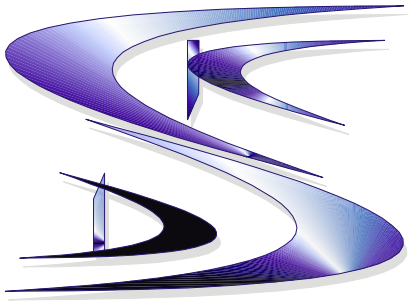
XI-th International Conference

Knowledge-Dialogue-Solution

June 20-30, 2005, Varna (Bulgaria)



A B S T R A C T S

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Gladun V.P., Kr.K. Markov, A.F. Voloshin, Kr.M. Ivanova (editors)

Abstracts of the XI-th International Conference “Knowledge-Dialogue-Solution”, Varna, 2005

The XI-th International Conference “Knowledge-Dialogue-Solution” (KDS 2005) continues the series of annual international KDS events organized by Association of Developers and Users of Intelligent Systems (ADUIS).

The conference is traditionally devoted to discussion of current research and applications regarding three basic directions of intelligent systems development: knowledge processing, natural language interface, and decision making.

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Preface

The scientific Eleventh International Conference “Knowledge-Dialogue-Solution” took place in June, 20-30, 2005 in Varna, Bulgaria.

The Conference continues the series of international scientific meetings, which were initiated more than fifteen years ago. It is organized owing to initiative of ADUIS - Association of Developers and Users of Intelligent Systems (Ukraine), Institute of Information Theories and Applications FOI ITHEA, (Bulgaria), and IJ ITA - International Journal on Information Theories and Applications, which have long-term experience of collaboration.

Now we can affirm that the international conferences “Knowledge-Dialogue-Solution” in a great degree contributed to preservation and development of the scientific potential in the East Europe.

The conference is traditionally devoted to discussion of current research and applications regarding three basic directions of intelligent systems development: knowledge processing, natural language interface, and decision making.

The basic approach, which characterizes presented investigations, consists in the preferential use of logical and linguistic models. This is one of the main approaches uniting investigations in Artificial Intelligence.

The organization of the papers in KDS-2005 is based on specialized sessions. They are

1. Cognitive Modelling
2. Data Mining and Knowledge Discovery
3. Decision Making
4. Intelligent Technologies in Control, Design and Scientific Research
5. Mathematical Foundations of AI
6. Neural and Growing Networks
7. Philosophy and Methodology of Informatics

The official languages of the Conference are English and Russian.

Sections are in alphabetical order. The sequence of the papers in the sections has been proposed by the corresponded chairs and is thematically based.

The Conference is sponsored by FOI Bulgaria (www.foibg.com).

We appreciate the contribution of the members of the KDS 2005 Program Committee.

On behalf of all the conference participants we would like to express our sincere thanks to everybody who helped to make conference success and especially to Kr.Ivanova, I.Mitov, N.Fesenko and V.Velichko.

V.P. Gladun, A.F. Voloshin, Kr.K. Markov

Section 1. Cognitive Modelling

Концептуальное представление об опознании образов и решении проблем в памяти человека и возможностях его использования в искусственном интеллекте

З.Л. Рабинович

Данное кибернетическое представление выработано на основании сведений из нейрофизиологии, нейропсихологии, нейрокибернетики, а также правдоподобных гипотез автора, восполняющих их недостаток. Прежде всего, уделено внимание общим принципам организации памяти в мозге и происходящим в ней процессам, реализующие такие психические функции как восприятие и идентификация входной образной информации и как решение проблем, задаваемой исходной и целевой ситуацией. Реализация второй функции, собственно мыслительной, рассматривается в аспектах образного и языкового мышления на уровнях интуиции и осознания. Высказываются соображения о целесообразности и принципах бионического подхода в создании соответствующих средств искусственного интеллекта.

Ключевые слова: образ, восприятие, опознание, решение, генератор проблем, осознание, интуиция.

Новое содержание в старых понятиях: К пониманию механизмов мышления и сознания

Геннадий С. Воронков

The work is written in the form of glossary. Its extended papers discuss the pairs of notions comprising the problem of the brain: thinking and consciousness, consciousness and sensation, mind and consciousness, model and information. The author is developing the approach, based on the paradigm ”The brain as neuron model”, which introduces the new content in these notions.

Keywords: thinking, consciousness, mind, sensation, model, information.

Формирование нейронных элементов в обонятельной коре: обучение путем прорастания

Геннадий С. Воронков, Владимир А. Изотов

The computer model is offered to describe the formation of selective connections of the olfactory bulb neurons (OB-network) with the olfactory cortex neurons (OC-network) during sensory training. The model is based on the previously constructed computer model of the olfactory epithelium (OE) – OB. The process includes the growth of axons from OB-network into OC-network and the establishment the conjunctional input between OB and OC neurons. Supposedly, the simulated process approximately reflects the natural process in OB-OC. Likewise, the work concerns some conceptual questions related to the information representation and processing in the olfactory and other sensory systems, in particular, the "combinatorial explosion " problem.

Keywords: computer modelling, olfactory cortex, learning via axon growth, "combinatorial explosion" problem.

Mathematical and Computer Modelling and Research of Cognitive Processes in Human Brain. Part I. System Compositional Approach to Modelling and Research of Natural Hierarchical Neuron Networks. Development of Computer Tools

Yuriy A. Byelov, Sergiy V. Tkachuk, Roman V. Iamborak

System compositional approach to modelling and research of informational processes, which take place in biological hierarchical neuron networks, is being discussed. A number of computer tools have been successfully developed for solution of tasks from this domain. A raw of computational experiments, investigating the work of these tools for olfactory bulb model, has been conducted. The common-known psycho-physical phenomena have been reproduced in experiments.

Keywords: system compositional approach, mathematical and computer modelling, elementary sensorium, hierarchical neuron networks, computer tools, olfactory bulb.

Mathematical and Computer Modelling and Research of Cognitive Processes in Human Brain. Part II. Applying of Computer Toolbox to Modelling of Perception and Recognition of Mental Pattern by the Example of Odor Information Processing

Yuriy A. Byelov, Sergiy V. Tkachuk, Roman V. Iamborak

Results of numerical experiments are introduced. Experiments were carried out by computer simulation on olfactory bulb for the purpose of checking of thinking mechanisms conceptual model, introduced in [1]. Key role of quasisymbol neurons in processes of pattern identification, existence of mental view, functions of cyclic connections between symbol and quasisymbol neurons as short-term memory, important role of synaptic plasticity in learning processes are confirmed numerically. Correctness of fundamental ideas put to base of conceptual model is confirmed on olfactory bulb at quantitative level.

Keywords: thinking phenomena, olfactory bulb, numerical experimentation, model, neuronal network.

О моделировании образного мышления в компьютерных технологиях: общие закономерности мышления

Юрий Валькман, Вячеслав Быков

This study considers the problems of modelling the creative image thinking in field of computer technologies. Special attention concentrates on representation of general thinking rules in knowledge bases of intelligent system. Such rules are well-known to psychologists, but specialists in computer sciences are less familiar with these matter. The paper to a greater extent is directed to initialize the discussions on the stated problem with indicating the main topics of subjects.

Keywords: Image, thinking, computer technology, artificial intelligence.

Модели биоритмов взаимодействия

Степан Г. Золкин

Models of associative connections of functional sites of a bark of a brain of the person are described during processing the touch information.

Keywords: a robotics, models, associative connections

Section 2. Data Mining and Knowledge Discovery

Автоматизация процессов построения онтологий

Николай Г. Загоруйко, Владимир Д. Гусев, Александр В. Завертайлов, Сергей П. Ковалёв, Андрей М. Налётов, Наталия В. Саломатина

Аннотация: Описывается проект инструментальной системы “OntoGRID” для автоматизации построения онтологий предметных областей с использованием GRID–технологий и анализа текстов на естественном языке. Рассматривается содержание и текущее состояние разрабатываемых блоков системы “OntoGRID**”.**

Ключевые слова: онтология, лингвистический процессор, пирамидальные Q-сети, GRID сети.

Application of the Multivariate Prediction Method to Time Series

Tatyana Stupina, Gennady Lbov

An approach to solving the problem of heterogeneous multivariate time series analysis with respect to the sample size is considered in this paper. The criterion of prediction multivariate heterogeneous variable is used in this approach. For the fixed complexities of probability distribution and logical decision function class the properties of this criterion are presented.

Keywords: the prediction of multivariate heterogeneous variable, multivariate time series, the complexity of distribution.

К определению интеллектуального анализа данных

Ксения А. Найденова

В работе рассматриваются ключевые проблемы интеллектуального анализа данных, анализируется содержание термина «интеллектуальный анализ данных (ИАД). Показывается роль методов машинного обучения для извлечения концептуальных знаний из данных. Рассматривается абстракция данных как метод формирования знаний. Взаимосвязь между базами данных и средствами машинного обучения выделяется как ключевая проблема реализации ИАД.

Ключевые слова: интеллектуальный анализ данных, машинное обучение, machine learning, извлечение знаний из данных, data mining.

The Development of the Generalization Algorithm based on the Rough Set Theory

M. Fomina, A. Kulikov, V. Vagin

This paper considers the problem of concept generalization in decision-making systems where such features of real-world databases as large size, incompleteness and inconsistence of the stored information are taken into account. The methods of the rough set theory (like lower and upper approximations, positive regions and reducts) are used for the solving of this problem. The new discretization algorithm of the continuous attributes is proposed. It essentially increases an overall performance of generalization algorithms and can be applied to processing of real value attributes in large data tables. Also the search algorithm of the significant attributes combined with a stage of discretization is developed. It allows avoiding splitting of continuous domains of insignificant attributes into intervals.

Keywords: knowledge acquisition, knowledge discovery, generalization problem, rough sets, discretization algorithm.

Extreme Situations Prediction by Multidimensional Heterogeneous Time Series Using Logical Decision Functions

Svetlana Nedel'ko

A method for prediction of multidimensional heterogeneous time series using logical decision functions is suggested. The method implements simultaneous prediction of several goal variables. It uses deciding function construction algorithm that performs directed search of some variable space partitioning in class of logical deciding functions. To estimate a deciding function quality the realization of informativity criterion for conditional distribution in goal variables' space is offered. As an indicator of extreme states, an occurrence a transition with small probability is suggested.

Keywords: multidimensional heterogeneous time series analysis, data mining, pattern recognition, classification, statistical robustness, deciding functions.

Co-ordination of Probabilistic Expert's Statements and Sample Analysis in Recognition Problems

Tatyana Luchsheva

Considered in the paper is the method of the recognition problem decision on the base of an empirical information introduced with either probabilistic expert statements, or the sample, or expert statements and the sample simultaneously.

Keywords: pattern recognition, logical regularities, probabilistic expert statements.

Evaluating Misclassification Probability Using Empirical Risk

Victor Nedel'ko

The goal of the paper is to estimate misclassification probability for decision function by training sample. Here are presented results of investigation an empirical risk bias for nearest neighbours, linear and decision tree classifier in comparison with exact bias estimations for a discrete (multinomial) case. This allows to find out how far Vapnik–Chervonenkis risk estimations are off for considered decision function classes and to choose optimal complexity parameters for constructed decision functions. Comparison of linear classifier and decision trees capacities is also performed.

Keywords: pattern recognition, classification, statistical robustness, deciding functions, complexity, capacity, overtraining problem.

SCIT — Ukrainian Supercomputer Project

Valeriy Koval, Sergey Ryabchun, Volodymyr Savyak, Ivan Sergienko, Anatoliy Yakuba

The paper describes a first supercomputer cluster project in Ukraine, its hardware, software and characteristics. The paper shows the performance results received on systems that were built. There are also shortly described software packages made by cluster users that have already made a return of investments into a cluster project.

Keywords: supercomputer, cluster, computer structure.

Discovery of New Knowledge in Structural-predicate Models of Knowledge

Valeriy N. Koval, Yuriy V. Kuk

The effective mathematical method of finding new knowledge of structure of complex objects with required properties is developed. The method comprehensively takes into account the information on properties and relations of the primary objects, which are included in complex objects. It is based on measurement of distances between groups of predicates at their some interpretation. The optimum measure for measurement of these distances with the maximal discernibleness of different groups of predicates is constructed. The method is approved on the decision of a problem of discovery of the new compound possessing electrooptical properties.

Keywords: new knowledge, predicates, measure, complex objects, primary objects, maximal discernibleness.

Cluster Management Processes Organization and Handling

Valeriy Koval, Sergey Ryabchun, Volodymyr Savyak, Anatoliy Yakuba

The paper describes cluster management software and hardware of SCIT supercomputer clusters built in Glushkov Institute of Cybernetics NAS of Ukraine. The paper shows the performance results received on systems that were built and the specific means used to fulfil the goal of performance increase. It should be useful for those scientists and engineers that are practically engaged in a cluster supercomputer systems design, integration and services.

Keywords: cluster, computer system management, computer architecture.

Multi-agent User Behavior Monitoring System Based on Aglets SDK

Alexander Lobunets

The paper describes an experience that was obtained during development of multi-agent system using Java and Aglets SDK. The user behavior monitoring system described in this paper utilizes a neural network classifier for user processes analysis. The overview of the neural classifier is out of the scope of this article. The main issues pointed in this paper include software technology evaluation, agent oriented patterns, usage of UML for software design and brief Aglet API overview. The monitoring system prototype is installed in local area network of IT Department of Space Research Institute NASU-NSAU, Ukraine.

Keywords: neural network, multi-agent system, network security system, user behavior model, intrusion detection system, aglet development.

Development of Educational Ontology for C-Programming

Sergey Sosnovsky, Tatiana Gavrilova

Development of educational ontologies is a step towards creation of sharable and reusable adaptive educational systems. Ontology as a conceptual courseware structure may work as a mind tool for effective teaching and as a visual navigation interface to the learning objects. The paper discusses an approach to the practical ontology development and presents the designed ontology for teaching/learning C programming.

Keywords: Ontology Design, Knowledge, Educational Ontology, C Programming, Ontology Visualization.

How Can Domain Ontologies Relate to One Another?

Alexander S. Kleshchev, Irene L. Artemjeva

Building domain ontologies and applying them to different objectives, researchers faced the fact that many ontologies are associated with one another by one or another relations. Therefore, the problem arose to study relations among different ontologies of the same domains as well as of different ones. A formalization of a relation among domain ontologies is the analogous mathematical relation among mathematical models of these ontologies. The article considers the case when domain ontology model is represented by logical relationship system. Relations among domain ontologies give a possibility to reuse one ontology model when another ontology models are worked out and when new intellectual computer system for same or different domain is worked out.

Keywords: Mathematical model of domain ontology, ontologies representing the same conceptualisation, resemblance between ontologies, simplification of ontologies, composition of ontologies, intellectual task solver.

Development of Procedures of Recognition of Objects with Usage Multisensor Ontology Controlled Instrumental Complex

Alexander Palagin, Victor Peretyatko

The ontological approach to structuring knowledge and the description of data domain of knowledge is considered. It is described tool ontology-controlled complex for research and developments of sensor systems. Some approaches to solution most frequently meeting tasks are considered for creation of the recognition procedures.

Keywords: the tool complex, methods of recognition, ontology.

A concept of the Knowledge Bank on Computer Program Transformations

Margarita A. Knyazeva, Alexander S. Kleshchev

The paper presents basic notions and scientific achievements in the field of program transformations, describes usage of these achievements both in the professional activity (when developing optimizing and unparallelizing compilers) and in the higher education. It also analyzes main problems in this area. The concept of control of program transformation information is introduced in the form of specialized knowledge bank on computer program transformations to support the scientific research, education and professional activity in the field. The tasks that are solved by the knowledge bank are formulated. The paper is intended for experts in the artificial intelligence, optimizing compilation, postgraduates and senior students of corresponding specialties; it may be also interesting for university lecturers and instructors.

Keywords: Knowledge bank; Ontology; Knowledge base; Ontology editor; Database editor; Knowledge processing

Implementation of Various Dialog Types Using an Ontology-based Approach to User Interface Development

Valeriya Gribova

A new method to implementation of various dialog types using an ontology-based approach to user interface development is proposed. The main idea of the approach is to form necessary to the user interface development and implementation information using ontologies and then based on this high-level specification to generate the user interface. To combine various types of dialog (verbal and graphical) in the framework of the same interface two ontologies are suggested, the ontology of the graphical user interface and the ontology of graphical static scenes on a plane.

Keywords: Ontology, interface model, user interface development

Онтологии как перспективное направление интеллектуализации поиска информации в мультиагентных системах е-коммерции

Анатолий Я.Гладун, Юлия В.Рогушина

Предлагается использовать онтологическое представление знаний об интересах покупателя в процессе е-коммерции. Это повышает эффективность поиска наиболее продавцов, наиболее подходящих покупателям, мультиагентными системами. Реализован алгоритм сравнения онтологий покупателей с онтологиями электронных магазинов (таксономий) и мультиагентная система электронной коммерции, использующая онтологии для поиска информации в распределенной среде.

Ключевые слова: онтология, е-коммерция, мультиагентная система.

Implementing Simulation Modules as Generic Components

Anton Kolotaev

In this paper generic programming techniques applicability to build simulation models library is discussed. Policy-based design is proposed for implementation simple simulation modules.

Keywords: generic programming, library design, discrete-event simulation, policy-based design.

Использование Semantic Web технологий при аннотировании программных компонентов

Михаил Рощин, Алла Заболеева-Зотова, Валерий Камаев

В данной статье описывается принципиально новый подход при аннотировании компонентов с использованием логического формализма.

Keywords: Semantic Web, компоненты, моделирование, семантика, логический формализм.

DIAGaRa: An Incremental Algorithm for Inferring Implicative Rules from Examples (Part 1)

Xenia Naidenova

An approach is proposed for inferring implicative logical rules from examples. The concept of a good diagnostic test for a given set of positive examples lies in the basis of this approach. The process of inferring good diagnostic tests is considered as a process of inductive common sense reasoning. The incremental approach to learning algorithms is implemented in an algorithm DIAGaRa for inferring implicative rules from examples.

Keywords: Incremental and non-incremental learning, learning from examples, machine learning, common sense reasoning, inductive inference, good diagnostic test, lattice theory.

DIAGaRa: An Incremental Algorithm for Inferring Implicative Rules from Examples (Part 2)

Xenia Naidenova

An approach is proposed for inferring implicative logical rules from examples. The concept of a good diagnostic test for a given set of positive examples lies in the basis of this approach. The process of inferring good diagnostic tests is considered as a process of inductive common sense reasoning. The incremental approach to learning algorithms is implemented in an algorithm DIAGaRa for inferring implicative rules from examples.

Keywords: Incremental and non-incremental learning, learning from examples, machine learning, common sense reasoning, inductive inference, good diagnostic test, lattice theory.

Программные системы и технологии для интеллектуального анализа данных

Александр Е. Ермаков, Ксения А. Найденова

Работа знакомит с несколькими программными средствами, используемыми для решения задач интеллектуального анализа данных. В первом разделе рассматриваются специализированные пакеты программ, предназначенные для решения различных задач анализа данных, опыт применения которых свидетельствует о перспективности их использования в современных условиях (ОТЭКС, ОМИС и др.). Во втором разделе описываются несколько инструментальных программных систем, помогающих пользователю создавать свои собственные технологии извлечения знаний из данных, адаптированные к различным условиям, данным и целям анализа в конкретных проблемных областях исследования. Приводятся примеры применения прикладных систем анализа данных в медицине.

Ключевые слова: интеллектуальный анализ данных, извлечение знаний из данных

Модуль формирования таблиц соответствия измерительных шкал в подсистеме индуктивного вывода знаний проблемно-ориентированного инструментального средства

Александр Е. Ермаков, Вадим А. Ниткин

Описывается разработанный авторами подход к формированию таблиц соответствия значений первичных и стандартизированных измерительных шкал психологических и физиологических показателей с учетом статистического закона распределения этих значений, реализованный в подсистеме индуктивного вывода знаний проблемно-ориентированного инструментального средства, используемого для автоматизированного создания компьютерных систем психологической и физиологической диагностики. Рассмотрен алгоритм и особенности формирования этих таблиц.

Ключевые слова: стандартизированная шкала, таблица соответствия значений измерительных шкал, процентиль, диагностический показатель, эмпирический закон распределения значений показателя, обучающая выборка значений показателя, критерий нормальности распределения значений показателя

Section 3. Decision Making

О проблемах принятия решений в социально-экономических системах

Алексей Ф. Волошин

Анализируются причины ограниченной применимости моделей принятия решений в социально-экономических системах. Предлагаются 3 основных принципа повышения их адекватности – «локализация» решений, непосредственный учет влияния субъекта на процесс принятия решений («субъективизация объективности») и уменьшение влияния индивидуальных психосоматических характеристик субъекта («объективизация субъективности»). Принципы иллюстрируются на математических моделях принятия решений в эколого-экономических и социальных системах.

Ключевые слова: принятие решений, эколого-экономические и социальные системы, последовательный анализ вариантов, нечеткий анализ, методы экспертного оценивания, коллективное принятие решений, системы поддержки принятия решений.

Оптимальная траектория модели динамического межотраслевого баланса открытой экономики

Игорь Ляшенко, Елена Ляшенко

Дано обобщение классических качественных результатов магистральной теории на случай оптимизационной модели динамического межотраслевого баланса для открытой экономики, когда экспорт и импорт оказываются связанными с выпуском основной продукции, а целевой функционал представляет конечное состояние экономики.

Ключевые слова: Динамический межотраслевой баланс, оптимизационная задача, магистральная теория, открытая экономика, траектория сбалансированного роста.

Нечеткие множества: Аксиома абстракции, статистическая интерпретация, наблюдения нечетких множеств

Владимир С. Донченко

Рассматриваются вопросы, касающиеся определения нечётких множеств, введения аналога аксиомы свёртки, статистической интерпретации и её связи с аксиомой свёртки, наблюдений нечётких множеств

Keywords:нечёткое подмножество, функция принадлежности, теория множеств

Технология классификации электронных документов с использованием теории возмущения псевдообратных матриц

Владимир С. Донченко, Виктория Н. Омардибирова

Предложена технология классификации электронных документов с использованием теории возмущения псевдообратных матриц.

Ключевые слова: классификация, обучающая выборка, псевдообратная матрица,Web Data Mining.

Векторные равновесия во многокритериальных играх

Сергей Мащенко

There are proposed the necessary and sufficiency conditions of the vector Nash's equilibria in multicriterion games.

Keywords: Nash's vector equilibria, multicriterion game.

Эволюционная кластеризация сложных объектов и процессов

Виталий Снитюк

В статье предложен метод кластеризации сложных объектов и процессов, базирующийся на использовании генетического алгоритма. Рассмотрены аспекты его реализации и формирования фитнесс-функции. Представлено решение задачи кластеризации областей Украины по социально-экономическим показателям и осуществлен его сравнительный анализ с результатами классических методов.

Ключевые слова: Кластеризация, генетический алгоритм.

Система качественного прогнозирования на основе нечетких данных и психографии экспертов

А.Ф. Волошин, В.М. Головня, М.В. Панченко

Дается описание системы технологического прогнозирования, основанной на методе дерева решений. Ставится задача сбора и обработки экспертной информации, предлагаются методы ее обработки, которые позволяют учитывать нечеткость информации и разрешают проблему большой размерности, которая возникает при значительном объеме дерева решений. Приводится описание системы диагностики эпилептических заболеваний.

Ключевые слова. Метод дерева решений, нечеткие экспертные данные, поиск оптимальных путей.

Процедуры локализации вектора весовых коэффициентов за обучающими выборками в задаче потребления

Елена В. Дробот

Рассматривается задача индивидуального потребительского выбора на множестве обучающих выборок. Предлагается рассматривать функцию полезности потребителя в виде аддитивной свертки. Для локализации вектора весовых коэффициентов аддитивной свертки предлагаются процедуры, базирующиеся на метрике близости объекта к идеальной точке.

Ключевые слова: теория потребления, функция полезности.

Нечеткие модели многокритериального коллективного выбора

Алексей Ф. Волошин, Николай Н. Маляр

Для многокритериальной задачи с конечным числом альтернатив определяется нечеткая задача достижения "точки удовлетворения лица, принимающего решения"**.** Предлагаются различные типы "точек удовлетворения ЛПР", в качестве функций принадлежности предлагаются различные типы сверток, для выбора которых учитываются психосоматические характеристики экспертов. Задача обобщается на случай принятия коллективного решения.

Ключевые слова: коллективный выбор, многокритериальная оптимизация, нечеткая модель, свертка критериев, точка удовлетворения.

Алгоритм последовательного анализа и отсеивания елементов в задаче определения медианы строгих ранжирований объектов

Павел П. Антосяк, Григорий Н. Гнатиенко

Рассматривается задача нахождения результирующего ранжирования объектов по индивидуальным ранжированиям, заданных экспертами. Предлагается алгоритм, основанный на последовательном анализе вариантов и условии ацикличности решения. Приводятся результаты вычислительного эксперимента.

Ключевые слова: последовательный анализ, результирующее ранжирование.

Один подход к модели теории инвестиционного анализа с учетом фактора нечеткости

Ольга В. Дьякова

Рассматривается классическая модель Гари Марковица, которая используется для формирования оптимального портфеля ценных бумаг; недостатки вероятностного описания прибыльности ценной бумаги и анализируется в качестве такого описания использование теории нечётких множеств; рассматриваются расчетные формулы степени риска неэффективности инвестиций на основании предположения о том, что показатель эффективности инвестиций – треугольное нечёткое число, где коэффициент рассчитывается на основании критического и фактического значений прибыльности портфеля ценных бумаг.

Ключевые слова: принятие решений, степень риска, эффективность инвестиций, нечёткие числа, прибыльность.

Model of Active Monitoring

Sergey Mostovoi, Vasiliy Mostovoi

Active monitoring and problem of non-stable of sound signal parameters in the regime of piling up response signal of environment is under consideration. Math model of testing object by set of weak stationary dynamic actions is offered. The response of structures to the set of signals is under processing for getting important information about object condition in high frequency band. Making decision procedure by using researcher's heuristic and aprioristic knowledge is discussed as well. As an example the result of numerical solution is given.

Keywords: math model, active monitoring, set of weak stationary dynamic actions.

Towards the Problems of an Evaluation of Data Uncertainty in Decision Support Systems

Victor Krissilov, Daria Shabadash

The question of forming aim-oriented description of an object domain of decision support process is outlined. Two main problems of an estimation and evaluation of data and knowledge uncertainty in decision support systems – straight and reverse, are formulated. Three conditions being the formalized criteria of aim-oriented constructing of input, internal and output spaces of some decision support system are proposed. Definitions of appeared and hidden data uncertainties on some measuring scale are given.

Keywords: decision support systems, straight and reverse problems of data uncertainty, three conditions of aim-oriented object domain constructing, appeared and hidden uncertainties.

Применение квалиметрических моделей при решении социально-экономических задач

А. Крисилов, В. Степанов, И. Голяева, Б. Блюхер

В работе описано применение векторной модели, предложенной для оценки сложных объектов, в некоторых задачах социально-экономического мониторинга в Украинском Причерноморье.

Ключевые слова: уровень социально-экономического развития, совокупности признаков, векторная модель, пространство описания, весовые коэффициенты.

Analogous Reasoning for Intelligent Decision Support Systems

A.P. Eremeev, P.R. Varshavsky

Methods of analogous reasoning for intelligent decision support systems are considered. Special attention is drawn to methods based on a structural analogy that use the analogy of properties, the analogy of relations, and take the context into account. This work was supported by RFBR (project 02-07-90042).

A MultIcriteria Decision Support System *MultiDecision-1*

Vassil Vassilev, Krasimira Genova, Mariyana Vassileva

The present paper describes some basic elements of the software system developed (called MultiDecision-1), which consist of two separate parts (the systems MKA-1 and MKO-1) and which is designed to support decision makers in solving different multicriteria analysis and multicriteria optimization problems. The class of the problems solved, the system structure, the operation with the interface modules for input data entry and the information about DM's local preferences, the operation with the interface modules for visualization of the current and final solutions for the two systems MKA-1 and MKO-1 are discussed.

Keywords: multicriteria analysis, multicriteria optimization, multicriteria decision support system.

Recognition on Finite Set of Events: Bayesian Analysis of Statistical Regularity and Classification Tree Pruning

Vladimir B. Berikov

The problem of recognition on finite set of events is considered. The statistical regularity of decision functions for this problem is studied within the Bayesian approach. The results are applied in pruning of classification trees.

Keywords: statistical regularity, Bayesian learning, classification tree pruning.

Decision Forest versus Decision Tree

Vladimir Donskoy, Yuliya Dyulicheva

A research and improvement of learning and recognition algorithms based on building up binary decision trees (BDT); to working out the rules for binary decision trees pruning on the basis of conjunctive regularities evaluation; to creating consistent decision tree family synthesis procedure (i.e. the empirical decision forest synthesis algorithm) and pruned decision trees family correction methods as a set of heuristic procedures for decision making are considered.

Keywords: empirical decision forest, conjunctive regularity, decision tree pruning criterion, overfitting, VCD of decision rules class

Generalized Scalarizing Problems *GENS* and *GENSLex* of Multicriteria Optimization

Mariyana Vassileva

Generalized scalarizing problems, called GENS and GENSLex, for obtaining Pareto optimal solutions of multicriteria optimization problems are presented in the paper. The basic properties of these scalarizing problems are described. The existence of single-criterion problems with differentiable objective functions and constraints, which are equivalent to GENS and GENSLex scalarizing problems, are pointed out.

Keywords: multicriteria optimization, interactive methods, decision support systems.

Information System for Situational Design

T. Goyvaerts, A. Kuzemin, V. Levikin

From the standpoint of the system analysis the quantitative simulation of the information-technological complex (a situational center – SC) as an object of simulation and management requires consideration of a simulation object as a complex multilevel stochastic and self-developing system; its current state imitative modelling also requires the use of the fuzzy media description.

To build an informational model of a "situation" development and to manage it, there is a good reason to use the informational technology of integration of aerospace monitoring and ground contact measurements by the minimization criterion of expenditures of time *T* and material resources *S*.

Equipment of different type for information recording through remote sounding can be placed on the mobile platforms (space, flying, aerostat vehicles). With the initial information obtained with these methods it is possible to solve various problems of monitoring and prompt detection of important abnormal events on the earth surface.

The decision-making system is a methodology for a complex solution of the problem making it possible to simulate problematic situations of unlimited complexity and therewith providing a high quality of the made decision. In other words, this system is the main direction in complex decision-making; it performs one of the main functions of the situational center (SC).

Making of the right decision is realized using many parameters being measured with corresponding sensors. SC realizes the decision making in the automatic regime when indeterminate parameters and features appear. Moreover, it is necessary to make a decision in the real time with a high probability that this decision will be made right. This decision is defined by the ratio of the measured values to the standard ones.

The system performs polling of all sensors and analyses the obtained values comparing them wit the standard. Initially the polling is carried out using the clear set features and then it is performed with the fuzzy set. The fuzzy set should be divided into a number of fuzzy sets each of them having their own features. This will make it possible to take a decision close to a real time and increase the probability of the right decision making as the probability of a right decision-making is equal to the sum of probabilities obtained with all clear and fuzzy sets.

Decision-making with a clear set is performed by comparison of the obtained value with the standard.

To build a membership function for a right decision-making three approaches should be taken: the objective, subjective and statistical ones.

Implementation of the System Approach in Designing Information System for Ensuring Ecological Safety of Mudflow and Creep Phenomenae

E. Petrov, A. Kuzemin, N.Gusar, D. Fastova, I. Starikova, O. Dytshenko

In this assignment pit into practice the researching of language identification of the information analytic system of the situation center for the region energy safety. This method proposes the creating of the scientific grounded and economically sound information system to control situations that are built on the base of wide application new information technologies. Also, there are given foundation of choice of the context-sensitive language for the simulation of the system and instrument application of fuzzy logic. And has developed the mathematics model of the system that reflect main point of manage process especially tariff manage for energy safety.

A Method of the Speaker Identification on Basis of the Individual Speech Code

M.F. Bondarenko, A.V. Rabotyagov, M.I. Sliptshenko

A new method for speaker identification is being offered. The base of the method lies in new theoretical statements and non-traditional views on the questions of formal voice signals transformation and voice objects classification. These views rest upon the concept of heuristic simulation. The novelty of the method is that the identification is carried out on basis of the individual speech code, which is assigned to each voice code during the classification of voice objects adaptive search for informative signs. The digital code pattern of a personal voice code as an informative signs combination represents a set of elements with significant functions.

Mathematical Model for Situational Center Development Technology

V.M. Levykin

As the experience shows there are general systems problems emerging when creating an information-analytical system regardless of its complexity. These problems are associated with developers' and customers' functions due to incomplete understanding of both the object domain and the structure of the future system.

Realization of these problems envisages the development of technology and creation of such a system, which would take into account peculiarities of the object domain in the system structure.

Section 4. Intelligent Technologies in Control, Design and Scientific Research

A Workbench for Document Processing

Karola Witschurke

During the MEMORIAL project an international consortium has developed a software solution called Digital Document Workbench. It provides a set of tools to support the process of digitization of documents from the scanning up to the retrievable presentation of the content. The attention is focused to machine typed archival documents. One of the important features is the evaluation of quality in each step of the process. The workbench consists of automatic parts as well as of parts, which request human activity. The measurable improvement of 20% shows the approach is successful.

Keywords: Document Management, Digital Document Workbench, Image Processing, OCR, Machine Typed Document.

Experiments in Detection and Correction of Russian Malapropisms by Means of the WEB

Elena I. Bolshakova, Igor A. Bolshakov, Aleksey P. Kotlyarov

Malapropism is a semantic error that is hardly detectable because it usually retains syntactical links between words in the sentence but replaces one content word by a similar word with quite different meaning. A method of automatic detection of malapropisms is described, based on Web statistics and a specially defined Semantic Compatibility Index (SCI). For correction of the detected errors, special dictionaries and heuristic rules are proposed, which retains only a few highly SCI-ranked correction candidates for the user's selection. Experiments on Web-assisted detection and correction of Russian malapropisms are reported, demonstrating efficacy of the described method.

Keywords: semantic error, malapropism, error correction, Web-assisted error detection, paronymy dictionaries, correction candidates, Semantic Compatibility Index.

Verbal Dialogue versus Written Dialogue

David Burns, Richard Fallon, Phil Lewis, Vladimir Lovitskii, Stuart Owen

Modern technology has moved on and completely changed the way that people can use the telephone or mobile to dialogue with information held on computers. Well developed "written speech analysis" does not work with "verbal speech". The main purpose of our article is, firstly, to highlights the problems and, secondly, to shows the possible ways to solve these problems.

Keywords: data mining, speech recognition, natural language processing

Конспектирование естественноязыковых текстов

Виктор П. Гладун, Виталий Ю. Величко

Some applications of Natural language texts need such form of text representation that is a result of reasonable compromise between the wish to make the text shorter, saving its fundamental thematic purposes, and the wish to retell the source text more fully. Some degree of this compromise should be achieved at text abstracting when creation of different storage of textual information, for example archives, personal libraries and so on. What are the ways of this compromise achievement? The report deals with this problem. The method, realized in program system KONSPEKT is considered.

О задаче семантического индексирования тематических текстов

Надежда Мищенко, Наталья Щеголева

The creation of domain ontology is of high importance in information systems. This paper discusses software tools for concept extraction from domain texts in natural languages. The approach presented by authors allows eliminate the irrelevant combination of words from the very beginning of text processing.

Keywords: ontology, combination of words, terms, vocabulary of auxiliary words and links, morphological analysis.

Resolution of Functional Homonymy on the Basis of Contextual Rules for Russian Language

Olga Nevzorova, Julia Zin'kina, Nicolaj Pjatkin

Applied problems of functional homonymy resolution for Russian language are investigated in the work. The results obtained while using the method of functional homonymy resolution based on contextual rules are presented. Structural characteristics of minimal contextual rules for different types of functional homonymy are researched. Particular attention is paid to studying the control structure of the rules, which allows for the homonymy resolution accuracy not less than 95%. The contextual rules constructed have been realized in the system of technical text analysis.

Keyword: natural language processing, functional homonymy, resolution of homonymy

Information Processing in a Cognitive Model of NLP

Velina Slavova, Alona Soschen, Luke Immes

A model of the cognitive process of natural language processing has been developed using the formalism of generalized nets. Following this stage-simulating model, the treatment of information inevitably includes phases, which require joint operations in two knowledge spaces – language and semantics. In order to examine and formalize the relations between the language and the semantic levels of treatment, the language is presented as an information system, conceived on the bases of human cognitive resources, semantic primitives, semantic operators and language rules and data. This approach is applied for modelling a specific grammatical rule – the secondary predication in Russian. Grammatical rules of the language space are expressed as operators in the semantic space. Examples from the linguistics domain are treated and several conclusions for the semantics of the modeled rule are made. The results of applying the information system approach to the language turn up to be consistent with the stages of treatment modeled with the generalized net.

Keywords: Cognitive model, Natural Language Processing, Generalized Net, Language Information System

Application of Artificial Intelligence Methods to Computer Design of Inorganic Compounds

Nadezhda N. Kiselyova

In this paper the main problems for computer design of materials, which would have predefined properties, with the use of artificial intelligence methods are presented. The DB on inorganic compound properties and the system of DBs on materials for electronics with completely assessed information: phase diagram DB of material systems with semiconducting phases and DB on acousto-

optical, electro-optical, and nonlinear optical properties are considered. These DBs are a source of information for data analysis. Using the DBs and artificial intelligence methods we have predicted thousands of new compounds in ternary, quaternary and more complicated chemical systems and estimated some of their properties (crystal structure type, melting point, homogeneity region etc.). The comparison of our predictions with experimental data, obtained later, showed that the average reliability of predicted inorganic compounds exceeds 80 %. The perspectives of computational material design with the use of artificial intelligence methods are considered.

Keywords: artificial intelligence, computer design of materials, databases on properties of inorganic materials, information-analytical system.

К вопросу о развитии интерфейса «разработчик-заказчик»

Леонид Святогор

Рассмотрены разные примеры приложения програмного комплекса КОНФОР.

Two-machine Minimum-length Shop-Scheduling Problems with Uncertain Processing Times

Natalja Leshchenko, Yuri Sotskov

The problem of non-preemptive job-shop scheduling with bounded random processing times is studied. In contrast to deterministic two-machine job-shop problem, it is assumed that processing time t_{jm} of job $j \in J = \{1, 2, ..., n\}$ by machine $m \in M = \{1, 2\}$ is not fixed before scheduling. Moreover, probability distribution of random processing time t_{jm} between given lower and upper bounds is unknown. In such an uncertain version of a shop-scheduling problem, there may not exist a unique schedule that remains optimal for all possible realizations of processing times t_{jm}. Therefore, we have to consider a set S^* of schedules (permutations) that dominates all other feasible schedules for makespan criterion. We find necessary and sufficient conditions when transposition of two jobs may be used to minimize makespan for the uncertain version of a flow-shop problem with two machines. We study the easiest case of a flow-shop problem if there exists a single permutation that is optimal for all possible realizations of processing times t_{jm}. We also study hardiest case if cardinality $|S^*|$ of set S^* is maximal.

Keywords: Scheduling, flow-shop, job-shop, makespan, uncertainty.

Learning Technology in the Scheduling Algorithm Based on the Mixed Graph Model

Yuri Sotskov, Nadezhda Sotskova, Leonid V. Rudoi

We propose the adaptive algorithm for solving a set of similar scheduling problems using learning technology. It is devised to combine the merits of the exact enumerative algorithm based on the mixed graph model, and heuristic algorithm oriented on the real-world scheduling problems. The former one may ensure high quality of the solution by means of implicit exhausting enumeration of all the feasible schedules. The latter one may be developed for certain type of problems using their peculiarities. The main idea of the learning technology is to produce effective (in performance measure) and efficient (in computational time) heuristics by adapting local decisions for scheduling problems under consideration.

Algorithm adaptation is realized at the stage of learning while solving a set of sample problems (using branch and bound algorithm), accumulating knowledge, and structuring it (using artificial intelligence apparatus).

Keywords: Scheduling, mixed graph, adaptation, learning.

Автоматный метод решения систем линейных ограничений в области {0,1}

Сергий Крывый, Людмила Матвеева, Виолета Гжывач

Рассматривается автоматный метод построения базиса множества всех решений системы линейных диофантовых уравнений с коэффициентами из множества {-1,0,1} в области {0,1}.

Ключевые слова: системы линейных диофантовых уравнений, базис множества решений, конечный автомат без выходов.

Logical Models of Composite Dynamic Objects Control

Vitaly J. Velichko, Victor P. Gladun, Gleb S. Gladun, Anastasiya V. Godunova, Yurii L. Ivaskiv, Elina V. Postol, Grigorii V. Jakemenko

The questions of designing multicriteria control systems on the basis of logic models of composite dynamic objects are considered.

Keywords: control, logical model, composite dynamic object, balancing network.

The Information-analytical System for Diagnostics of Aircraft Navigation Units

Ilya Prokoshev, Vyacheslav Suminov

The operation of technical processes requires increasingly advanced supervision and fault diagnostics to improve reliability and safety. This paper gives an introduction to the field of fault detection and diagnostics and has short methods classification. Growth of complexity and functional importance of inertial navigation systems leads to high losses at the equipment refusals. The paper is devoted to the INS diagnostics system development, allowing identifying the cause of malfunction. The practical realization of this system concerns a software package, performing a set of multidimensional information analysis. The project consists of three parts: subsystem for analyzing, subsystem for data collection and universal interface for open architecture realization. For a diagnostics improving in small analyzing samples new approaches based on pattern recognition algorithms voting and taking into account correlations between target and input parameters will be applied. The system now is at the development stage.

Keywords: technical diagnostics, fault detection, inertial navigation system, navigation, aircraft units, supervision, monitoring, fault diagnostics, diagnostic reasoning

Динамические системы в описании нелинейных рекурсивных регрессионных преобразователей

Микола Ф. Кириченко, Владимир С. Донченко, Денис П. Сербаев

The task of approximation-forecasting for a function, represented by empirical data was investigated. Certain class of the functions as forecasting tools: so called RFT-transformations, – was proposed. Least Square Method and superposition are the principal composing means for the function generating. Besides, the special classes of beam dynamics with delay were introduced and investigated to get classical results regarding gradients. These results were applied to optimize the RFT-transformation. The effectiveness of the forecast was demonstrated on the empirical data from the Forex market.

Keywords: empirical functions, learning samples, beam dynamics with delay, recursive nonlinear regressive transformation, Generalized Inverse, Least Square Method.

The Matrix Method of Determining the Fault Tolerance Degree of a Computer Network Topology

Sergey Krivoi, Miroslaw Hajder, Pawel Dymora, Miroslaw Mazurek

This work presents a theoretical-graph method of determining the fault tolerance degree of the computer network interconnections and nodes. Experimental results received from simulations of this method over a distributed computing network environment are also presented.

Keywords: computer network, fault tolerance, coherent graph, regular graph, network topology, adjacency matrix.

Robot Control Using Inductive, Deductive and Case Based REASONING

Agris Nikitenko

The paper deals with a problem of intelligent system's design for complex environments. There is discussed a possibility to integrate several technologies into one basic structure that could form a kernel of an autonomous intelligent robotic system. One alternative structure is proposed in order to form a basis of an intelligent system that would be able to operate in complex environments.

The proposed structure is very flexible because of features that allow adapting via learning and adjustment of the used knowledge. Therefore, the proposed structure may be used in environments with stochastic features such as hardly predictable events or elements. The basic elements of the proposed structure have found their implementation in software system and experimental robotic system. The software system as well as the robotic system has been used for experimentation in order to validate the proposed structure - its functionality, flexibility and reliability. Both of them are presented in the paper. The basic features of each system are presented as well. The most important results of experiments are outlined and discussed at the end of the paper. Some possible directions of further research are also sketched at the end of the paper.

Keywords: Artificial intelligence, Inductive reasoning, Deductive reasoning, Case based reasoning, Machine learning, Learning algorithms.

Information Models for Robotics System with Intellectual Sensor and Self-organization

Valery Pisarenko, Ivan Varava, Julia Pisarenko, Viktoriya Prokopchuk

It is chosen broad class of complex technical intellectualized systems with adaptation and self-training and some special properties of extremality. As example, the problem of adaptive control system for the scientific experiment with thermonuclear plasma is considered. The second example is connected with creation self-organizing mobile robot for examination emergency technical object on sea bottom.

Keywords: simulation modelling, autonomous mobile robots, self-training, aggressive ambience.

Static and Dynamic Integrated Expert Systems: State of the Art, Problems and Trends

Galina Rybina, Victor Rybin

Systemized analysis of trends towards integration and hybridization in contemporary expert systems is conducted, and a particular class of applied expert systems, integrated expert systems, is considered. For this purpose, terminology, classification, and models, proposed by the author, are employed. As examples of integrated expert systems, Russian systems designed in this field and available to the majority of specialists are analyzed.

Keywords: integrated expert systems, real-time, simulation modelling, object-oriented model, rule, complex engineering systems, software tools, task-oriented methodology.

Adaptive Routing and Multi-Agent Control for Information Flows in IP-Networks

Adil Timofeev

The principles of adaptive routing and multi-agent control for information flows in IP-networks.

Keywords: telecommunication system, adaptive quality service, multi-agent control, IP-network.

The on-board Operative Advisory expert Systems for Anthropocentric Object

Boris E. Fedunov

A class of intelligent systems located on anthropocentric objects that provide a crew with recommendations on the anthropocentric object's rational behavior in typical situations of operation is considered. We refer to this class of intelligent systems as onboard real-time advisory expert systems. Here, we present a formal model of the object domain, procedures for obtaining knowledge about the object domain, and a semantic structure of basic functional units of the onboard real-time advisory expert systems of typical situations. The stages of the development and improvement of knowledge bases for onboard real-time advisory expert systems of typical situations that are important in practice are considered.

Keywords: expert systems, AI architectures, inference technique.

Оптимизация телекоммуникационных сетей с технологией ATM

Леонид Л. Гуляницкий, Андрей А. Баклан

Рассматриваются проблемы оптимизации сетей с технологией ATM, которые формулируются как задачи комбинаторной оптимизации. Для решения возникающих задач разработан ряд приближенных алгоритмов. Приведены результаты их сравнения при решении серии задач со случайными данными.

Keywords: network, optimization,local search, simulated annealing, genetic algorithm

Testing AI in One Artificial World

Dimiter Dobrev

In order to build AI we have to create a program which copes well in an arbitrary world. In this paper we will restrict our attention on one concrete world, which represents the game Tick-Tack-Toe. This world is a very simple one but it is sufficiently complicated for our task because most people cannot manage with it. The main difficulty in this world is that the player cannot see the entire internal state of the world so he has to build a model in order to understand the world.

Keywords: AI Definition, Artificial Intelligence, Artificial World, Machine Learning.

Concurrent Algorithm for Filtering Impulse Noise on Satellite Images

Nguyen Thanh Phuong

A parallelized algorithm using improved “master/worker” architecture is applied to filtering noise on satellite images. Besides, being simple, natural and effective, paradigm of “data parallelism” is considered as a basis of parallel program. Finally, the most effective distribution is found basing on theoretical analyses and experimental results obtained from parallel–computing machines.

Keywords: impulsive noise, noised streak, image distribution, parallelized algorithm.

Сравнительный анализ четкого и нечеткого методов индуктивного моделирования (МГУА) в задачах макроэкономического прогнозирования

Юрий П. Зайченко

The fuzzy Group Method of Data Handling(FGMDH) is considered and investigated. The algorithm of fuzzy GMDH is suggested. The experimental investigations of the suggested algorithm of FGMDH in the problem of macroeconomic indexes forecasting are presented and the comparative analysis with the conventional algorithm GMDH are presented and discussed.

Keywords: fuzzy, group method of data handling, economy forecast.

Исследование нечеткой нейронной сети ANFIS в задачах макроэкономического прогнозирования

Юрий П. Зайченко, Фатма Севаее

The fuzzy neural network ANFIS with logical inference of Sugeno is considered. The training algorithm is described and its experimental investigations in the problem of macroeconomic indexes forecasting on the example of Ukrainian economy are presented.

The influence of the number of linguistic variables and number of fuzzy rules on the efficiency of forecast is investigated and discussed.

Keywords : fuzzy neural network, ANFIS, economy, forecast, training algorithm.

Математическая модель реструктуризации сложных технико-экономических структур

Май Корнийчук, Инна Совтус, Евгений Цареградский

Излагается исследование и разработка математической модели оптимального распределения ресурсов (в основном финансовых) для обеспечения нового (повышенного) качества (надежности) сложной системы, относительно которой принято решение о ее реструктуризации. Итоговая модель дает ответы (алгоритм расчета) на вопросы: сколько элементов системы выделить на модернизацию, какие именно элементы, до какого уровня глубины нужна модернизация каждого из выделенных, причем оптимальные ответы по критерию минимизации финансовых расходов.

Ключевые слова: система, реструктуризация, качество, надежность

Raising Efficiency of Combinatorial Algorithms by Randomized Parallelization

Arkadij D. Zakrevskij

A new approach is proposed to deal with some hard combinatorial optimization problems, which admit a certain reformulation. Considering such a problem, several similar problems are prepared differing in initial data but having the same set of solutions. They are solved in parallel until one of them will be solved, and that solution is accepted. Notwithstanding the evident overhead, the whole run-time could be significantly reduced due to dispersion of velocities of combinatorial search in regarded cases. The efficiency of this approach is investigated on the concrete problem of finding short solutions of non-deterministic system of linear logical equations.

Keywords: combinatorial problems, combinatorial search, parallel computations, randomization, run-time, acceleration.

Specifying Agent Interaction Protocols with Parallel Control Algorithms

Dmitry Cheremisinov, Liudmila Cheremisinova

The purpose of the paper is to explore the possibility of applying existing formal theories of description of distributed and concurrent systems to interaction protocols for real-time multi-agent systems. In particular it is shown how the language, proposed for description of parallel logical control algorithms and rooted in the Petri net formalism, can be used for the modelling of complex concurrent conversations between agents in a multi-agent system. It is demonstrated with a known example of English auction on how to specify an agent interaction protocol using considered means.

Keywords: multi-agent system, interaction protocols, parallel control algorithm

Об одной модификации TSS-алгоритма

Руслан А. Багрий

В работе рассматривается одна модификация TSS–алгоритма, который генерирует минимальное порождающее множество решений системы однородных линейных диофантовых уравнений над множеством натуральных чисел.

Ключевые слова: Система линейных диофантовых уравнений, базис решений, минимальное порождающее множество.

The Development of Parallel Resolution Algorithms Using the Graph Representation

Andrey Averin, Vadim Vagin

The parallel resolution procedures based on graph structures method are presented. OR-, AND- and DCDP- parallel inference on connection graph representation is explored and modifications to these algorithms using heuristic estimation are proposed. The principles for designing these heuristic functions are thoroughly discussed. The colored clause graphs resolution principle is presented. The comparison of efficiency (on the Steamroller problem) is carried out and the results are presented. The parallel unification algorithm used in the parallel inference procedure is briefly outlined in the final part of the paper.

Keywords: Automated Reasoning, Logical inference

Магнитная гидродинамика жидкости и динамика упругих тел: моделирование в среде Mathematica

Ю.Г. Лега, В.В. Мельник, Т.И. Бурцева, А.Н. Папуша

В статье предложен метод компьютерного моделирования и численного анализа нелинейных взаимодействий в механике сплошных сред, в которых учитываются электромагнитные эффекты при помощи компьютерной алгебры среды Mathematica.

Some Approaches to Distributed Encoding of Sequences

Artem Sokolov, Dmitri Rachkovskij

We discuss several approaches to similarity preserving coding of symbol sequences and possible connections of their distributed versions to metric embeddings. Interpreting sequence representation methods with embeddings can help develop an approach to their analysis and may lead to discovering useful properties.

Keywords: sequence similarity, metric embeddings, distributed representations, neural networks

Representing the Closed World Assumption in Modal Logic

Frank M. Brown

The nonmonotonic logic called the Closed World Assumption is shown to be representable in a monotonic Modal Quantificational Logic whose modal laws are stronger than S5. Specifically, it is proven that a set of sentences of First Order Logic is equal to the Closed World Assumption of an initial set of sentences and defaults if and only if the meaning of that set of sentences is logically equivalent to a particular modal functor of the meanings of that initial set of the sentences and those defaults. This result is important because the modal representation allows the use of powerful automatic deduction systems for Modal Logic and because unlike the original Closed World Assumption, it is easily generalized to the case where quantified variables may be shared across the scope of the components of the defaults thus allowing such defaults to produce quantified consequences.

Keywords: Closed World Assumption, Modal Logic, Nonmonotonic Logic.

Representing Skeptical Logics in Modal Logic

Frank M. Brown

Several skeptical nonmonotonic logics are shown to be representable in a monotonic Modal Quantificational Logic whose modal laws are stronger than S5. Specifically, it is proven that under certain conditions a set of sentences of First Order Logic is the intersection of the possibly infinite number of fixed-points of the fixed-point equation of a base nonmonotonic logic with an initial set of axioms and defaults if and only if the meaning of that set of sentences is logically equivalent to the meaning of the set of sentences entailed by the disjunction of the possibly infinite number of solutions to a necessary equivalence formed from a particular modal functor of the meanings of that initial set of sentences and of the sentences in those defaults.

This result is important because the modal representation allows the use of powerful automatic deduction systems for Modal Logic and because unlike the set theoretic definition of a skeptical logic, the modal representation is easily generalized to the case quantified variables may be shared across the scope of the components of the defaults thus allowing the such defaults to produce quantified consequences.

Keywords: Skeptical Fixed-point Logics, Modal Logic, Nonmonotonic Logic.

Automatic Fixed-point Deduction Systems for Five Different Propositional NonMonotonic Logics

Frank M. Brown

The commonality and differences among five different nonmonotonic logics is described by implementing an automatic fixed-point equation solver for their propositional logic versions with finite stream based algorithms involving maps, filters, and accumulators. The result of organizing nonmonotonic computations in this fashion is to make apparent in an elementary way, that different nonmonotonic systems embody many of the same basic ideas and in fact differ by often only a few filters or accumulators. The nonmonotonic systems investigated are the Closed World Assumption, the kernel of Autoepistemic Logic, Frame Logic, Default Logic, and Parallel Circumscription. Scheme code which defines all the fixed-points for all these systems for all propositional problems is given.

Keywords: Automatic Deduction Systems, Fixed-point, Nonmonotonic Logic.

Nonmonotonic Systems Based on Smallest and Minimal Worlds Represented in World Logic, Modal Logic, and Second Order Logic

Frank M. Brown

A monotonic representation of a nonmonotonic logic makes it possible for an automatic theorem prover for that monotonic logic to be used to automatically deduce consequences for the nonmonotonic logic. Multiple monotonic representations, allow different automatic deduction approaches to be developed. Herein, we discuss two different nonmonotonic concepts, namely simplest worlds and minimal worlds, and show how each may be represented in three different monotonic logics. These monotonic logics are World Logic, Modal Logic, and Second Order Logic. These representations are more general than those previously described and are related back to less general previous work. In all these representations quantifiers obey the normal laws of both classical logic and S5 Modal Logic and may quantify variables across the scope of the nonmonotonic structures.

Keywords: Smallest Worlds, Minimal Worlds, Nonmonotonic Logic.

Z Priorian Modal Second Order Logic

Frank M. Brown

Multiple representations of a concept allow different automatic deduction approaches to be developed for theorems involving. Herein, we discuss three different monotonic logics. These monotonic logics are World Logic, Modal Logic, and Second Order Logic. In all these representations quantifiers obey the normal laws of both classical logc.

Keywords: Z Priorian Modal Second Order Logic, Modal Logic, World Logic, Second Order Logic

Section 6. Neural and Growing Networks

Parallel Markovian Approach to the Problem of Cloud Mask Extraction

Natalia Kussul, Andriy Shelestov, Nguyen Thanh Phuong, Michael Korbakov, Alexey Kravchenko

An application of Markovian approach to cloud mask extraction is presented. Also parallel algorithm of Markovian segmentation is considered.

Keywords: Meteosat, cloud mask, Markov Random Fields, parallel programming, MPI.

Идентификация нейросетевой модели поведения пользователей компьютерных систем

Н. Куссуль, С. Скакун

В работе проводилось математическое моделирование поведения пользователей компьютерных систем. Изучалась динамика работы пользователя во время сеанса. Также осуществлялось статистическое моделирование данных, характеризующих его работу за сеанс в целом.

Ключевые слова: модель поведения пользователей, нейронные сети, компьютерные системы.

Jamming Cancellation Based on a Stable LSP Solution

Elena Revunova, Dmitri Rachkovskij

Two jamming cancellation algorithms are developed based on a stable solution of least squares problem (LSP) provided by regularization. They are based on filtered singular value decomposition (SVD) and modifications of the Greville formula. Both algorithms allow an efficient hardware implementation. Testing results on artificial data modelling difficult real-world situations are also provided

Keywords: jamming cancellation, approximation, least squares problem, stable solution, recurrent solution, neural networks, incremental training, filtered SVD, Greville formula

Graph Representation of Modular Neural Networks

Michael Kussul, Alla Galinskaya

Modular neural networks are widely used for applied tasks solving due to its flexibility and big potential abilities. As a result, development of modelling aids for modular neural networks become very important. Networks that contain cycles are of particular interest. However, for the networks with cycles there is necessity to have tools for formal analysis, which allow defining sequence of run of modules in the networks. We propose representation of modular neural networks with help of directed graphs. This representation is intended for general analysis of modular architectures and, first of all, for analysis with automatic systems. On the basis of proposed representation we give definitions of cycles, build its classification and examine properties of cycles in modular neural networks.

Keywords: neural networks, modular neural networks, graph of neural network, cycle.

Гетерогенные полиномиальные нейронные сети для распознавания образов и диагностики состояний[1]

Адиль В.Тимофеев

Рассмотрены различные параллельные архитектуры и методы самоорганизации и минимизации сложности гетерогенных полиномиальных нейронных сетей (ПНС) в задачах распознавания образов и диагностики состояний. Получены конструктивные оценки степени гетерогенности и параллелизма в процессе автономного принятия классифицирующих решений с помощью ПНС различных типов. Показано, что параллелизм, самоорганизация и робастность гетерогенных ПНС могут значительно возрасти при коллективном (мульти-агентном) решении сложных задач распознавания образов, анализа изображений, развернутой (векторной) диагностики состояний и адаптивной маршрутизации информационных потоков

Neuronal Networks for Modelling of Large Social Systems. Approaches for Mentality, Anticipating and Multivaluedness Accounting.

Alexander Makarenko

It is consider the new global models for society of neuronet type. The hierarchical structure of society and mentality of individual are considered. The way for incorporating in model anticipatory (prognostic) ability of individual is considered. Some implementations of approach for real task and further research problems are described. Multivaluedness of models and solutions is discussed. Sensory-motor systems analogy also is discussed. New problems for theory and applications of neural networks are described.

Представление нейронных сетей динамическими системами

Владимир С. Донченко, Денис П. Сербаев

Рассматривается представление нейронных сетей в виде динамических систем. Предложен метод обучения нейронных сетей с помощью теории оптимального управления.

Keywords: нейронные сети, динамические системы, обучение.

Generalization by Computation Through Memory

Petro Gopych

Usually, generalization is considered as a function of learning from a set of examples. In present work on the basis of recent neural network assembly memory model (NNAMM) a biologically plausible 'grandmother' model for vision has been proposed within which each separate memory unit itself can generalize. For such a generalization by computation through memory analytical formulae and numerical procedure are found to calculate exactly the perfectly learned memory unit's generalization ability. The model's memory has complex hierarchical structure and can be learned by one-step process from one example. A simple binary neural network for bell-shaped tuning is described.

Keywords: generalization, 'grandmother' model for vision, neural network assembly memory model, one-step learning, learning from one example, neuron receptive field, bell-shaped tuning.

Neural Network Based Approach for Developing the Enterprise Strategy

Todorka Kovacheva, Daniela Toshkova

Modern enterprises work in highly dynamic environment. Thus, the developing of company strategy is of crucial importance. It determines the surviving of the enterprise and its evolution. Adapting the desired management goal in accordance with the environment changes is a complex problem. In the present paper, an approach for solving this problem is suggested. It is based on predictive control philosophy. The enterprise is modelled as a cybernetic system and the future plant response is predicted by a neural network model. The predictions are passed to an optimization routine, which attempts to minimize the quadratic performance criterion.

Keywords: enterprise strategy, model predictive control, neural network, black-box modelling, business trends.

Neuro-Fuzzy Kolmogorov's Network with a Hybrid Learning Algorithm

Yevgeniy Bodyanskiy, Yevgen Gorshkov, Vitaliy Kolodyazhniy

In the paper, a novel Neuro-Fuzzy Kolmogorov's Network (NFKN) is considered. The NFKN is based on and is the development of the previously proposed neural and fuzzy systems using the famous Kolmogorov's superposition theorem (KST). The network consists of two layers of neo-fuzzy neurons (NFNs) and is linear in both the hidden and output layer parameters, so it can be trained with very fast and simple procedures: the gradient-descent based learning rule for the hidden layer, and the recursive least squares algorithm for the output layer. The validity of theoretical results and the advantages of the NFKN in comparison with other techniques are confirmed by experiments.

Нейросетевая классификация земного покрова на основании спектральных измерений

Алла Лавренюк, Лилия Гнибеда, Екатерина Яровая

Разработка метода классификации наземных объектов

Ключевые слова: нейронные сети, спектральные кривые, классификация

The Staple Commodities of the Knowledge Market

Krassimir Markov, Krassimira Ivanova, Ilia Mitov

In this paper, the “Information Market” is introduced as a payable information exchange and based on it information interaction. In addition, special kind of Information Markets - the Knowledge Markets are outlined. The focus of the paper is concentrated on the investigation of the staple commodities of the knowledge markets. They are introduced as kind of information objects, called “knowledge information objects”. The main theirs distinctive characteristic is that they contain information models, which concern sets of information models and interconnections between them.

Keywords: Information Market, Knowledge Market, Knowledge Information Objects, General Information Theory

Basic Interactions between Members of the Knowledge Market

Krassimira Ivanova, Natalia Ivanova, Andrey Danilov, Ilia Mitov, Krassimir Markov

The interconnections and information interactions between main members of the Knowledge Market are presented in the paper.

Keywords: Knowledge Market, Components of the Knowledge Market, Information Interaction

Ценность информации

Андрей Данилов

В этой статье обсуждается один из важнейших вопросов теории информации и практики ее применения, а именно, какова ценность информации и как ее можно оценить?

Ключевые слова: ценность информации; количественная оценка информации; критичность информации.

The Main Question of the Informatics, 100 Years after its Poseing

Stoyan Poryazov

Paul Otlet (1905) defines term "documentation" (a predecessor of "Information Science" and "Informatics") as activity comprising: 1. gathering; 2. processing (handling); 3. storage; 4. retrieval; and 5. dissemination (distribution) of documents. With this he posed the main question of the Informatics - what are the basic information activities? We argue that the only activities, unique for Informatics are: 1. Creation of languages (including designing of signs' material presentations and denotations); 2. Creation of information (including creation of messages for models' presentation (model coding)); 3. Equivalent message transformation; 4. Interpretation of messages; end 5. Destroying of Information. These very old activities are in the early stages of their scientific study in Informatics and Mathematics.

Objects, Functions and Signs

Stoyan Poryazov

Our approach to sign definition is based on the Black Box paradigm - every material entity is considered as a convertor (function) of the influences to the entity (input) to its reactions (output). We consider two possible types of functions of the material objects, in case of their interaction with subjects (e.g. humans): non-receptive (natural) and receptive (through the sensors). Some arguments corroborating the hypothesis that every information usage of the material entities may be presented as a conjunction of the three receptive functions (1. Emotional; 2. Modelling; 3. Sign (Convention correspondence) function are given.

Approaching the Noosphere of INTANGIBLE – Esoteric from Materialistic Viewpoint

Vitaliy Lozovskiy

Exploration of intangible world is under the serious influence of esoteric. Mystics, religions, unrestrained use of metaphors, fairy tales, gossips, unverified and uncertified “facts” – all this needs accurate well-disposed, but sound scientific consideration. Our society really needs new ideas, new approaches and new paradigms. Technological civilization becomes more and more complicated, risky and ecologically critical. The current level of AI research cannot guarantee successful solution of societal control and management. Besides, the human being itself practically did not change its mental and psychological abilities for several hundred thousands years. We can lose control over our society and its technology, if we do not change cardinally ourselves. In this text, I tried to approach this problem – the problem of our noosphere from materialistic viewpoint.

Keywords: philosophy, noosphere, esoteric, intangible world, beliefs, soul, God, materialism, idealism, egregors

Informatics, Psychology, Spiritual Life

Larissa A. Kuzemina

Informatics as a key link of our life is directly connected to a human perception with all its sides.

The process of perception is connected to a psychological self-programming for selection, comprehension, accumulation and transmission of information. This brings us into the channel of a personal freedom psychology forming (ability of a person to control his development closely connected to self-consciousness, resourcefulness, openness, readiness to changes). In the course of self-consciousness development the range of the human choice and his freedom widens.

Information Support of Passionaries

Alexander Ya. Kuzemin

Passionaries are to be known as the most creative persons of the society.

Combination of adaptation of generations, imitation of ancestors and existence of the creative people are necessary coordinates forming “ethnos”, which are characterized by the original stereotyped behavior and unique internal structure.

In this connection, the problem of design of the Passionaries information support arises.