vision pipeline, embedded system, real time image processing, smart camera*

Sławomir Jeżewski, Michał Jaros: **Scanning of Three-Dimensional Room Space** • *Automatyka* 2008, t. 12, z. 3

In this article were shown most common methods for scanning three-dimensional space in context of scanning rooms. The aim of scanning space is to generate a three-dimensional model of scanned scene. This model can be further used for example in virtual reality to show scanned objects. Nowadays space scanning issue is getting more and more important and scanners are used more often.

Keywords: *room scanner, scanning 3D space, laser triangulation*

Renata Kopeć, Piotr Pawlik: **Analysis of Images from Thermoluminescent Reader with CCD Camera for Individual Dosimetry** • *Automatyka* 2008, t. 12, z. 3

In radiation protection dosimetry, in case of overdose, it is important to distinguish between static and dynamic exposure. In thermoluminescent (TL) dosimetry it was not possible to know when

the dosimeter was leaving in the radiation field. Nowadays it is able to making such distinction by analyzing image of distribution of TL light emitted from thermoluminescent detector. In this work we present a method of image recognition to analyze the images of static and dynamic exposure. We developed the algorithm, which allows to proper classification of such images.

Keywords: thermoluminescent dosimetry, image analysis

Przemysław Korohoda: **Comparison of Two 3-D Digital Image Modelling Techniques Based on Taylor Second Order Series** • Automatyka 2008, t. 12, z. 3

In the paper a comparative study of two methods, based on the second order Taylor series, is presented. The 3x3 pixel block modelling is performed with the derived convolution filters. It has been shown, that the 3-D edge detection with Hessian eigen-values ratio, as suggested in the SIFT algorithm, depends strongly on the computation technique, and therefore an alternative method, also based on the Hessian eigen-values, has been derived. The study is illustrated with the computational examples.

Keywords: Taylor series, Hessian, 3-D interpolation, 3-D approximation, image convolution filters

Tomasz Kryjak, Marek Gorgoń: **Hardware Accelerator for Data Stream Encryption** • Automatyka 2008, t. 12, z. 3

The paper describes a data stream encryption hardware accelerator. The used DES algorithm and its implementation in VHDL language have been discussed. Different FPGA platforms have been evaluated to determine the most suitable one for creating an accelerator co-operating with a PC computer. The software and hardware parts of the presented solution, as well as problems with data transfer from the PC computer to the FPGA device have been described. Correctness and speed of the implemented application have been tested. Finally, the performance of the presented hardware solution and software solutions has been compared.

Keywords: encryption, hardware computing acceleration, re-programmable devices, software-hardware solutions

Patryk Orzechowski, Marcin Waśko: **Method of Fraction Differentiation Basing on Image Analysis of Human Serum Proteins** • Automatyka 2008, t. 12, z. 3

The article explains the process of human serum protein electrophoresis and its usage in diseases diagnostics. A basic concept of

the extended electrophoresis is presented – an innovative and intensively developed diagnostic technique, which purpose is to increase the effectiveness of illnesses detection. The paper presents the prototype of an algorithm to differentiate serum fractions, which bases on image analysis. The algorithm scans the image in accordance with pixels' grayscale levels and uses the contextual grayscale values of the processed pixel.

Keywords: *electrophoresis, serum, proteins, image analysis*

Roman Vorobel, Krzysztof Przybyszewski: **Image Contrast Enhancement as One of Approaches to Its Quality Improvement** • *Automatyka* 2008, t. 12, z. 3

The analysis of known approaches to image quality enhancement with contrast amplification by global transformation is carried out. The original bi-parametric method for image gray level transformation, which uses pixel contrast evaluation with respect to fixed adaptation gray level, has been proposed. In association with local contrast transformation it provides image quality enhancement. The effectiveness of proposed approach is illustrated with examples.

Keywords: *image, global transformation, look-up-table, contrast enhancement*

Paweł Wołoszyn, Mirosław Jabłoński, Łukasz Malicki: **On the Research of Human Ability to Perceive Spatial Acoustic Scene** • *Automatyka* 2008, t. 12, z. 3

Human ability to discern sounds coming from different locations is based on interaural differences and head-related filtration of acoustic signals. It allows to precisely localize a single sound source with high acuity. Our research focuses on more difficult task of perceiving and recognizing complex spatial sound patterns consisting of several acoustic signals emitted simultaneously from multiple sources. In this paper we describe our hardware platform used to perform such psychoacoustic experiments. We also discuss the results of some experiments performed to check what requirements must be met in order to make perception of spatial sound scene possible.

Keywords: *psychoacoustics, sound localization, spatial acoustic pattern*

SIGNAL PROCESSING FOR IDENTIFICATION AND CONTROL SYSTEMS

Marcin Bąkała, Tomasz Koszmider: **Computerized Vision System for Certain Brasing Parameters Indication** • Automatyka 2008, t. 12, z. 3

In this paper brazing process is presented. The parameters defining soldering are described. Experimental ways of determining soldering are shown. The automatic computerized high-temperature brazeability analyzing system is also presented. There are given the experiments results.

Keywords: brasing, brasing tester

Grzegorz Ciesielski, Andrzej Albrecht, Rafał Wojciechowski: **The Project of Distributed Environment for Nonlinear System Research Using the Java RMI Technology** • Automatyka 2008, t. 12, z. 3

In the paper, the usage of distributed computing mechanisms for the nonlinear system research was shown. The project of generalized distributed environment using the Java RMI technology was described. The concept of the environment for nonlinear system research was introduced and the functional requirements were given. The communication protocol allowing the management and data exchange between system modules was discussed. The requirements for the client API including the organization of modules flow, data types standardization and data exchange, were introduced. The grammar concept of the script language for the environment automatization was also described.

Keywords: distributed computing, Java, Java RMI, modeling and correction of nonlinear systems

Maciej Garbacz, Mieczysław Zaczyk: **Mobile Robot Khepera III – Programming for MATLAB Environment** • Automatyka 2008, t. 12, z. 3

In this paper the mobile robot Khepera III and its programming environment was presented. Because of wireless communication with PC and swappable battery packs robots are completely autonomous. The laboratory stand consists of two robots and it enable im-

plementing path planning algorithms for mobile robots and working two robots in common workspace.

Keywords: *path planning, mobile robots, obstacle avoidance, proximity sensors, ultrasonic sensors*

Szymon Grabowski: **Making Dense Codes Even Denser** • Automatyka 2008, t. 12, z. 3

Dense byte-oriented compression codes are a useful tool for compressing textual databases over a large alphabet. The requirement for large alphabet is naturally fulfilled for most human languages, where the symbols can be words, but also non-segmented texts can be handled similarly, using q -grams. Recently, several interesting schemes, combining speed, high compression ratios, fast search support and simplicity, have been presented. In this work, we show a couple of simple ideas increasing slightly the compression ratios of common byte codes, like (s,c) -DC or tagged Huffman, assuming the text is static. Preliminary experimental results with one of those techniques show that it is more efficient with q -gram compression, and the compression ratio improves in those cases often by 1% or more, without compromising the search or decoding efficiency and simplicity.

Keywords: *compressed pattern matching, word-based models, q -grams, byte codes*

Przemysław Korohoda: **Indirect Measurement of Human Limbs and Trunk Bioimpedance** • Automatyka 2008, t. 12, z. 3

In the paper an indirect technique for human body segments bioimpedance measurement is described. The four limbs and the trunk bioimpedance values are computed from six measurements, performed between four distal points located on the limbs. The multi-frequency measurement, for: 5 kHz, 50 kHz and 100 kHz, provided relevant data. Three alternative computation approaches have been proposed and their properties have been compared with use of the measurement data obtained for 10 persons.

Keywords: *bioimpedance analysis, segmental bioimpedance*

Przemysław Korohoda: **Comparative Study of the GFR Reference Formulas Based on Cystatin C** • Automatyka 2008, t. 12, z. 3

In the paper a list of nine of the most commonly used formulas for Glomerular Filtration Rate (GFR) computed from the cystatin C

concentration has been composed, along with selected data related to the experiment which lead to each formula. A unified form of the formulas, based on the single-compartmental model, has been proposed and all of the formulas were converted to that form. The proposed nontypical approach to comparing the GFR formulas has led to deriving the new formulas being the averaged compromise between the mutually different reference formulas. For the sake of completeness a comparative study of two of the most commonly used formulas for the Body Surface Area (BSA) has been provided.

Keywords: GFR, single-compartmental model, cystatin C

Paweł Kośła, Marcin Raniszewski: **New Feature Selection Methods and Reference Set Reduction Algorithms for 1-NN Classifier** • Automatyka 2008, t. 12, z. 3

The reference set minimization methods for 1-NN classifier were proposed. The combine of a feature selection procedure, based on analysis of dependences between features, and reference set reduction algorithm that uses double point sorting was introduced. The proposed approach to the reference set size reduction was compared with the well-known forward feature selection, the Gowda and Krishna algorithm and the RMHC algorithm introduced by Skalak. The computational experiments were performed with use of seven real and artificial datasets.

Keywords: 1-NN rule, pattern recognition, reference set minimization, unsupervised feature selection, correlation, reference set reduction, mutual distance measure, representative measure

Konrad Kułakowski, Jarosław Wąs, Marcin Szpyrka: **Autonomous Mobile Robot Architecture with Dynamic World Model** • Automatyka 2008, t. 12, z. 3

Successful working of autonomous mobile robot highly depends on ability to plan its own motion in such a way, which allows accomplishing specified tasks. Important role in such planning plays model of the surrounding world. It serves as knowledge storage and it allows for effective computing a sequence of admissible motions of the robot. In the presented paper authors would like to present a general architecture of intelligent control system for autonomous mobile robot with dynamic world model using knowledge in form of cellular automaton.

Keywords: intelligent control systems, cellular automata, autonomous mobile robot

Konrad Kułakowski, Jarosław Wąs, Marcin Szpyrka: **Dynamic World Representation in Control of Autonomous Mobile Robot** • Automatyka 2008, t. 12, z. 3

Successful working of autonomous mobile robot highly depends on ability to plan its own motion in such a way, which allows accomplishing specified tasks. Important role in such planning plays model of the surrounding world. It serves as knowledge storage and it allows for effective computing a sequence of admissible motions of the robot. In the presented paper authors take into a consideration world model in a form of cellular automaton. A simple control algorithm for a collision free path finding problem is also discussed.

Keywords: intelligent control systems, cellular automata, autonomous mobile robot

Piotr Urbanek, Andrzej Frączyk, Jacek Kucharski: **Algorithm of Elimination of Surface Emissivity Variations in Non-Contact Temperature Measurement of the Rotating Steel Cylinder** • Automatyka 2008, t. 12, z. 3

Non-contact methods is often used for temperature measurement of rotating steel cylinder surface. Accuracy of the obtained this way results strongly depends on emissivity distribution along the surface. Local surface contamination causes variations of measured temperature. Due to cylinder rotation these disturbances have a periodic character. This feature became a basis of the family of algorithms attenuating disturbances. The algorithms have been verified on laboratory set-up of induction heated rotating steel cylinder.

Keywords: non-contact temperature measurement, unequal surface emissivity, measurement contaminations elimination

IMAGE ANALYSIS AND RECOGNITION

Leszek Kotulski, Adam Sędziwy: **Stochastic Methods of IE Graphs Generation** • Automatyka 2008, t. 12, z. 3

In the article the probabilistic methods of graph structures generation are discussed. That class of graphs known also as IE graphs allows to formalize a variety of problems including pattern recognition area. In the paper we also present the methods of descrip-

tion of the obtained IE graphs (by using so called descriptors) and their properties. Generation methods being presented here allow to create the graphs having the desired properties.

Keywords: *graph generation, syntactic pattern recognition, IE-graphs*

PROCESS TOMOGRAPHY

Robert Banasiak, Radosław Wajman, Zbigniew Chaniecki, Krzysztof Grudzień, Andrzej Romanowski, Jakub Betiuk: **4D ECT Real-Time Imaging of Bulk Solids Flow in Industrial Environment** • Automatyka 2008, t. 12, z. 3

This paper presents the system of Electrical Capacitance Tomography (ECT) for non-invasive three-dimensional in real-time imaging of solid material concentration during gravitational silo discharging. The three-dimensional image reconstruction method was presented. Additionally, the implementation of VTK library was shown for three-dimensional tomograms presentation.

Keywords: *real-time visualization, 3D reconstruction, hopper-flow*

Robert Banasiak, Radosław Wajman, Manuchehr Soleimani: **System of Capacitance Tomography for Three-Dimensional Real-Time Imaging** • Automatyka 2008, t. 12, z. 3

Electrical capacitance tomography (ECT) is a relatively mature non-intrusive and non-invasive imaging technique that maps permittivity of dielectric materials. ECT has become promising monitoring technique in industrial process tomography especially in fast flow visualization. One of the most challenging tasks in further development of the ECT for real applications are the computational aspects. In this paper we present a robust and computationally efficient 4D image reconstruction algorithm applied to real ECT data.

Keywords: *Electrical Capacitance Tomography, image reconstruction*

Krzysztof Grudzień, Maciej Niedostatkiwicz, Zbigniew Chaniecki: **The Diagnostic of Solid Flow During the Discharging of the Cylindrical Silo** • Automatyka 2008, t. 12, z. 3

The paper presents the results of the measurements of the solid concentration changes during gravitational emptying the cylindrical silo. The measurements were taken by applied the non-invasive dia-

gnostic method - Electrical Capacitance Tomography (ECT). The experiments conducted for different initially density of granular material with smooth and rough silo walls. Increasing the wall roughness is a one of the most effective way to reduce the dynamics effects, arousing as the result of the resonance between the trembling of granular material and the silo construction. In order to conduct the detailed analysis of shear zone in the wall profile was applied ECT methodology to visualize the changes of concentration distribution in time and tomography image processing to calculate the characteristic parameters of shear zone.

Keywords: *capacitance tomography, gravitational flow, granular material, tomography image processing*

Mariusz R. Rzaša, Anna Błaszak-Gawlik, Radosław Wajman: **Capacitance Tomography for Identification of Volume Fraction in Two-Phase Gas-Liquid Flows** • Automatyka 2008, t. 12, z. 3

The paper presents the stand for determination of structure of the gas-liquid flow. The flow structure can be both bubble and stratified. Since the considered phenomena are complicated, it is difficult to prepare one uniform measuring system. In the paper, the authors describe the measuring system containing the optical tomograph, applied for recognition of bubble structures. On the other hand, the capacitance tomograph is applied for recognition of stratified flows. The paper presents the measuring system and the obtained test results.

Keywords: *electrical capacitance tomography, two-phase gas-liquid flow, image reconstruction process*

Yong-Bo He, Hua-Xiang Wang, Dominik Sankowski: **Analysis of Electrical Impedance Tomography Sensitive Field Based on Multi-Terminal Network** • Automatyka 2008, t. 12, z. 3

Electrical Impedance Tomography (EIT) aims to study the conductivity/permittivity distribution of the interested field. The distributed parameters can be analyzed with electromagnetic field based Finite Element Method (FEM). Because only the lumped circuit parameters can be measured by the data acquisition unit, the multi terminal network modals of the sensitive field with common node and common loop topology are introduced. By analyzing the inherent relationships of different excitation strategies, the number of independent measurements is calculated and an optimum single source excitation mode, quasi opposite excitation, that has the ad-

vantages of more uniform sensitive distribution and more independent measurements, is proposed.

Keywords: *Electrical Impedance Tomography, sensitive field, multi-terminal network, Independent measurement*

Zhijian Liu, Laurent Babout, Robert Banasiak, Dominik Sankowski: **Image Reconstruction Based on Rotatable ECT Sensor** • *Automatyka* 2008, t. 12, z. 3

Electrical capacitance tomography (ECT) has been successfully applied in many industrial fields. However, the resolution of ECT still needs to be improved so that it can be used in a wider scope. As a first attempt to overcome this drawback, arithmetic for image reconstruction is presented based on a rotatable sensor. By keeping the number of electrodes constant, the image quality is enhanced by making additional measurements at different angles.

Keywords: *image reconstruction, improved resolution, ECT sensor, rotatable sensor*

NEURAL NETWORKS

Joanna Grabska-Chrząstowska: **An Attempt of Neural Modelling of Radioactive Cobalt Content Depending on the Chemical Constitution of Water in a Nuclear Reactor** • *Automatyka* 2008, t. 12, z. 3

The paper presents the use of neural networks to create a dependence model of the content of a radioactive mineral ^{60}Co on the content of five metals in the water of a nuclear reactor. Very promising models of the process were received which gives hope to research the sensitivity of the model towards changes of the input parameters. At the same time a great importance of the history of measurements at creating the model was proved.

Keywords: *neural network, nuclear power station*

Zbigniew Mikrut: **Examination of the Differentiation Level of Signatures Generated by the ICM Pulsed Network** • *Automatyka* 2008, t. 12, z. 3

In the paper the signatures generated by the ICM pulsed network have been analyzed. The signatures were generated basing on subimages derived from two aerial images. Subimages of two sizes

were taken into account for the comparison purposes. Basing on two criteria it was found that the differentiation level is better for the shorter signatures and for the smaller subimages.

Keywords: *image signatures, PCNN network, ICM network*

BUSINESS INFORMATION SYSTEMS

Lidia Dutkiewicz, Edyta Kucharska: **An Algebraic-Logical Model for Problem of Route Planning for m Salesmen** • Automatyka 2008, t. 12, z. 3

In the article a concept of algebraic-logical model for problem of planning delivery routes to multi-branch companies. This problem is a modification of the well-known m -TSP problem. The algebraic-logical model corresponds to a formal representation of a multistage decision process connected with simulation of a discrete process. There are presented: a state of the system, a set of goal states and a set of not-admissible states. For the current state of the system there are introduced some sets of system elements with analogous features, which are useful in defining other components of the system. There are also specified: a notion of the decision, a set of possible decisions and a set of admissible decisions. Components of the transition function are given: a method of identifying a moment of the next process state and a method of determining values of coordinates of the next state.

Keywords: *algebraic-logical model, traveling salesman problem, discrete decision process*

Edyta Kucharska, Lidia Dutkiewicz: **Heuristic Search of Solution Tree for Scheduling Problem with Parallel Machines** • Automatyka 2008, t. 12, z. 3

The aim of the paper is to present an algorithm, in which heuristics search of solution tree is applied. This algorithm is designed for task scheduling problems on multiple machines. It uses state space representation and is based on an algebraic-logical model. The proposed algorithm consists in constructing a trajectory and then improving terminal parts of the constructed trajectory. Decision choosing in the algorithm is based on local optimization. In the article a specific scheduling problem with parallel machines is de-

scribed. For this problem there is given a structure of local criterion and a method of choosing a state from which the trajectory will be improved. Results of experiment are also presented.

Keywords: algebraic-logical model, heuristic search, state graph

Wiesław Popielarski: **Sequencing and Scheduling in Management of Business Processes** • Automatyka 2008, t. 12, z. 3

Author of article introduces reader in problems of planning and managing of business projects, some issues which may infer from planning and managing processes and ways of their solving. Further, the variety of deterministic scheduling models is presented with considering known optimal algorithms according to appropriate chosen criterion. There is also the discussion about some problems for which such optimal and reasonable algorithms remain unknown.

Keywords: scheduling models, single machine model, parallel machine model, flow shop problem, real-life scheduling model

Dominik Sankowski, Sławomir Jeżewski, Roman Krzeszewski, Jacek Nowakowski: **Integrated Computer System for Regional Tourist Activities Management** • Automatyka 2008, t. 12, z. 3

The subject of the paper is concept and description of highly integrated computer system for management of tourist activities in a region. The presented system services not only while preparation of the activity – accommodation, transport, but also integrates on-line services. It is integrated with GIS and GPS system and allows monitoring of groups of people localization, provides ease access to emergency services. Integrated data may also be useful in preparation of publications for promotion of local tourist attractions.

Keywords: integrated management system, tourist services, GPS, GIS, promotion

Tadeusz Szuba, Paweł Skrzyński: **Adam Smith's Invisible Hand Paradigm Based on the Collective Intelligence Model** • Automatyka 2008, t. 12, z. 3

Nowadays an invisible hand [7] process is understood as something very general – the process in which the outcome to be explained is produced in a decentralized way, with no explicit agree-

ments between the acting agents. The second essential property is that the process is not intentional, however its impact on the market is very strong. The agents' aims are not coordinated nor identical with the actual outcome, which is a byproduct of those aims. The process works even without the agents having any knowledge of it. This is why the process is called invisible. Such economical process surprisingly fits to the Collective Intelligence definition [8]. Hence the paper presents the concepts of the market simulation system which is based on Collective Intelligence computational model. This simulation system is expected to enable firing of the invisible hand of market phenomena, its observation and analysis.

Keywords: *Collective Intelligence, computational model, inference process in social structure, Adam Smith Invisible Hand of Market, simulation model, self-regulation*

Michał Turek: **Modified Shape Grammars Theory for Automatic 3D-Mesh Generating** • Automatyka 2008, t. 12, z. 3

This article discusses some advantages of Shape Grammars theory modifications – used for simplified 3D-Mesh creating. Generally – application of a Shape Grammar to that kind of task is based on multiple shape transitions performed on a 3D-Mesh. Those transitions are described with a set of Shape-Rules, defined in a Shape Grammar. The main problem to solve here is to provide correct input shape interpretation, so the rules could be launched in a correct order. That will also provide control for a mesh generation process and will avoid non-deterministic behavior. It will also remove some annoying limitations for the method. To achieve the goal many experimental Shape Grammar modifications will be needed. In the end experiment results should establish a new Modified Shape Grammar formula without described limitations.

Keywords: *Shape Grammars, 3D transformations, 3D-mesh, shape rules, genspec relation, whole-part relation, object modeling*

Mirosław Zajdel, Bogusław Filipowicz: **Optimization Methods' Selection for Transportation Networks** • Automatyka 2008, t. 12, z. 3

One of the areas, in which methods of optimization have proved extremely useful is the analysis of data transport in networks. These methods are pretty general, flexible and can be easily adapted

to various instances of networks. However there is a relevant difficulty in applying these methods. Selection of the method is connected to finding a compromise between our needs, efficiency of algorithm and its computational complexity. This paper attempts to analyze typical methods and their characteristics. Adopted approach based on collation of methods shows which criteria we should care about when we are to choose one method from among other similar to it in functionality.

Keywords: *optimization, net, logistics, transport*

COMPUTER SCIENCE IN EDUCATION

Bogusław Filipowicz, Joanna Kwiecień: **The Use of Queuing Theory to Modeling of Administrative Units in Education** • *Automatyka* 2008, t. 12, z. 3

Queuing theory is a good tool for determining the performance and operating measures of real-world systems. This article presents the use of open queueing networks with one job class and multiple job classes to modeling process of receiving annotation of promotion for next academic year and dean's office operation. Performance measures such as the mean number of jobs and the mean response time have been also presented.

Keywords: *queueing networks, modeling of administrative units*

Dominika Lisiak, Izabela Politowska, Maciej Szmit: ***Ignorantia Juris Nocet*. The Consciousness of Law Aspects of Computer Use Among Computer Science Specialist** • *Automatyka* 2008, t. 12, z. 3

The article presents results of a questionnaire research conducted among the group of research workers in the Computer Engineering Department and computer science students at the faculty of Electrical, Electronic, Computer and Control Engineering at the Technical University of Lodz. The topic of research was concerned with the consciousness of law aspects of the use of computers among computer specialist.

Keywords: *computer law, law consciousness of computers users, law aspects of information technology, computer crimes, intellectual property law, computer systems security*

Krzysztof Przybyszewski: **Application of the Fuzzy Sets for Evaluation of Different Aspects of the Learning Systems** • Automatyka 2008, t. 12, z. 3

The paper describes a conception of an application of the fuzzy numbers for assessing students' progress in learning, knowledge assimilation and abilities. The method of judge is based on operations performed on the fuzzy numbers and fuzzy sets. The method has been used for a determination of the semester and annual marks for one group of the gymnasium and one chosen subject. Those values of marks have been compared with teachers' ones. We propose to apply that method of the final marks determination for the information function definition for the learning systems treated like information systems. We hope that it is possible to forecast an efficiency factors (in pedagogical sense) for those systems.

Keywords: *artificial intelligence in education, fuzzy numbers, expert system, validation, evaluation, forecast of efficiency factor*

Agata Skowrońska-Kapusta, Andrzej Szelejak, Piotr Goetzen, Paweł Kapusta: **Project of International Linux Certification Center for Administrators of Linux Systems and Linux Networks** • Automatyka 2008, t. 12, z. 3

While Linux operating systems have become more and more popular, it is important to test and verify the knowledge of the administrators of Linux. To do so, many companies create their own certifications paths and exams systems to be able to state the level of Linux knowledge of the student. The certificates are additional and very important elements of personal development and state the supplementary competence of an employee. Hardware, system and software companies create their own certification paths, which include reading, hands-on labs and examination tests, they also introduce the methodology of teaching and provide the teachers help in delivering the courses.

In case of Linux network operating system the certification paths cover different commercial systems. Testing is completed in authorized centers, usually by providing the electronic exams (tests), in some cases testing includes the practical tasks to be done in laboratory environment.

Most certification paths are limited to form the administrator of the certain distribution (Novell, Red Hat) and they do not cover the knowledge of different versions of Linux.

Courses and certificates offered by SAIR and LPI concentrate on GNU distributions, paying no attention to commercial distributions. The main aim of the presented project called Linux Certification Center is to introduce high quality courses and certification path which will train and verify future “no-matter-which-distribution” Linux administrators. High quality of administrators will be ensured by introducing the courses and examination system into international academic institutions.

Keywords: *Linux certificate, certification path, Linux administrator, courses, syllabus*