

**Institute of Automation and Control Processes
of the Far Eastern Branch of Russian Academy of Sciences
Far Eastern Federal University
IEEE NSW Section, Australia**

**2nd Russian-Pacific Conference
on Computer Technology and Applications
RPC 2017**

**Youth Scientific School on Mathematical
Modeling and Computer Technologies**

Vladivostok, Russia, 25-29 September, 2017

<http://www.rpc2017.dvo.ru/>

Thanks a lot to the conference sponsors:

- Russian Foundation for Basic Research, grant 17-07-20473 (<http://www.rfbr.ru>),
- OJSC MegaFon (<https://megafon.ru>);

and information partners:

- Russian Association of Artificial Intelligence (<http://raai.org>);
- Inter-regional magazine FAR EAST CAPITAL (<http://dvcapital.ru>).

MONDAY, September 25

09:00am - 10:00am		Marine Conference Hall	Registration
10:00am - 10:30am		Marine Conference Hall	Opening Session
10:30am - 11:30am		Marine Conference Hall	Plenary Lecture
11:30am - 12:00pm Coffee break			
12:00pm - 01:00pm		Marine Conference Hall	Plenary Lecture
FREE TIME			
02:30pm - 04:10pm Technical Session			02:30pm - 06:00pm Tutorial
Room B537	Room B552	Room B626	Marine Conference Hall
Technologies	Intelligent Computing	Cloud Computing	02:30pm - 03:30pm Lecture 1 Break 03:40pm - 04:40pm Lecture2 Break 04:50pm - 06:00pm Lecture3
04:10pm - 04:40pm Coffee break			
04:40pm - 06:00pm Technical Session			
Room B537	Room B552	Room B626	
Technologies	Intelligent Computing	Ontologies	
07:00pm - 09:00pm WELCOME PARTY Building A, Level 12, Restaurant «Paluba №12»			

TUESDAY, September 26

09:00am-10:00am		Marine Conference Hall	Plenary Lecture
10:00am - 10:30am Coffee break			
10:30am-11:30am		Marine Conference Hall	Plenary Lecture
11:30am-12:30pm		Marine Conference Hall	Plenary Lecture
FREE TIME			
02:00pm - 03:20pm Technical Session			02:00pm-04:50pm Tutorial
Meeting Room №1 (Building B, level 5)	Room B552	Room B626	Marine Conference Hall
Technologies	Intelligent Computing	Ontologies	02:00pm - 02:50pm Lecture 4 Break 03:00pm - 03:50pm Lecture 5 Break 04:00pm - 04:50pm Lecture 6
03:20pm-03:50pm Coffee break			
03:50pm – 05:10pm Technical Session			
Meeting Room №1 (Building B, level 5)	Room B552	Room B626	
Technologies	Intelligent Computing	Ontologies	
06:00pm-09:00pm VLADIVOSTOK SIGHTSEEING TOUR (BY BUS) Departure from Hotel Building №3			

WEDNESDAY, September 27

09:00am - 10:00am		Marine Conference Hall		Plenary Lecture
10:00am - 10:30am Coffee break				
10:30am - 11:30am		Marine Conference Hall		Plenary Lecture
FREE TIME				
01:00pm - 02:40pm			01:00pm- 06:20pm	
Technical Session			Tutorial	
Meeting Room №1 (Building B, level 5)	Room B552	Meeting Room №4 (Building A, level 4)	Marine Conference Hall	
Technologies	Intelligent Computing	Ontologies	01:00pm - 01:50pm Lecture 7 Break 02:00pm - 02:50pm Lecture 8 Break 03:00pm - 03:50pm Lecture 9 Break 04:00pm - 05:00pm Lecture 10 Break 05:10pm - 06:10pm Lecture 11	
02:40pm - 03:10pm Coffee break				
03:10pm – 04:30pm				
Technical Session				
Meeting Room №1 (Building B, level 5)	Room B552			
Technologies	Intelligent Computing			

THURSDAY, September 28

09:00am - 03:00pm	Room D938
Youth Scientific School on Mathematical Modeling and Computer Technologies	
04:00pm - 05:30pm BOAT TRIP	
Departure from FEFU Campus Pier. Arrival to Sea Station.	
06:00pm - 10:00pm BANQUET	
Restaurant "The Marine" (Sea Station, Level 4)	
10:00 pm – 10:30pm TRANSFER TO FEFU HOTEL (BY BUS)	

FRIDAY, September 29

10:00am - 11:40am		Technical Session
Meeting Room №1 (Building B, level 5)	Room B552	
Technologies	Intelligent Computing	
11:40am - 12:10pm Coffee-break		
12:10pm - 01:50pm Technical Session		
Meeting Room №1 (Building B, level 5)	Room B552	
Technologies	Intelligent Computing	
02:00pm - 02:30pm	Marine Conference Hall	Closing Session

PLENARY LECTURE

MONDAY, September 25

Marine Conference Hall

Chair: Gennady Osipov

10:30am-11:30am

Boris Stilman (University of Colorado at Denver, Denver, CO, USA)

Prepare, Aim, and ... Checkmate the Enemy

Linguistic Geometry (LG) is a type of game theory scalable to solving complex real world problems that are considered intractable by conventional approaches. Modern applications of LG, related to defense, generate, in real time, courses of action that are highly creative and even exceed the level of those developed by human commanders. Currently, those applications considered vital for the US national defense. This talk will consist of two historical surveys.

In the first survey, going backward in time, I will review applications of LG, from modern battles to the ancient ones. I will introduce participants to several advanced applications; especially those developed for DARPA and US Army and to major experiments utilized those applications. I will also establish link between LG and legendary ancient battles of Alexander the Great and Hannibal. I will introduce the hypothesis that LG is one of the ancient algorithms based directly on the Primary Language of the human brain crucial for development of human intelligence.

In the second survey, going forward in time, I will cover development of LG beginning from the 18th century to the foundation of STILMAN Advanced Strategies in 1999. Within this survey, I will introduce participants to the results in solving chess endgames and positions and to the elements of the theory of LG with the focus on the hierarchy of pictorial constructs, a trajectory, a zone, and a translation, represented as a hierarchy of formal languages.

12:00pm-01:30pm

Alfred Inselberg (Tel Aviv University, Tel Aviv, Israel)

Visual Analytics for High Dimensional Data

A dataset with M items has 2^M subsets any one of which may be the one satisfying our objective. With a good data display and interactivity our fantastic pattern-recognition defeats this combinatorial explosion by extracting insights from the visual patterns. This is the core reason for data visualization. With parallel coordinates the search for relations in multivariate data is transformed into a 2-D pattern recognition problem. Together with criteria for good query design, we illustrate this on several real datasets (financial, process control, credit-score, one with hundreds of variables) with stunning results. A geometric classification algorithm yields the classification rule explicitly and visually. The minimal set of variables, features, are found and ordered by their predictive value. A model of a country's economy reveals sensitivities, impact of constraints, trade-offs and economic sectors unknowingly competing for the same resources. An overview of the methodology provides foundational understanding; learning the patterns corresponding to various multivariate relations. These patterns are robust in the presence of errors and that is good news for the applications. A topology of proximity emerges opening the way for visualization in Big Data.

TUESDAY, September 26

Marine Conference Hall

Chair: Valeria Gribova

09:00am-10:00am

Gennady Osipov (Federal Research Center "Computer Sciences and Control" RAS, Moscow, Russia)

From Artificial Intelligence to Artificial Consciousness

According to modern theories of mental function's emergence and the role of neurophysiological processes therein, the mental function formation is associated with the existence or communicative synthesis of specific information structures containing three information types of different origin: information coming from the external environment, information extracted from the memory and information coming from motivation centers. The binding of these components into a single entity is ensured by naming them; this also provides for the emerging structures' stability. We call such information structures as signs due to their resemblance to similar structures that have been studied in semiotics. The set of signs formed by the actor during activities and communication forms his signs-based world model including his ideas about the environment, himself and other actors. The signs-based world model enables the setting and resolution of a number of tasks arising for intelligent agents and their coalitions during behaviour modeling, such as goal-setting, purposeful behaviour synthesis, role distribution, and the interaction of agents in the coalition. In artificial intelligence researches, the latter problem is not even defined. Presumably, this is due to limitations related to symbol-based formalism. Here we consider a fragment of the formalism that may be called a sign-based. Operations and relationships in the signs-based world model simulating of the psychological characteristics of human behaviour are determined on this basis.

10:30am-11:30am

Sergei Naumov (MegaFon VAS, Moscow, Russia)

MegaFon.API, Free Telecom : the Last Chance?

Telecom industry enjoyed high profits and fast growing market share for a very long time. Despite many warnings that were occurring for quite some time it seems that high profits ride has come to a stall. Besides, other industries seem to eat up market share from telco companies. What can carriers do to replenish their growth? Can this growth even occur in the future? How can telecom industry work with other industries? We are suggesting one of the possible avenues towards answering these questions and discuss telco API approach that would allow to team up with IT industry. The ways to work with IT communities are also discussed.

11:30am-12:30pm

Alexey Petrovsky (Federal Research Center “Computer Sciences and Control” RAS, Moscow, Russia)

Multi-Method Technology for Group Multi-Attribute Choice

A new multi-method technology PAKS-M (Progressive Aggregation of the Classified Situations by many Methods) for group choice of objects with many numerical and/or verbal attributes is presented. The technology provides a reduction of the dimension of the attribute space; a construction of several hierarchical systems of composite criteria and an integral quality index; ordering and/or classification of multi-attribute objects using several decision making methods. This technology was used for the multicriteria selection of prospective computing complex.

WEDNESDAY, September 27

Marine Conference Hall

Chair: Boris Stilman

09:00am-10:00am

De-Shuang Huang (Tongji University, Shanghai, China)

Modeling and Analysis of High-throughput Transcription Factors Binding Data

As the key regulatory elements of gene transcription, transcription factors (TFs) can activate or suppress the transcription by binding to specific sets of DNA sequences. In the past decade, the introduction of high-throughput sequencing technologies (e.g., ChIP-seq) provides immense opportunities for precise categorization of TF binding sites. In this talk, we will introduce several novel computational models for integrative analysis of the accumulated ChIP-seq data. Firstly, due to cost, time or sample material availability, it is not always possible for researchers to obtain ChIP-seq data for every TF in every sample of interest, which considerably limits the power of integrative studies. To tackle this problem, we propose Local Sensitive Unified Embedding (LSUE) for imputing new ChIP-seq datasets. In LSUE, the ChIP-seq data compendium are fused together by mapping proteins, samples, and genomic positions simultaneously into the Euclidean space, thereby making their underlying associations directly evaluable using simple calculations. Meanwhile, a novel form of local sensitive low rank regularization is also proposed to further improve the performance. Secondly, we construct gene regulatory networks in 13 human tissues by integrating large-scale transcription factor (TF)-gene regulations with gene and protein expression data. By comparing these regulatory networks, we find many tissue-specific regulations that are important for tissue identity. In particular, the tissue-specific TFs are found to regulate more genes than those expressed in multiple tissues, and the processes regulated by these tissue-specific TFs are closely related to tissue functions. Therefore, recognizing tissue specific regulatory networks can help better understand the molecular mechanisms underlying diseases and identify new disease genes.

10:30am-11:30am

Hong Yan (City University of Hong Kong, Kowloon Tong, Hong Kong)

Co-clustering Analysis of Multidimensional Big Data

Multidimensional big datasets are being produced in many applications due to the rapid development of electronic and communications systems. Although a dataset can be very large, it may contain coherence patterns much smaller in size. For example, we may need to detect a subset of genes that co-express under a subset of conditions. In this presentation, we discuss our recently developed co-clustering algorithms for the extraction and analysis of coherent patterns in big datasets. In our method, a co-cluster, corresponding to a coherent pattern, is represented as a low-rank tensor and it can be detected from the intersection of hyperplanes in a high dimensional data space. Our method has been used successfully for DNA and protein data analysis, disease diagnosis, drug therapeutic effect assessment, and feature selection in human facial expression classification. Our method can also be useful for many other real world data mining, image processing and pattern recognition applications.

TUTORIAL

MONDAY, September 25

Marine Conference Hall

Boris Stilman

University of Colorado Denver, Denver, USA

STILMAN Advanced Strategies, USA

www.stilman-strategies.com

02:30pm-03:30pm Lecture 1

The Primary Language I: From Primary to Conventional Science

This is the first lecture in a series of lectures on the Primary Language, a Language of Visual Streams (LVS) or the so-called mental movies. Our hypothesis about the structure of the Primary Language of the human brain goes back to J. von Neumann who hypothesized its existence in 1957. According to von Neumann, the Primary Language should have empowered all the Secondary languages, i.e., human symbolic languages and sciences. I will explain how this is accomplished with introduction of the LVS. This lecture includes the details of communication between the primary and conventional languages and demonstrates examples of such communication. Visual streams, the components of the Primary Language, operate via multiple thought experiments. There are various types of streams including communication and internal streams as well as mundane and science streams. The communication streams include expression and impression streams. The expression streams pass information from the internal streams to the outer world via converting it into the strings of symbols and pictures while the impression streams pass information in the opposite direction. The science streams may generate new knowledge because they include the discovery streams controlled by the Algorithm of Discovery (AD). We assume that there exists a universal AD, the ultimate tool utilized by the human brain for discovering new algorithms and perfecting the existing ones. One of the goals of our research is to understand the AD to the level which will permit producing discoveries on demand. Several examples of discoveries rediscovered employing the simulated AD are given in other lectures titled “The Primary Language II and III...”

03:40pm-04:40pm Lecture 2

The Primary Language II: Discovering Structure of DNA and Differential Calculus

This lecture continues a series of lectures on the Primary Language, a Language of Visual Streams (mental movies). The Algorithm of Discovery (AD) is the major algorithm based directly on the Primary Language. The AD makes discoveries via visual streams within the primary science and then reflects them in the secondary science, the conventional one. The AD operates via initiating thought experiments, programming them, and executing them in due course. The streams are focused employing various themes including proximity and mosaic reasoning. In this lecture, I will demonstrate execution of the AD on two examples of discoveries. These examples include different reasoning themes and different communication between the primary and conventional science. Each example consists of a series of thought experiments that turn a piece of the primary science to the conventional one. Those examples include discovery of the Double Helix, the structure of DNA (by Watson and Crick) and discovery of the formulas of differentiation (by Newton and Leibnitz).

04:50pm-06:00pm Lecture 3

University Spin-off in the USA: How We Turned Idea into Reality

In the USA, many research-oriented start-ups are the university spin-offs, i.e., they were originally created within the university's environment. I will describe chronologically the process of creation, survival, and subsequent take-off of such companies on example of STILMAN Advanced Strategies, the company created in 1999 based on my research in Linguistic Geometry, a type of Game Theory (within AI). Intelligent software tools developed at STILMAN for the US Army are currently considered vital for the US national defense. This lecture includes a comparison of roles of investors, competitive government contracts, large businesses, and foreign sources in obtaining working capital for small companies. The emphasis is on the US government system of competitive awards, especially, in defense, including SBIR (Small Business Innovation Research) as well as those from the federal agencies such as DARPA (Defense Advanced Research Agency), AFRL (Air Force Research Laboratory), etc. I will provide details of the relationship of a university and spin-off businesses. Special attention will be paid to the role of customers in developing new problem domains, theoretical ideas, and turning those ideas into working systems.

TUESDAY, September 26

Marine Conference Hall

Alfred Inselberg

Tel Aviv University, Tel Aviv, Israel

aiisreal@post.tau.as.il

02:00pm-02:50pm Lecture 4

03:00pm-03:50pm Lecture 5

04:00pm-04:50pm Lecture 6

Multidimensional Visualization: Part I

The first part is introductory with an *overview* of the subject. *Visualization – Insight from Images*: incorporating our tremendous pattern recognition into the problem solving process. Overview of visualization methodologies. *Parallel Coordinates*: Motivation, point \leftrightarrow line duality in 2-D. The goal is to map multivariate relations into distinct visual 2-dimensional patterns. The patterns for Lines, Hyperplanes and various kinds of Hypersurfaces (Developable, Ruled, Convex, Non-orientable) are presented followed by interactive demonstrations of applications to Air Traffic, Data Mining (Visual and Automatic) and Decision Support.

WEDNESDAY, September 27

Marine Conference Hall

Alfred Inselberg

Tel Aviv University, Tel Aviv, Israel

aiisreal@post.tau.as.il

01:00pm-01:50pm Lecture 7

02:00pm-02:50pm Lecture 8

03:00pm-03:50pm Lecture 9

Multidimensional Visualization: Part II

The second part is foundational and mathematical. The results/theorems are explored in depth discussing the special properties of Parallel Coordinates and how they are used. The representation of linear flats is constructed recursively (in increasing dimension). Then the representation of smooth hypersurfaces is obtained by considering them as envelopes of their tangent hyperplanes. The resulting patterns provide some new geometrical insights. Our intuition, obtained from our 3-dimensional habitation, together with the new representations becomes a laboratory to make conjectures from the picture, in the true spirit of Geometry, and then try to prove a new result. Geometrically based/motivated algorithms like convex hypersurface interior point construction with applications to Intelligent Process Control and elsewhere are presented. Research topics will be pointed out.

Boris Stilman

University of Colorado Denver, Denver, USA

STILMAN Advanced Strategies, USA

www.stilman-strategies.com

04:00pm-05:00pm Lecture 10

05:10pm-06:10pm Lecture 11

The Primary Language III: Discovering No-Search Approach to Opposing Games

This lecture continues a series of lectures on the Primary Language, a Language of Visual Streams (mental movies). The Algorithm of Discovery (AD) is the major algorithm based directly on the Primary Language. In this lecture, the AD is applied to rediscover Linguistic Geometry (LG), a type of game theory that permits solving a class of opposing games by constructing (not searching) the solution and this way avoid combinatorial explosion. This lecture consists of two parts:

The first part includes theoretical account into the LG Game Solving. It includes step-by-step manual execution of the AD to obtain the major result in LG, the so-called No-Search Approach. This Approach shows that LG generates optimal solutions for a class of opposing games without search and demonstrates construction of those solutions. At first, the AD initiates the Terminal Set Expansion, i.e., expansion of the subsets of terminal states into “bubbles,” the larger sets of states. For

each of the states from those bubbles the AD determines a strategy leading to the respective terminal states. Then, it realizes that the bubbles of states permit to decompose the whole game state space into subspaces. This decomposition is implemented via constructing a visual model called a State Space Chart. This Chart is intended to serve as a strategic “geographical map” of the state space by providing guidelines for “travel” from state to state. Then the AD utilizes this Chart for constructing classes of potential strategies for all the opposing sides and for pruning those classes that cannot be implemented for a given problem. Subsequent application of the non-pruned potential strategies leads to construction of the optimal solution – the only real strategy existing in this problem.

The second part includes brief introduction to the LG Game Construction for solving real world defense problems (with a short movie). The LG Game Construction includes construction of the Abstract Board Games (ABG) and the LG Hypergames including abstract boards, abstract pieces, and relations of reachability.

TECHNICAL SESSIONS

MONDAY, September 25, 02:30pm-04:10pm

Technologies Room B537 Chair: Irina Artemieva

02:30pm–02:50pm

Tamara Chistyakova (Saint-Petersburg State Institute of Technology, Saint-Petersburg, Russia),
Roman Makaruk, Ilya Sadykov, Christian Kohlert

Methods and Technologies for Protecting Pharmaceutical Products in Polymer Packaging from Counterfeiting

This article considers the problem of protecting pharmaceutical products with polymer packaging from counterfeiting. This issue has grown vital in almost the entire world, as the significant harm can come not only to the producer, but the legitimate producer, but the consumers as well. Due to this, the issue of protecting these products against forgery, and creating and improving existing approaches to anti-forgery protection, becomes a crucial one. The authors suggest methods and technologies for protecting pharmaceutical products' polymer packaging based on modern ideas from IT and manufacturing such as image recognition, client-server software architecture, mobile apps, digital signatures, luminophores, and PVC film. Testing the authors' approach showed the effectiveness of the presented methods and technologies. The results should be of interest to companies producing pharmaceuticals.

02:50pm-03:10pm

Hao Chen (China University of Mining & Technology, Xuzhou, China),

Shun Yao Yang, Xing Wang, Alexey Shumsky

A Research on Three-phase Grid-Connected Photovoltaic Power Generation System

With the development of world economic and shortage of energy, Research on solar photovoltaic power generation system is of great theoretical and practical significance in alleviating energy and environmental problems, improving the energy consumption structure and the performance of distributed generation systems. Under this background, this paper focus on the three-phase grid-connected photovoltaic power generation system, in the terms of hardware system design, control algorithm and system simulation. In this paper, module of three-phase grid-connected photovoltaic power generation system is established. A variable step-size maximum power point tracking control strategy is proposed. And a control algorithm named double d-q axis phase-locked loop is proposed. Simulation is verified in the form of hardware.

03:10pm-03:30pm

Jing Zhi Lim (Chuo University, Tokyo, Japan),

Hisashi Suzuki, Shuichi Utsugi, Hitoshi Katai

Experimental Development of a Multi-View Stereo Endoscope System

This paper reports on developing experimentally a multi-view stereo endoscope system that reconstructs once 3D data from each stereo image handled in the medical field, enhances the 3D data, and renders a set of multi-view images being available to an arbitrary multi-view glasses-free 3D display in contrast to a conventional stereo endoscope system being unavailable to multi-view displays. The developed system is similar to a CT reconstructing 3D data but is different in the respects that the former inputs one-shot stereo images with visible light to observe the surface of object in real-time while the latter inputs multidirectional projections with X-ray to observe the inside of object in non-real-time.

03:30pm-03:50pm

Georgi Martinov (Moscow State Technological University "STANKIN", Moscow, Russia),

Liliya Martinova

Automation Of Machine-Building Production According To Industry 4.0

Low-priced individual goods are sought-after, which creates demand for resource-effective technologies and sustainably developing industry. Machine maintenance is performed according to machine builders' regulations, while digital technologies offer approaches, based on on-line monitoring, diagnosing of equipment and comparing data with standards, set at the start-up stage. The computer numerical control (CNC) application, digital oscilloscope, monitoring servo-drives allows canceling scheduled irrelevant machine downtime.

03:50pm-04:10pm

Larisa Ginis (Southern Federal University, Taganrog, Russia),

Larisa Gordienko, Sergey Levoniuk

Aircraft & Space Interfaces Testing with National Instruments Equipment

Special interfaces for remote sensing aircraft & satellite on-board equipment information exchange are widely applied today. Aircrafts & space interfaces features, input-output modules testing application, testing virtual instruments and the testing process are described. The article discusses the National Instruments equipment for aircraft & space interfaces testing.

02:30pm-02:50pm

Sergey Bobkov (Federal State Institution "Scientific Research Institute for System Analysis" RAS, Moscow, Russia)

Microprocessors KOMDIV for High-Performance Embedded Systems

The problems of creating of high-performance embedded computing systems based on microprocessors KOMDIV is considered. Processor performance is dependent upon three characteristics: clock cycle, clock cycles per instruction, and instruction count. These characteristics for microprocessors KOMDIV are optimized using parameter performance/power consumption and requirements of embedded systems.

02:50pm-03:10pm

Sergey Chernyshev (Bauman Moscow State Technical University, Moscow, Russia)

Algorithm of Restore Shape of the Object from the Reflected UWB Signal

Algorithm of reconstructing the shape of the object from the reflected UWB signal based on the mentioned reflections developed. This algorithm uses a discrete model of the object and allows to determine the wave reflection coefficients of local inhomogeneities which completely determine the shape of the object.

03:10pm-03:30pm

Sheheryar Khan (City University of Hong Kong, Kowloon Tong, Hong Kong),

Guoxia Xu, Hong Yan

Tensor Learning using N-mode SVD for Dynamic Background Modelling and Subtraction

Background modelling and subtraction is an essential component in motion analysis with wide range of applications in computer vision, whereas the task becomes more challenging in context of complex scenarios such as dynamic backgrounds. In this paper, we address the problem of modelling dynamic backgrounds in online tensor leaning framework. We use Tucker decomposition to model the spatio-temporal correlation of video background. To facilitate the online execution of foreground detection, we incrementally update the subspace factor matrices and core tensor by using the N-mode SVD. For the upcoming frame, the estimate of new basis matrix is updated, whereas the contents from last observation are removed. Similarity measure based on pixel values is carried out to produce the foreground mask. Visual analysis on video datasets has revealed that the proposed approach is well suited against dynamically varying backgrounds. Our quantitative results show that the proposed strategy is superior to state-of-the-art methods.

03:30pm-03:50pm

Maria Mikheyenkova (Federal Research Center "Computer Science and Control" RAS, Moscow, Russia),

Victor Finn

Cognitive Sociology from the Knowledge Discovery Point of View

The means of cognitive heuristics formalization that realize the inductive strategies of empirical sociological research are presented in the work. The generation of hypotheses on behavior determinants, empirical regularities detection in expanding empirical data and studying the social individuals' cognitive effects are considered to be the knowledge discovery in cognitive sociology. The JSM Method of automated support for scientific research is proved to be the knowledge discovery instrument.

03:50pm-04:10pm

Michael Zabezhalo (Federal Research Center "Computer Science and Control" RAS, Moscow, Russia),

Victor Finn

Intelligent Data Analysis and Machine Learning: Are They Really Equivalent Concepts?

Some specific features of modern Artificial Intelligence (AI) technologies are discussed. Intelligent Data Analysis (IDA), defined as data analysis by means of computer intelligent systems (more formal – reasoning systems), is in focus of our discussion. We compare effectiveness of classical Machine Learning (ML) and IDA in extraction of empirical laws (i.e. stable empirical regularities - dependencies) from open collections of experimental data – i.e. in so called knowledge discovery (KD) problems. We'll demonstrate (by examples of applications of JSM Method of automated support for scientific research) that IDA is more general concept than classical ML. Some new IDA-based abilities to improve effectiveness of AI-technologies in important applications are presented.

02:30pm-02:50pm

Irina Bolodurina (Orenburg State University, Orenburg, Russia),

Denis Parfenov

The Development and Study of the Methods and Algorithms for the Classification of Data Flows of Cloud Applications in the Network of the Virtual Data Center

This paper represents the results of the research, which have allowed us to develop a hybrid approach to the processing, classification, and control of traffic routes. The approach enables to identify traffic flows in the virtual data center in real-time systems. Our solution is based on the methods of data mining and machine learning, which enable to classify traffic more accurately according to more criteria and parameters. As a practical result, the paper represents the algorithmic solution of the classification of the traffic flows of cloud applications and services embodied in a module for the controller of the software-defined network. This solution enables to increase the efficiency of handling user requests to cloud applications and reduce the response time, which has a positive effect on the quality of service in the network of the virtual data center.

02:50pm-03:10pm

Philip Moskalenko (Institute for Automation and Control Processes FEB RAS, Vladivostok, Russia),

Valeria Gribova, Alexander Kleshev, Vadim Timchenko, Leonid Fedorischev, Elena Shalfeeva

The IACPaaS Cloud Platform: Features and Perspectives

Main features, functionality and perspectives of the IACPaaS platform are described. The platform provides three models of cloud services: PaaS, SaaS, and DaaS. It is intended for development of intelligent services and services with complex-structured data on the basis of several technologies.

03:10pm-03:30pm

Alexander Shumilov (Matrosov Institute for System Dynamics and Control Theory SB RAS, Irkutsk, Russia),

Igor Bychkov, Gennady Rugnikov, Roman Fedorov

Services and Cloud Infrastructure to Support Interdisciplinary Scientific Research

The problem of open information exchange substantiates the perspective of SOA paradigm for the creation of infrastructure that supports interdisciplinary research. The infrastructure solves problems of service and data cataloging, publication and multi user editing of data, deployment and execution of services and their compositions. The developed infrastructure effectively utilizes resources, adapts to environment changes and solves problems in biology, geography and ecology sciences.

03:30pm-03:50pm

Andrew Ponomarev (St. Petersburg Institute for Informatics and Automation RAS, St. Petersburg, Russia),

Alexander Smirnov, Nikolay Shilov,

Ontology-Driven Human-Computer Cloud for Decision Support

The paper discusses a novel cloud architecture that unifies different types of resources (hardware, software and human) and leverages them for decision support. One of the distinctive features of the proposed cloud architecture is extensive use of ontological models and ontology-driven inference techniques. This paper describes some of the core ontological models used in human computer cloud and the ways they are used to deliver value for all stakeholders of the human-computer cloud environment. Tourism is among application domains that may especially benefit from this human-computer cloud as today's tourism applications heavily rely both on human and computer information processing and standardization of this processing via cloud interfaces will greatly simplify the creation of tourism decision support services.

03:50pm-04:10pm

Dmitry Krasnov (Far Eastern State University, Vladivostok, Russia),

Valeria Gribova, Margaret Petryaeva, Dmitry Okun, Alexey Tarasov, George Ostrovsky

Software Toolkit for Creating Intelligent Systems in Practical and Educational Medicine

The article considers a specialized cloud toolkit for development of medical expert systems and computer simulators. A special feature of the toolkit is usage of specialized ontologies for formation of knowledge bases and databases for diagnosis and treatment of diseases that do not depend on the area of medicine, and which can be reused for different types of intelligent systems (expert systems and simulators).

MONDAY, September 25, 04:40pm-06:00pm

Technologies

Room B537

Chair: Ilya Tikhomirov

04:40pm-05:00pm

Aleksey Filippov (Ulyanovsk State Technical University, Ulyanovsk, Russia),

Nadezhda Yarushkina, Vadim Moshkin

Application of the fuzzy knowledge base in the construction of expert systems

This article describes a formal model of the fuzzy knowledge base based on the analysis of contexts of the subject area. Also, the article describes the architecture of the fuzzy knowledge base. In addition, the article describes application of the knowledge base model in developing an expert system for diagnosing the level of development children of early age.

05:00pm-05:20pm

Alexander Murygin (Siberian State Aerospace University, Krasnoyarsk, Russia),

Vadim Tynchenko, Valeriy Laptенок, Olesya Emilova, Yuriy Seregin

Development of an Automated Information System for Controlling the Induction Soldering of Aluminum Alloys Waveguide Paths

Automated technology and specialized equipment for induction soldering of spacecraft aluminum alloy waveguide path are presented. The equipment is controlled from the industrial computer by the information from pyrometers, which control the process temperature. The automated system software provides workpiece heating control and temperature stabilization in a narrow temperature range. Developed bank of technological regimes provides soldering process registration and documentation.

05:20pm-05:40pm

Konstantin Mironov (Ufa State Aviation Technical University, Ufa, Russia),

Nafisa Yusupova, Gouzel Shakhmametova, Valery Mironov, Rustem Zulkarneev

Statistical and Intelligent Methods of Medical Data Processing

The new approach to the medical, in particular, the toxicological data analysis is considered. For the data processing multilevel system realization the three-stage technique for data analysis is offered what allows to reach the comprehension about the data structure, to extract patterns, to get new, unknown knowledge, and also to increase the data analysis process efficiency. The results of the research are discussed.

05:40pm-06:00pm

Oleg Amosov (Komsomolsk-na-Amure State Technical University, Komsomolsk-na-Amure, Russia),

Svetlana Baena

Design Concept of the Intelligent Information and Telecommunication System of University Security

The design concept of intelligence information and telecommunication system for the university complex safety of new generation is offered. Problems of objects reliable protection, the access control for natural persons and technical objects, the ensuring information security are solved. Technologies of the neural network and fuzzy approach, swarm intelligence, expert systems, video content analysis, simultaneous localization and mapping, fractal and wavelet analysis are used.

Intelligent Computing Room B552 Chair: Olga Klimenko

04:40pm-05:00pm

Oleg Neretin (Federal Institute of Industrial Property, Moscow, Russia)

Creation of Tools for Scientific and Educational Organizations for Identification and Clarification of the Scientific and Technological Priorities Based on the Search and Analysis of Patent Data

Patent data search system PatScape gives access to more than 100 million patent documents through special effective user interface designed as an analytic tool. This tool provides analytic representation of patent information helping to clarify priorities of science and technology and also to identify prospective directions of research basing on the analysis of patent data and patenting areas in Russia and abroad. The system was designed by Federal Institute of Industrial property (Russia) for Russian research and educational organizations.

05:00pm-05:20pm

Roman Senchenko (The National University of Science and Technology MISiS, Moscow, Russia),

Nina Krapukhina

Multi-Agent Simulation Modelling with Intellectual Agents for City Traffic Control

This work suggests an approach to developing a traffic control system based on a multi-agent model of a road network. The intellectual agents flow in simulation model is adjusted in real time mode based on the data from standard video systems. The agents in the model describe their intellectual cooperation, and reflects the dynamics and system qualities of the real traffic flows. The regulation decisions are made as a result of the series of calculation experiments in real time mode.

05:20pm-05:40pm

Irina Timina (Ulyanovsk State Technical University, Ulyanovsk, Russia),

Eugene Egov, Nadezhda Yarushkina, Dmitry Yashin

The Use of the Aggregator for Choosing the Method of Forecasting Time Series

In this paper, we propose an approach to optimizing the solution of the problem of forecasting time series. Optimization of the solution consists in using an aggregator to select the forecasting methods that will give the best forecast. When choosing methods, the time series features are taken into account. The aggregator uses methods of machine learning to select methods. The aggregator is built into the information system "Combination of fuzzy and exponential models".

05:40pm-06:00pm

Nikolay Kamenov (National University of Science and Technology MISIS, Moscow, Russia),

Nina Krapukhina

A Method for Predicting Vehicles Motion Based on Road Scene Reconstruction and Neural Networks in Real Time

The suggested method helps predicting vehicles movement in order to give the driver more time to react and avoid collisions on roads. The algorithm is dynamically modelling the road scene around the vehicle based on the data from the on-board camera. All moving objects are monitored and represented by the dynamic model on a 2D map. After analyzing every object's movement, the algorithm predicts its possible behavior.

Ontologies Room B626 Chair: Nafisa Yusupova

04:40pm-05:00pm

Alexander Fridman (Institute for Informatics and Mathematical Modelling KSC RAS, Apatity, Russia),

Irina Artemieva

Ontologies in the Automation Problem for Situational Modelling

The automation problem is considered for development of situational systems to model dynamic hierarchical spatial complexes (DHSC) under the guidance of a set of ontologies. The novelty of the proposed approach consists in automated semantic search for particular models of DHSC components in a specialized sector of the Internet, their correct automatic connection to the general model of DHSC with analysis of completeness and consistency for the obtained model. Compared to prototypes, the developed model allows detailing the link control up to each material or information signal transferred among DHSC elements. This raises description adequacy of links among object components and decidability control at branching links among model elements. The successful completion of the introduced procedures of correctness analysis assures possibility to automatically generate correct job specifications for simulation performance. The given paper mostly presents matters of the model consistency checks.

05:00pm-05:20pm

Liudmila Massel (Melentiev Energy Systems Institute SB RAS, Irkutsk, Russia)

Fractal Approach to Constructing Ontological Knowledge Space

The article describes the fractal approach proposed by the author for structuring of knowledge broadly used for developing ontological knowledge space, primarily in the field of energy. The methodological concept of the fractal information space and that of fractal stratified (FS) model have been introduced, and mathematical descriptions have been provided. The application of fractal approach was exemplified by constructing information technologies and ontological knowledge space within the energy sector. In addition, the paper offers the examples of ontologies.

05:20pm-05:40pm

Alexander Stolbov (Matrosov Institute for System Dynamics and Control Theory SB RAS, Irkutsk, Russia),

Nikita Dorodnykh, Aleksandr Yurin

Ontology Driven Development of Rule-Based Expert Systems

An ontology-driven development process of rule-based expert systems and knowledge bases is described. The process is based on a redefined approach, namely, a model-driven development (MDD). The main feature of the proposed process is the use of ontology as a computation-independent model (CIM). At the same time, ontology is created by analyzing the conceptual models of a subject domain, in particular, UML class diagrams presented in XML-based formats. The Rule Visual Modeling Language (RVML) is used as the extension of a UML for the development of a platform-independent and platform-specific models, and also the C language integrated production system (CLIPS) is used as the target platform. The formalized descriptions of the approach stages and model transformations are considered. The approach proposed allows one: to eliminate programming errors through the automatic code generation; to reduce a time of identification, conceptualization, and formalization stages due to the use of ontologies. The Knowledge Base Development System (KBDS) and the Personal Knowledge Base Designer (PKBD) implement processes and algorithms described and they intend for the rapid development of prototypes of rule-based expert systems and knowledge bases.

05:40pm-06:00pm

Arseniy Bapanov (L.N. Gumilyov Eurasian National University, Astana, Kazakhstan),

Anatolii Fedotov, Jamalbek Tussupov, Olga Fedotova

The Creation of Information Model of Digital Library for Supporting Scientific and Educational Activity

The work is dedicated to the creation of information model of digital library for supporting scientific and educational activity. The information needs of modern users and data objects, which describe basic entities of the scientific information space such as the publication of document, person, dictionary entry, function and user, also the relationships between them are discussed.

TUESDAY, September 26, 02:00pm-03:20pm

Technologies

Meeting Room №1 (Building B, Level 5)

Chair: Devid Tien

02:00pm-02:20pm

Natalia Filatova (Tver State Technical University, Tver, Russia),

Konstantin Sidorov, Pavel Shemaev, Igor Rebrun

Emotion and Cognitive Activity Monitoring System

The paper describes a system that provides registration of speech responses and involuntary reactions as EEG signals during the perception of emotional stimuli, as well as decision-making in the process of forming accessory functions by assessing the color or the size of the object. As a mathematical apparatus, the authors use nonlinear methods for analyzing phase trajectories, reconstructing attractors and constructing fractal dimensions. The paper also describes the experiments with cognitive tasks.

02:20pm-02:40pm

Vadim Tynchenko (Siberian Federal University, Krasnoyarsk, Russia),

Valeriya Tynchenko, Vladimir Bukhtoyarov, Evgeniy Agafonov

Decision Support System for Designing an Effective Configuration of a Computing Network for Distributed Complex Problem Solving

The problem of choosing an effective configuration of computer network for parallel solution of complex problem is discussed. An automated decision support system is proposed for designing a computer network based on the theory of mass service theory and the evolutionary approach. The results of solving the practical task of forming the structure of the computing network confirm the effectiveness of the proposed decision support system.

02:40pm-03:00pm

Alexey Hmelnov (Matrosov Institute for System Dynamics and Control Theory SB RAS, Irkutsk, Russia),

Igor Bychkov, Evgeniy Fereferov, Gennadiy Rugnikov, Andrey Gachenko

Methods for Automation of Development of Information Systems Using Specifications of Database Applications

The approach is based upon declarative specifications of database applications (SDA). The specifications of database applications contain all the information about database structure, which is required to build a typical AIS (automated information system). The information is represented in its pure form, so the specifications are rather concise. The AIS'es are implemented using general algorithms, which are directed by the specifications. We have developed algorithms for such tasks as: user interface generation, query building, report generation, GIS interaction. Using the specifications of database applications and the algorithms the software system GeoARM was implemented. The technology considered was well-trying by use of the system GeoARM for development of several dozens of true-life AIS for different purposes.

03:00pm-03:20pm

Yuliya Bidulya (Tyumen State University, Tyumen, Russia)

An approach to the Development of Software for Effective Search of Scientific Articles

The paper considers a method of information retrieval of scientific articles. Search engine users often find it difficult to formulate a query using a proper terms related to the research area. We propose an approach, in which the system does not modify the user's query but analyses the articles using natural language processing methods and adds semantically similar articles to the initial set of documents. The system for the article search was developed and tested on the collection of 280 scientific articles.

Intelligent Computing

Room B552

Chair: Alexander Fridman

02:00pm-02:20pm

Boris Paliukh (Tver State Technical University, Tver, Russia),

Alexander Vetrov, Irina Emelyanova

Diagnostics and State Analysis of Multiple-stage Production in Terms of Evolution Management

The scheme of effective management of multiple-stage production evolution based on adaptive processes is regarded. Model of process management architecture is described as multi-agent system where agents interact with each other and with centerpoint. It is proposed here to set a task on identification of current problems related to improvement of agents performance and of production system in general. The diagnosis and analysis procedure of engineering and manufacturing system current state in terms of its effectiveness and competitiveness by methods of interval analysis and evidence theory is settle down.

02:20pm-02:40pm

Alexander Eremeev (National Research University “Moscow Power Engineering Institute” Moscow, Russia),

Sergey Ivliev, Vladimir Vagin

Using NoSQL Databases and Machine Learning for Implementation of Intelligent Decision System in Complex Vision

One of the most important fields of decision support system development is processing medical data for helping experts to make decision in the case of complex pathologies. In generally, a system for storing data and a decision module is main parts of these systems, what that is the reason why is very important to create systems, which can handle medical and expert information, that can be presented in various types and forms. One of the decision in this case is combining methods of machine learning and NoSQL databases.

02:40pm-03:00pm

Ilya Tikhomirov (Federal Research Center “Computer Science and Control” RAS, Moscow, Russia),

Ivan Khramoin, Margarita Kamenskaya, Natalya Toganova

Sentiment Analysis of Innovations in Russian Media

The paper presents the sentiment analysis based algorithm for evaluation of public's attitude to innovations. Domain-dependent corpus for training algorithm was created. More than 200 000 articles from Russian mass media devoted to innovations were analyzed. Results of analysis represented as set of histogram. Conclusions and future work are given.

03:00pm-03:20pm

Igor Semaev (University of Bergen, Bergen, Norway),

Experimental Study of DIGIPASS GO3 and the Security of Authentication

Based on the analysis of 6-digit one-time passwords (OTP) generated by DIGIPASS GO3 we were able to reconstruct the synchronization system of the token, the OTP generating algorithm and the verification protocol in details necessary for an attack. The OTPs are more predictable than expected. A forgery attack is described. We argue the attack success probability is much higher than it may be expected if all the digits are independently and uniformly distributed. The implications for the security of authentication are discussed and open questions are formulated.

Ontologies Room B626 Chair: Maria Mikheyenkova

02:00pm-02:20pm

Yury Zagorulko (A.P. Ershov Institute of Informatics Systems SB RAS, Novosibirsk, Russia),

Olesya Borovikova, Galina Zagorulko

Methodology for the Development of Ontologies for Thematic Intelligent Scientific Internet Resources

The paper presents the methodology used to develop ontologies for thematic intelligent scientific Internet resources (ISIR). ISIR provide content-based access to systematized scientific knowledge and information resources of a certain field of knowledge, as well as to the information processing and analysis facilities related to this field. Ontology is used in ISIR not only to formalize, describe and systematize heterogeneous knowledge and resources, but also to organize convenient access to them. Building ontologies that have these properties is a very complex and time-consuming process. To facilitate it, we have proposed a methodology that includes a set of techniques and patterns of ontology development, as well as an original method for constructing the ontology of the thematic ISIR on the basis of a representative set of base ontologies. The application of this methodology is demonstrated on the example of developing ontology for the ISIR on decision support.

02:20pm-02:40pm

Nafisa Yusupova (Ufa State Aviation Technical University, Ufa, Russia),

Olga Smetanina, Aygul Agadullina, Ekaterina Rassadnikova

The Development of Ontologies to Support the Decisions in Production Systems Management

The article involves the analysis of the known ontologies for solving the problems in production systems management. It describes the developed ontology integration at the semantic level of data from databases of different industry information systems to support the management decisions, to use knowledge bases to support the decisions in logistics and environmental management, to ensure the general terminology for many professionals and shared applications.

02:40pm-03:00pm

Gleb Guskov (Ulyanovsk State Technical University, Ulyanovsk, Russia),

Alexey Namestnikov, Nadezhda Yarushkina

The System of Searching Similar Software Projects, Based on the Ontology Constructed by UML Metascheme and Design Patterns

The description of the system for the searching similar program solutions for software project or module was proposed in this paper. The search is performed under the project architecture in order to abstract from the implementation. The

UML meta-scheme is used to represent the project architecture. Design templates are used as generally accepted software design solutions. To perform a search among projects, it is necessary to store UML diagrams with their semantics, ontologies in OWL format are suitable for this. Search can be carried out among projects from public repositories and organizations internal repositories. The initial data for the search are the class diagram of the developing project and the names of the public libraries structural elements. The paper describes the structure and description of ontology on the basis of which the system was built. The rules, nuances and examples of the transformation of the architectural solution into ontology are given. An example of the proposed approach to the problem of finding architectural solutions for integration with the public service API is considered. The paper contains an analysis of the results and directions for further research.

03:00pm-03:20pm

Alexander Kirillovich (Kazan (Volga Region) Federal University, Kazan, Russia),
Olga Nevzorova, Vladimir Nevzorov

A Syntactic Method of Extracting Terms from Special Texts for Replenishing Domain Ontologies

Natural Language Processing (NLP) is one of the principal areas of artificial intelligence. It can be argued that the use of ontologies increases the efficiency of natural language processing. However, most ontologies are built manually and require a lot of work. Thus, the problem of automated ontology replenishment is very relevant. One approach is to develop methods for replenishing ontologies using NLP for specific texts of a certain area. We applied the developed method of replenishing the OntoMathPro mathematical ontology, by extracting new terminology from mathematical documents. We developed a method for processing complex syntactic structures (structures with coordination reduction). The method includes certain rule schemata, conditions under which they are to be applied, and conditions determining the sequence of subtrees for which they are to be performed. In our studies, we investigated typical coordination models for mathematical works and performed experiments with a big mathematical collection.

TUESDAY, September 26, 03:50pm-05:10pm

Technologies Meeting Room №1 (Building B, Level 5) Chair: Michael Zabezhailo

03:50pm-04:10pm

Olga Klimenko (Institute of Computational Technologies SB RAS, Novosibirsk, Russia),
Matthias Dehmer, Alexey Medvedev, Yuri Shokin, Andrey Dobrynin, Elena Konstantinova, Elena Rychkova, Andrei Vesnin

Analysis of Webspaces of the Siberian Branch of the Russian Academy of Sciences and the Fraunhofer-Gesellschaft

In this paper, two webspaces of academic institutions of the Siberian Branch of Russian Academy of Sciences (SB RAS) and of the Fraunhofer-Gesellschaft (FG), Germany, will be investigated. The webspaces are represented by directed graphs possessing vertices corresponding to websites. An arc connects two vertices if there exists at least one hyperlink between the corresponding websites. Webometrics is used for ranking the websites of SB RAS and FG. We discuss numerical results when studying the websites structurally. In particular, we examine scientific communities of the underlying websites representing directed graphs and draw important conclusions.

04:10pm-04:30pm

Ivan Tarkhanov (Federal Research Center “Computer Science and Control” RAS, Moscow, Russia)

Access Control Model for Collaborative Environments in ECM

This research is dedicated to the examination of collaboration problems in industrial enterprise content management (ECM) systems. In the article we try to define how collaboration is organized during simultaneous use of documents, files and other securable objects and how the well-known problems of access control are solved. In the first part of the article several popular ECM systems are analyzed and classified by the storage methods for object versions and special issues of access control. It was found out that the existing systems do not allow to simultaneously grant permissions to every version of an object and to provide a user-friendly centralized access control with consideration to the relation with processes and tasks in ECM. Then the model which solves this problem and which is implemented in Evfrat system is described. In the end the relevance of this model to the general requirements for collaborative environments is disputed and the model is compared to other models.

04:30pm-04:50pm

Georgy Dorrer (Siberian State Aerospace University, Krasnoyarsk, Russia),
Sergey Yarovoy

Use Of Agent-Based Modeling For Wildfire Situations Simulation

An agent-based method of wildfire situation modeling suggested. Agent-based approach allows to describe the interaction of a large number of actors in the process of fire propagation and firefighting: directly wildfire, fire crews, machinery, air tools and others. In the work presented the contour of fire edge is approximate with a set of A-agents, each of them modeled an elementary burning fuel range. Moving these agents described with the Hamilton-Jacobi equations and realized with help the movable grid numerical algorithm. Agents of other type – B-agents describe the process of fire

extinguishing. On the basis of this model worked out the software system, which may be useful for wildfire management and firefighting personnel training.

04:50pm-05:10pm

Sergey Krasnopeyev (Pacific Geographical Institute FEB RAS, Vladivostok, Russia),
Evgeniy Shulkin, Sergey Pashinskiy

The System of Spatial Interpretation of Hydrological Information for Automated Information System of Hydrological Monitoring and Data Management of PRIMHYDROMET

The system of spatial interpretation of hydrological and thematic information has been developed. The purpose of the system: spatial interpretation of hydrological and thematic information, predictive results of mathematical modeling of the currents and possible zones of flooding; interaction and data exchange with the program of hydrodynamic modeling of river currents «STREAM_2D»; publication of spatial data using the interoperable geospatial Web services, hourly updating of observed hydrometeorological parameters: water level, consumption of water, precipitation, air temperature.

Intelligent Computing Room B552 Chair: Liudmila Massel

03:50pm-04:10pm

Boris Paliukh (Tver State Technical University, Tver, Russia),
Valery Kemaykin, Yuliya Kozlova

Development Principles of Knowledge Database of Intelligent System for Estimation of Dynamical Interaction of Orbital Systems with Space Debris

In the paper, a principles underlying the construction of an intelligent information system estimated results of the dynamic interaction of orbital systems with space debris is presented. It describes the knowledge database model based on these principles which is the synthesis of theoretical and practical information in the field of estimating the high-speed interaction of objects.

04:10pm-04:30pm

Alexander Ereemeev (National Research University “Moscow Power Engineering Institute” Moscow, Russia),

Roman Alekhin, Pavel Varshavsky, Anton Kozhevnikov

Application of the Case-based Reasoning Approach for Identification of Acoustic-emission Control Signals of Complex Technical Objects

The work is devoted to the problem of developing a case-based reasoning module, capable of performing identification and filtration of data, obtained during acoustic emission control of complex technical objects. The application of case-based reasoning approach for identifying and filtering noise (non-standard, distorted) signals is considered. The parametric case representation is proposed to solve this problem.

04:30pm-04:50pm

Gennady Vinogradov (Tver State Technical University, Tver, Russia),
Nadezhda Kirsanova

Modeling of Subjective Choice in an Uncertain and Poorly Structured Environment

The paper considers a relevant problem of creating a strategy (model) of economic and social system development, which uses its members' information interaction mechanisms. A midpoint of such interaction is formation of compatible representations of aims, limitations, requirements, possibilities and directions for development. The paper shows that formulation of a strategy attains a special educational form in the context of semi structured, poorly formalized external environment with high degree of uncertainty organization. This educational forms should be based on the combination of casual (cause-effect) and theological (determined by aims, conceptual, realism) vision of the future and directions for development. The role of an executive management involves strategic training process control in the field where new strategies might appear and develop. Such controls should be based on understanding how a retrospective way of thinking leads to new options and choice of useful representations of a choice situation, how motivating factors and a value system affects choice processes, etc. These facts define the goal of the paper, which is focused on developing an approach to creating a model of choice of an agent, which forms its evolution aims endogenously, structures the environment and creates subjective representations of the desired future.

04:50pm-05:10pm

Anatolii Shoberg (Pacific National University, Khabarovsk, Russia),
Kirill Shoberg

Variants of Block Frequency Transform for Image Retrieval

An accelerated growth of digital media collections has established the need for development of tools for efficient access and retrieval of visual information. The paper presents different variants of block frequency transform to form an array of features for a quick search. Our approach is to perform block frequency transform with elements of invariance for certain rotation angles. We show three main variants macroblock forming. Two variants have different kinds. Mathematical definitions are presented. Graphic views of different macroblock types for discrete cosine transform are showed. A comparison of three

transform variants with rotation at different angles is made and presented. It performed in frequency and spatial domains. The execution time does not increase. This approach can be used in various fields related to data processing, data transfer, etc.

Ontologies **Room B626** **Chair: Natalia Filatova**

03:50pm-04:10pm

Vadim Moshkin (Ulyanovsk State Technical University, Ulyanovsk, Russia),

Anton Zarubin, Albina Koval, Aleksey Filippov

Fuzzy Ontology-Based Approach to Analyzing the Free-form Answers

Open-ended questions are questions that allow someone to give a free-form answer. Analysis and evaluation of answers to open-ended questions requires automation. Experts who develop standards of free-form answers use uncertain information. Uncertainty may appear in cases of synonymy, polysemy, insufficiency or redundancy of the object description. Therefore, fuzziness is the most common type of uncertainty in activities related to the evaluation of answers to open-ended questions. This paper describes the methodology for evaluating free-form answers using knowledge discovery methods. Methods of knowledge discovery consider the uncertainty and fuzziness in the answers to open-ended questions.

04:10pm-04:30pm

Aleksei Massel (Melentiev Energy Systems Institute SB RAS, Irkutsk, Russia),

Vadim Tiuriumin

Integration of Situation Semantic Models Based on Ontology System

Integration method of semantic modeling technologies based on ontology system, which describes basic concepts and relations, is proposed. Those concepts systematization and classification from the point of view of contingency management and subject domain is performed. The designed ontology-driven knowledge domain will allow to develop specifications and automated transition rules between semantic models.

04:30pm-04:50pm

Ludmila Braginskaya (Institute of Computational Mathematics and Mathematical Geophysics SB RAS, Novosibirsk, Russia),

Valery Kovalevsky, Andrey Grigoryuk, Galina Zagorulko

Ontological Approach to Information Support of Investigations in Active Seismology

The principles of organizing a scientific information system on active seismology, providing a holistic view of the subject area and various aspects of scientific activity are considered in the work. The ontology of the subject area "Active seismology" was used as a conceptual basis and information model.

04:50pm-05:10pm

Bato Merdygeev (East Siberia State University of Technology and Management, Ulan-Ude City, Russia),

Sesegma Dambaeva

The Criteria of Ontology Quality Analysis Based on Formal Concept Analysis

Paper presents an approach to analysis of domain ontology quality and criteria of analysis method based on approach. The approach allows to evaluate the completeness of the ontology relations. We use concept lattice of Formal Concept Analysis for evaluation of ontology relation structure.

WEDNESDAY, September 27, 01:00pm-02:40pm

Technologies **Meeting Room №1 (Building B, Level 5)** **Chair: Boris Paliukh**

01:00pm-01:20pm

Georgi Martinov (Moscow State Technological University "STANKIN", Moscow, Russia),

Sergei Grigoriev

An approach to Creation of Terminal Clients in CNC System

To facilitate the maintenance of large machines with working area of several meters, one equips them with additional terminals, as well as a supplementary remote handler. A practical approach to develop operator terminals, specialized panels and remote handlers, implemented as CNC kernel clients, is suggested. The control transfer mechanism is implemented. Examples of creating a multi-terminal solution for turning-milling machine and a web client for performing remote monitoring and controlling of a CNC machine are provided.

01:20pm-01:40pm

Denis Migov (Institute of Computational Mathematics and Mathematical Geophysics SB RAS, Russia)

Parallel Methods for Network Reliability Calculation and Cumulative Updating of Network Reliability Bounds

We consider the problem of all-terminal network reliability calculation for a network with unreliable communication links and perfectly reliable nodes. This problem is known to be NP-hard. Based on the well-known factoring method, we introduce a parallel method for network reliability calculation. Another approach we study is a cumulative updating of lower and upper bounds of network reliability for faster feasibility decision. Parallel implementation of this method is proposed, which allows deciding the feasibility of a given network without performing exhaustive calculation. The analysis of the numerical experiments allowed us to set some important parameters of the parallel algorithms for speeding up calculations.

01:40pm-02:00pm

Aigerim Yerimbetova (Novosibirsk State University, Novosibirsk, Russia),

Feodor Murzin, Saule Sagnayeva, Jamalbek Tussupov

Creation of Tools and Algorithms for Assessing the Relevance of Documents

In this paper we present development of new linguistic and algorithmic support of information retrieval technologies in information retrieval systems taking into account syntax and elements of semantics, including for Turkic texts. Namely, the goal is that the developing technologies allow the information retrieval systems to be able to compare them with the revised variants of the proposals, based on the analysis of their syntactic structures.

02:00pm-02:20pm

Karina Shakhgelyan (Vladivostok State University of Economics, Vladivostok, Russia),

Dmitriy Gmar, Marina Ermolitskaya, Boris Geltser

Using Machine Learning to Assess Efficiency of Tuberculosis Service

The purpose of the study was to assess the impact of the availability of TB care on the TB epidemic process. Processing and analysis were performed using methods of machine learning: cluster analysis, linear regression analysis and autoregressive models. It is shown that clusters with the severe epidemic situation are characterized by low staff availability in all its indicators and vice versa. The staff availability of TB care is the most important factor affecting the TB process.

02:20pm-02:40pm

Leonid Fedorischev (Institute of Automation and Control Processes FEB RAS, Vladivostok, Russia),

Valeria Gribova, Ying-Hao Chu

Control of Virtual Scenes

The article describes a concept and a tool for development and control of professional virtual environments. Control of the virtual environment logical model is based on a new extended ontology of professional virtual environments. A technology of control of 3D scenes is realized on the basis of a presentation model of the virtual environment. A mechanism of creation and control of specific functions for processing virtual environments is presented. A process of interpreting and launching a virtual environment taking into account the verification of its integrity is described.

Intelligent Computing

Room B552

Chair: Aleksei Massel

01:00pm-01:20pm

Aleksey Sapunkov (Ulyanovsk State Technical University, Ulyanovsk, Russia),

Tatyana Afanasieva, Alexander Afanasiev

Software of Time Series Forecasting based on Combinations of Fuzzy and Statistical Models

The developed software is a web application with open access and is aimed on forecasting of time series stored in database. We proposed approach of time series forecasting, combined ARIMA models with fuzzy techniques: three fuzzy time series models, fuzzy transformation (F-transform) and ACL-scale. Applications of a proposed web service have demonstrated efficiency in practical time series predictions with suitable accuracy.

01:20pm-01:40pm

Vladimir Kuzmin (Melentiev Energy Systems Institute SB RAS, Irkutsk, Russia),

Liudmila Massel

Situation Calculus Application in Tasks of Intelligent Decision-Making Support

The basic concepts of situational calculus are considered. The architecture of the intelligent decision support system (Situation polygon) for strategy development in the energy sector is presented. It is based on the use of situational management concept and semantic modeling. The possibility of applying situational calculus is illustrated on the example one of the main components of the Situation Polygon - Contingency management language (CML).

01:40pm-02:00pm

Alexander Fridman (Institute for Informatics and Mathematical Modelling KSC RAS, Apatity, Russia),

Boris Kulik

Logic-Probabilistic Analysis of Information with Uncertainties

Besides using logic-probabilistic analysis for probabilistic estimation itself, it is often necessary to consider uncertain or underdetermined information of different nature expressed in the following forms: interval estimates, lists of possible options, hypothetical or possibilistic statements, etc. This article discusses methods of logic and logic-probabilistic analysis of uncertain data and knowledge by means of n-tuple algebra the authors have developed earlier.

02:00pm-02:20pm

Vyacheslav Khachumov (Peoples' Friendship University of Russia, Moscow, Russia),

Vitaly Fralenko, Maria Shustova, Mikhail Khachumov

Isolation and Tracking of Transplanted Mesenchymal Stem Cells on MRI Images

The problems of automatic isolation and tracking of mesenchymal stem cells transplanted into the brain of experimental animals are considered. The experiments were performed on a series of images of the observed magnetic resonance imaging cut. The task of tracking is executed by constructing shells for the sets of stem cells allocated to the sequence of images. Trajectories connecting the corresponding central points of shells are carried out using special parametric Bézier curves.

02:20pm-02:40pm

Aleksey Senkov (Moscow Power Engineering Institute, Smolensk branch, Smolensk, Russia),

Mikhael Margolin

Modeling of Fuzzy Business Processes in Solving Operational Planning Tasks

The article proposes a new approach to modeling fuzzy business processes, that combines the advantages of existing ones and expanding their capabilities by simultaneously assessing the characteristics of the business process results, the reliability of these results, and assessing the time during which they were obtained.

Ontologies **Meeting Room №4 (Building A, Level 4)** **Chair: Yury Zagorulko**

01:00pm-01:20pm

Andrew Ponomarev (St. Petersburg Institute for Informatics and Automation RAS, St. Petersburg, Russia),

Alexander Smirnov, Tatiana Levashova, Alexey Kashevnik

Ontology-Based Resource Interoperability in Socio-Cyber-Physical Systems

The paper proposes a core ontology of socio-cyber-physical systems for resource interoperability. The ontology comprises the main concepts and relationships which are identified as relevant to model such systems. The approach considers a socio-cyber-physical system comprising cyber space, physical space, and mental space. In the ontology, these spaces are represented by sets of resources. The ontology provides the resources with a common vocabulary to share information and services and therefore makes these resources interoperable. The core ontology is specialized for a socio-cyber-physical system embedded in robotics domain. Technology of online communities is proposed to be used for resource communication.

01:20pm-01:40pm

Alex Kopaygorodsky (Energy Systems Institute SB RAS, Irkutsk, Russia)

Ontology-Based Decision Support System for Forecasting of Energy Infrastructure Development

This article reports the approach and software tools for decision support in forecasting the energy infrastructure development. Support of expert activity is based on using the ontological hybrid approach to describing the expert knowledge. The Intelligent Information Environment stores descriptions in a declarative explicit form. The software tools enrich the knowledge warehouse via mapping new knowledge elements with the existing ontology model.

01:40pm-02:00pm

Sergey Afonin (M.V. Lomonosov Moscow State University, Moscow, Russia),

Ontology Models for Access Control Systems

Modern software systems require complex fine-grained access control policies that can not be implemented in terms of the classical role-based access control (RBAC) model. In this paper we argue the necessity of conceptual modeling for developing a flexible, readable and concise attribute-based access control policies. In the proposed approach the access control rules are associated with domain specific concepts, that are mapped to the underlying data model.

02:00pm-02:20pm

Evgeny Lipachev (Kazan (Volga Region) Federal University, Kazan, Russia),

Alexander Elizarov, Shamil Khaydarov

Scientific Documents Ontologies for Semantic Representation of Digital Libraries

We present a system of services for the automatic processing of collections of scientific documents that are part of digital libraries. These services are based on ontologies for scientific documents representation, as well as on methods for semantic analysis of mathematical documents. The developed tools automatically check validity of documents for compliance with manuscript guidelines, convert these documents into required formats and generate their metadata.

02:20pm-02:40pm

Valentina Chernyavskaya (Vladivostok State University of Economics and Service, Vladivostok, Russia),

Oksana Kulikova

Ontology-Based Model of Object Field Concerning Individual's Capabilities for Self-Development

The subject of the research is the processes of individual self-development. The aim of the study is to build an ontology-based model of these processes. While constructing the ontology-based model we used Carl Wiig's methodology. Due to the research we singled out the levels in the conceptual apparatus of the investigated field, introduced new concepts that determine the opportunity to predict the abilities development, depending on external factors and internal resources of the individual.

WEDNESDAY, September 27, 03:10pm-04:30pm

Technologies Meeting Room №1 (Building B, Level 5) Chair: Philip Moskalenko

03:10pm-03:30pm

Nikolai Stepanov (Vladivostok State University of Economics, Vladivostok, Russia),

Karina Shakhgeldyan, Boris Geltser

The Use of Big Data for Extraction and Processing of Statistical Data of the Private Healthcare Sector

The article deals with the development of technology for extraction and processing of statistical information of private sector of regional healthcare. The concept of data mining from various sources in the Internet, methods of extraction and integration of information about medical organizations of private sector of regional healthcare are presented.

03:30pm-03:50pm

Anna Doronicheva (Institution of Science Computing Center FEB RAS, Khabarovsk, Russia),

Sergei Savin

WEB-Technology for Medical Images Segmentation

In work is described practical using of WEB-technology for segmentation and analysis tasks of medical image. Progress in the development of bioinformatics and mathematical methods in biomedicine, as well as the development of computer and telecommunications systems and networks determines the look of the present and future of medical technology and of medicine in general. At last years of one of the directions of development of cloud, computing technologies in high-tech-medicine is a processing the digital image: improvement of quality of image, recovering image, its recognition of separate elements. Recognition of pathological processes is one of the most important problems of processing the medical image. By now, a number of standards for medical imaging have been developed. By analogy with CAD/CAM systems (computer aided design and computer aided manufacturing) for technical applications, CAD (computer-aided diagnosis) systems are being developed for medical purposes. Some of them are already successfully operating, but to date these systems are only «assistants» of a diagnostician who takes decisions. CAD algorithms for medical imaging systems typically include image segmentation, the selection of some objects of interest («masses»), their analysis, parametric description of the selected objects and their classification.

03:50pm-04:10pm

Vladimir Kim (Far Eastern Federal University, Ussuriisk, Russia)

The Model of Informatization of the Russian Society

The article deals with the construction of regression models describing the processes of informatization of society in Russia. For creation of mathematical models data of Russian Longitudinal Monitoring Survey Higher School of Economics have been used. The constructed models carry both linear, and nonlinear character. Growth rates of use of the Internet for work and for training linearly grow with a speed of 2,5% annually.

04:10pm-04:40pm

Andrey Velichko (Institute for Automation and Control Processes FEB RAS, Vladivostok, Russia),

Valeriya Gribova, Leonid Fedorishchev

Simulation Software for Multicommodity Flows Model of Interregional Trade

The paper defines a multi-commodity network flow equilibrium approach. The "gravity" model is used for the transportation costs. The model is reduced to the nonlinear optimization. A software toolkit is realized for interactive modeling

and result visualization. The simulation module is implemented on a high-performance server platform, control and visualization modules are implemented on the IACPaaS cloud platform. Asynchronous http-queries are used for interaction between the platforms. For data exchange between the modules a declarative model in the JSON format is developed. It consists of three main types of objects: products, zones and communications. The paper demonstrates a practical use of the software for the simulation of inter-regional traffic in the Far East region of Russia.

Intelligent Computing **Room B552** **Chair: Alex Kopaygorodsky**

03:10pm-03:30pm

Vyacheslav Khachumov (Peoples' Friendship University of Russia, Moscow, Russia),
Mikhail Khachumov

The problem of target capturing by a group of unmanned flight vehicles under wind disturbances

This paper considers the game-theoretic pursuit-evasion problem, where a group of pursuers is required to capture a moving target in airspace in the conditions of random perturbing wind actions. As participants of the game we assume the unmanned flight vehicles (FVs), which mathematical models are determined by transfer functions that describe the double-circuit control system with autopilot and settings providing necessary stability of the flight. Behavioral strategies of all participants of the antagonistic game for a case when the speed of the evader is higher than the speed of the pursuers are suggested. Situations with different outcomes that are typical for the considered pursuit-evasion problem are modelled in the experimental part of the paper.

03:30pm-03:50pm

Petr Polezhaev (Orenburg State University, Orenburg, Russia),
Alexander Shukhman, Leonid Legashev, Yury Ushakov, Irina Bolodurina

Ant Colony Optimization Algorithm for Building Virtual Machine Images in Cloud Systems

The paper describes the development of an efficient algorithm for building virtual machine (VM) images in a cloud educational resource datacenter (CERD) providing remote shared access for educational institutions to software packages. In this paper the problem of time optimization for building VM images with limited server disk capacity is formalized. This problem is reduced to the Steiner problem for directed graphs. We have developed the efficient algorithm for building VM images based on ant colony optimization. Comparing the developed algorithm with the greedy algorithm we find that its solutions very effective for the proposed problem.

03:50pm-04:10pm

Roman Fedorov (Matrosov Institute for System Dynamics and Control Theory SB RAS Irkutsk, Russia),

Igor Bychkov, Gennadiy Rugnikov, Yuri Avramenko

Object Identification on Raster Images by User query

Currently, most software systems designed to identify objects on raster images are focused on identifying a rigid class of objects. Often for real-world tasks, the capabilities of software systems are not enough. One of the ways to solve the problem is to perform identification in accordance with the user query. The development and implementation of the method for identifying objects on raster images based on the user's knowledge is proposed.

04:10pm-04:50pm

Evgeny Lipachev (Kazan (Volga Region) Federal University, Kazan, Russia),

Alexander Kirillovich, Alexander Elizarov, Olga Nevzorova

Semantic Formula Search in Digital Mathematical Libraries

We are presenting semantic methods of search for mathematical objects in scientific publications. In particular, methods of search for mathematical formulas, as well as methods based on the logical structure of mathematical documents, are being discussed here. Based on the digital mathematical library Lobachevskii DML, created at Kazan Federal University in 2017, declared as Lobachevsky Year, we developed and tested new methods of search in digital collections of mathematical documents.

FRIDAY, September 29, 10:00am-11:40am

Technologies **Meeting Room №1 (Building B, Level 5)** **Chair: Andrey Velichko**

10:00am-10:20am

Roman Kuznetsov (Institute for Automation and Control Processes FEB RAS, Vladivostok, Russia),

Eugene Voloshin, Valeri Chipulis

The Achievements of Information Technology in the Russian Far East Heat Power Industry

The problems of energy efficiency and the prospects of information systems in the heat power industry are considered. Particular attention is paid to the framework for development of information and analytical systems. The applications of innovative information and analytical systems designed to improve reliability and energy savings are shown.

10:20am-10:40am

Dmitry Nazarov (Institute of Automation and Control Processes FEB RAS, Vladivostok, Russia),

Oleg Abramov

A Software System for Acceptability Region Construction and Analysis

This paper describes a software system for acceptability regions construction, analysis and using during engineering systems design. Acceptability region construction and utilization algorithms require high performance techniques, parallel computations, and cloud services providing data storage and computational resources. Components of the software system and their interaction are described in this work

10:40am-11:00am

Larisa Rodionova (Pacific State Medical University, Vladivostok, Russia),

Natalia Plekhova, Vera Nevzorova, Tatiana Brodskaya, Valentin Shumatov, Kirill Grunberg, Sergey Dolzhikov

Scale of Binary Variables for Predicting Cardiovascular Risk

The transforming of regression model development cardiovascular diseases difficult for apply in practical medicine into a more simplified version of scale is shown. This included the determination of predictors disease; categorization and inclusion in the regression model with optimal scaling and coefficient for subsequent calculation of importance; plotting regression dependence of theoretical probability investigated variable; selection of threshold value.

11:00am-11:20am

Aleksandr Eremenko (Institute of Automation and Control Processes FEB RAS, Vladivostok, Russia),

Anatoly Aleksanin, Marina Aleksanina, Pavel Babyak

Parallel Processing Computation of Marker Movement Velocities on Satellite Images

The approach for velocities computation of marker movements on a sequence of satellite images was developed. The first peculiarity of the approach is in the usage of autocorrelation function for analysis of templates with markers to reject the incorrect vectors. The second peculiarity of the approach is in the usage of new criterion of template similarity. The method was verified on computation of velocities for ice drifting, surface currents and cloud movements. The mass calculation of marker movement velocities on satellite images were organized on the principles of parallelizing by MPI.

11:20am-11:40am

Tatiana Kopus (Far Eastern Federal University, Ussuriisk, Russia),

Olga Zhigalova

Reimagine Teacher Training for Performing in Information-Oriented Society (FabLab)

The changes in today's society have great impact on teacher training system in higher education. A graduate is to be ready to manage learning and teaching in highly technological, excessively informative and dynamic educational environment. New approaches to teacher training and delivery are aimed at creating facilities contributing to high level of teachers' ICT competency, their experience in project activities and creative thinking. The article describes the results of implementing FabLab (Students' Project Bureau "Centre for Interactive Learning") in teacher training at Far Eastern Federal University (School of Education). The article is focused on the delivery models of the FabLab as well as on its benefits in the system of teacher preparation.

Intelligent Computing

Room B552

Chair: Alexey Tarasov

10:00am-10:20am

Andrey Klimenko (National Research Tomsk Polytechnic University, Tomsk, Russia),

Igor Nadezhdin, Flavio Manenti, Alexey Goryunov

Dynamic Simulation of Uranyl Nitrate Crystallization Process

The paper addresses the dynamic modeling of the uranyl nitrate crystallization process. The paper is filling the gap of the current literature in the regeneration of nuclear fuel, improvement of the process understanding, and future needs in controllability and operability for safety purposes to obtain a final product of the process in the pure state. Basing on the existing kinetic studies on uranium crystallization, a novel mathematical model of the uranyl nitrate crystallization process is proposed describing the heat and mass transfer phenomena. Sensitivity analyses are provided for the prediction of the main outlet parameters of the crystallization process and to improve the process design for enhanced operational flexibility.

10:20am-10:40am

Aleksandr Fedorets (Far Eastern Federal University, Vladivostok, Russia),

Evgeny Pustovalov, Evgeny Modin, Vladimir Tkachev, Vladimir Plotnikov

Regularities in the Disordered Atomic Structure of Rapidly Quenched Amorphous Cobalt-Based Alloys

Research presents regularities investigation in the atomic structure of amorphous rapidly quenched Co₅₈Ni₁₀Fe₅Si₁₁B₁₆ at.% alloys. The alloys were quenched on a copper wheel with a linear surface velocity from 22 to 38 m/s. We found nonlinear dependence of local atomic ordering from linear velocity of cooling wheel. Average lateral density of ordered atomic clusters of 5 nm size changes from 4% to 8%. This approach can be used to determine the best technological parameters for preparing amorphous metallic alloy with metastable structure.

10:40am-11:00am

Alexandr Stolbov (Matrosov Institute for System Dynamics and Control Theory SB RAS, Irkutsk, Russia),

Olga Nikolaychuk, Alexandr Pavlov

Web-oriented Software System for Agent-Based Modeling Driven by Declarative Specification of Implementation Process

The article discusses information models for describing the typical elements and software tools used for development of agent-based simulation models, including the inference and the simulation engine. Step-by-step specification formation method of the agent model driven by the domain ontology is proposed. A web-oriented software system was developed to approbate the method. It is provided implementation of that specification based on an extensible toolkit, for example Jess and Madkit.

11:00am-11:20am

Maksim Kutsenko (Pacific National University, Khabarovsk, Russia),

Valery Ovcharuk

Features of Spectral Analysis Methods Application for Solving Problems of Acoustic Emission Signals Processing

The article describes main problems of the acoustic-emission method of nondestructive testing. A comparative evaluation of the efficiency of acoustic emission signals parameters is carried out. This work is underlined inadequacy of spectral analysis methods in a narrow frequency band. As an example, the results of spectral analysis of acoustic emission signals are given. On the base of this, the necessity of using spectral analysis to increase the reliability of the results is substantiated.

11:20am-11:40am

Yuriy Ivanov (Komsomolsk-na-Amure State Technical University, Komsomolsk-on-Amur, Russia),

Oleg Amosov, Sergey Zhiganov

Semantic Video Segmentation with Using Ensemble of Particular Classifiers and a Deep Neural Network for Systems of Detecting Abnormal Situations

A new approach based on the use of a deep neural network and an ensemble of particular classifiers is proposed. This approach is based on use of the novel block of fuzzy generalization for combines classes of objects into semantic groups, each of which corresponds to one or more particular classifiers. As result of processing, the sequence of frames is converted into the annotation of the event occurring in the video for a certain time interval.

FRIDAY, September 29, 12:10pm-01:50pm

Technologies

Meeting Room №1 (Building B, Level 5)

Chair: Alexander Eremeev

12:10pm- 12:30pm

Sergey Melman (Institute of Automation and Control Processes FEB RAS, Vladivostok, Russia),

Valery Bobkov, Alexey Kudryashov, Vladimir May

Image-Based Navigation of Autonomous Underwater Robot and 3D Reconstruction of Environment

An approach to solving the problem of navigation an autonomous underwater robot by video stream in the conditions of local maneuvering is described. The approach is based on the using of the visual odometry method by stereo images and a virtual network for coordinate referencing. To increase the accuracy of the calculation of local movements of the robot, an original algorithm for tracing features on images taking into account past frames is proposed. The proposed method for solving the problem of 3D reconstruction of environment objects from images is described also.

12:30pm-12:50pm

Evgeniy Chusovitin (Institute of Automation and Control Processes FEB RAS, Vladivostok, Russia),

Semyon Balagan, Dmitry Goroshko, Olga Goroshko

Universal Algorithm for Scanning Probe Microscopy Images Grain Analysis of Objects on the Surface

Currently, scanning probe microscopy (SPM) is actively used to obtain surface data. A large number of images require a fast and high-accuracy calculation of the topographic parameters of particles on the surface. The original grain analysis algorithm based on finding a local maximum is realized by sorting an array of points forming the topography of the SPM image surface. It provides to determine various topographic characteristics of objects located on a surface (height, lateral dimensions, area, volume, etc.)

12:50pm-01:10pm

Denis Leontyev (Institute of Automation and Control Processes FEB RAS, Vladivostok, Russia),

Dmitry Kharitonov, Georgiy Tarasov

Imperative Programs Behavior Simulation in Terms of Compositional Petri Nets

The article considers a generation mechanism of compositional models simulating imperative programs behavior in terms of Petri nets. The mechanism of program models generation consists of two main stages. At the first stage, the structure of the program is prepared using such program elements like: libraries, functions and links between functions. At the second stage, the content of function bodies is generated on the base of template constructions. In the article some semantic constructions template examples of imperative programming language with their descriptions are given, and a generation example of a program model in terms of Petri nets is demonstrated.

01:10pm-01:30pm

Kseniya Dyuldina (Vladivostok State University of Economics and Service, Vladivostok, Russia),

Dmitriy Gmar, Sergey Snopko, Karina Shakhgeldyan, Vladimir Kryukov

Indoor Navigation Service Based On Wi-Fi Positioning

The paper provides a review of the in-building positioning algorithm based on the wireless access point signal and the elaboration of the mobile application providing indoor navigation. The research highlights the positioning algorithm through matching mobile devices data to the reference image signal. With the algorithm in use, the Location Based Service (LBS) provides in real time operation tracing of a mobile user with a location-aware application.

01:30pm-01:50pm

Elena Shalfeeva (Institute of Automation and Control Processes FEB RAS, Vladivostok, Russia),

Valeria Gribova, Alexander Kleshev, Philip Moskalenko, Vadim Timchenko, Leonid Fedorischev, Evgeny Zamburg

Technology for the Development of Intelligent Service Shells Based on Extended Generative Graph Grammars

A technology for development of intelligent service shells on the IACPaaS cloud platform is presented. It is based on extended generative graph grammars. Each one defines a set of information units in the form of a marked hierarchical digraph generated by it. The extension is represented by an information unit where correspondences of software agents and vertexes of the grammar are set. The technology is intended to reduce labor intensity and time of intelligent services development.

Intelligent Computing

Room B552

Chair: Leonid Fedorischev

12:10pm-12:30pm

Maksim Kenzin (Matrosov Institute for System Dynamics and Control Theory SB RAS, Irkutsk, Russia),

Igor Bychkov, Nikolay Maksimkin

Task Allocation and Path Planning for Network of Autonomous Underwater Vehicles

Cooperative multi-objective missions for connected heterogeneous groups of autonomous underwater vehicles are highly complex operations and it is an important and challenging problem to effectively route these vehicles in dynamic environment under given communication constraints. We propose a solution for the task allocation and path planning problems based on the evolutionary algorithms that allows one to obtain feasible group routes ensuring well-timed accomplishment of all objectives.

12:30pm-12:50pm

Daria Gaskova (Melentiev Energy Systems Institute SB RAS, Irkutsk, Russia),

Aleksei Massel

Intelligent System for Risk of Cybersecurity Violations Identification in Energy Facility

The article describes risk-based approach using for analysis threats and risk assessment of cybersecurity violations in energy facilities. Risk-based approach considers harm by damage or destruction of object using quantitative and qualitative parameters based on probability of damage or destruction of object leading to cascading failure. The proposed approach can be implemented to development system information-analytical system used for monitoring of cybersecurity violations in energy sector.

12:50pm-01:10pm

Sergey Ul'yanov (Matrosov Institute for System Dynamics and Control Theory SB RAS, Irkutsk, Russia),

Igor Bychkov, Artem Davydov, Nadezhda Nagul

Hybrid Control Approach to Multi-AUV System in a Surveillance Mission

Surveillance missions for multiple autonomous underwater vehicle (AUV) system suggest the use of different modes of operation including organizing and keeping a predefined formation, avoiding obstacles, reaching static and tracking dynamic targets. While exploiting a leader-follower strategy to formation control and the vector Lyapunov function method to controller design, we use discrete-event approach and supervisory control theory to switch between operational modes.

01:10pm-01:30pm

Dmitry Malyshev (Belgorod State Technological University n.a. V.G. Shukhov, Belgorod, Russia),

Sergey Khalapyan, Larisa Rybak, Elena Gaponenko

Intelligent Computing Based on Neural Network Model in Problems of Kinematics and Control of Parallel

Implementation of a closed-loop control system for a parallel robot is rather difficult due to impossibility of a mechanism output link position direct detection. In order to overcome this, a direct kinematics problem should be solved according to states of the mechanism drive links. However, such approach application requires a solution of a system of nonlinear equations. It is even more complicated for mechanisms with ambiguity of such solution. In this paper, we propose a method to determine the "correct" solution of the direct kinematics problem for such mechanisms using a tripod, a robot with three degrees of freedom, as an example. The method is based on artificial neural networks usage. The data of the mobile platform previous position are used as networks input information. In this paper, it is shown that in this case the adequacy of the obtained neural network based model is sufficiently improved since the neighborhood is defined, where the "correct" solution is located. As a result, both the reliability of the output link position determination and positioning speed and accuracy are improved. The obtained neural network based model can be directly used for the tripod control, and the method to develop this model can be used to synthesize models of other parallel robots.

01:30pm-01:50pm

Vladimir Mochalov (Institute of Cosmophysical Research and Radio Wave Propagation FEB RAS, Kamchatka region, Paratunka, Russia),

Anastasia Mochalova

Evaluation of the Similarity Coefficient of the Ontosemantic Graphs and its Application for the Problem of Question-Answering Search

The paper proposes an algorithm for the operation of the natural language question-answering system based on construction of supposed answers and comparison of the corresponding ontosemantic graphs with the ontosemantic graphs constructed on the interrogative sentence that is submitted to the system input. An algorithm for calculating the similarity coefficient of ontosemantic graphs is proposed. Examples illustrating the operation of the described algorithms are given through the paper.