Third International Conference

INFORMATION RESEARCH, APPLICATIONS AND EDUCATION

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A B S T R A C T S

Kr. Markov (Ed.)

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Preface

The International Conference "Information Research, Applications and Education" (i.TECH) is organized as a part of "ITA 2005 - Joint International Scientific Events on Information Theories and Applications".

The main organizer of the ITA 2005 as well as the i.TECH 2005 is the International Journal on Information Theories and Applications (IJ ITA).

The aim of the conference is to be one more possibility for contacts for IJ ITA authors. The usual practice of IJ ITA is to support several conferences at which the IJ ITA papers may be discussed before submitting them for referring and publishing in the journal. Because of this, such conferences usually are multilingual and bring together both papers of high quality and papers of young scientists, which need further processing and scientific support from senior researchers.

i.TECH 2005 was combined with a specialized International Workshop on Business Informatics (Bi'05). Bi'05 was devoted to discussion of current research, applications and education regarding the basic directions of business informatics.

I would like to express my thanks to all who support the i.TECH 2005 and especially to the Natural Computing Group (NCG) (http://www.lpsi.eui.upm.es/nncg/) of the Technical University of Madrid, which is leaded by Mr. Juan Castellanos. The group is one of the foundational groups of the European Molecular Computing Consortium (http://openit.disco.unimib.it/emcc/welcome.html). NCG is involved in natural computing activities researches including: Molecular Computing (DNA Computing and Membrane Computing), Artificial Neural Networks (new architectures and learning strategies, Chaos controlling by Artificial Neural Networks, etc), Artificial Intelligence, Evolutionary algorithms, etc. NCG is constituted by members of some departments of the Technical University of Madrid, having its site at the Department of Artificial Intelligence of the Faculty of Computer Science. NCG has participated in different national and international projects including INTAS and V Framework Program of European Union (MolCoNet).

Let me thank the Program Committee of the conference for referring the submitted papers. Special thanks to Mr. Viktor Gladun and Mr. Avram Eskenazi – Co-chairs of the Program Committee.

i.TECH 2005 Proceedings has been edited in the Institute of Information Theories and Applications FOI ITHEA and published by FOI COMMERCE Co.

The i.TECH 2005 Conference found the best technical support in the work of the Technical editor Ms. Krassimira Ivanova and Organizing secretary Mr. Ilia Mitov.

To all participants of i.TECH 2005 I wish fruitful contacts during the conference days and efficient work for preparing the high quality papers to be published in the International Journal on Information Theories and Applications.

Varna, June 2005

Krassimir Markov
IJ ITA Editor in Chief

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The main topics of:

i.TECH 2005

Applied program systems
Education informatics
Extreme programming
Hyper technologies
Information modelling
Information systems
Multimedia systems
Performance evaluation of computer and telecommunication systems
Quality of the programs
Software engineering
Statistical systems

Bi 2005

Theoretical foundations of business informatics: conceptions, languages, modelling technologies, metrics and measurements, information visualization

Tools and applications: tools for business information modeling, applied systems for business information service, business information access methods and collaboration tools, business information security and reliability, new customer engagement models enabled by business informatics tools

Business informatics education (BIE): BIE conceptions, including relation to other/traditional fields of study. computer aided BIE, methodology of BIE

Official languages of the conference are Bulgarian, Russian and English.
General sponsor of the i.TECH 2005 is FOI BULGARIA (www.foibg.com).

1. Data Models and Processing

1.1. Data Flow Analysis and the Linear Programming Model

Levon Aslanyan

The general discussion of the data flow algorithmic models, and the linear programming problem with the variating by data flow criterion function coefficients are presented. The general problem is widely known in different names - data streams, incremental and online algorithms, etc. The more studied algorithmic models include mathematical statistics and clustering, histograms and wavelets, sorting, set cover, and others. Linear programming model is an addition to this list. Large theoretical knowledge exists in this as the simplex algorithm and as interior point methods but the flow analysis requires another interpretation of optimal plans and plan transition with variate coefficients. An approximate model is devised which predicts the boundary stability point for the current optimal plan. This is valuable preparatory information of applications, moreover when a parallel computational facility is supposed.

Keywords: data flow algorithm, linear programming, approximation

1.2. The Boundary Descriptors of the *n*-dimensional Unit Cube Subset Partitioning

Hasmik Sahakyan and Levon Aslanyan

The specific class of all monotone Boolean functions with characteristic vectors of partitioning of sets of all true-vertices to be minimal is investigated. These characteristic vectors correspond to the column-sum vectors of special (0,1)-matrices – constructed by the interval bisection method.

Keywords: monotone Boolean functions, (0,1)-matrices.

1.3. Update-Retrieve Problem: Data Structures and Complexity

Jose Joaquin Erviti, Adriana Toni

Let V be an array storing values in an arbitrary commutative semi-group. The update-retrieve problem concerns the study and design of data structures for implementing the following operations. The operation update(j,x) has the effect [$v_i \leftarrow (v_i + x)$], and the operation retrieve(j) returns the sum $\sum_{i \in T_j} v_i$, being T_j ($1 \leq j \leq m$) non empty subsets of {1, 2, … n}.

These tasks are to be performed on-line. Different data structures involving different number of variables may be used to solve this computational problem, and the complexity of the operations will depend on the choice. In this paper we work inside an algebraic model of computation. Data structures are defined within the model, and the complexity will be measured relative to it.

Keywords: data structures, models of computation, analysis of algorithms and problem complexity

1.4. The Distributed System of Databases on Properties of Inorganic Substances and Materials

Nadezhda N. Kiselyova, Victor A. Dudarev, Ilya V. Prokoshev, Valentin V. Khorbenko, Andrey V. Stolyarenko, Dmitriy P. Murat, and Victor S. Zemskov

The principles of organization of the distributed system of databases on properties of inorganic substances and materials based on the use of a special reference database are considered. The last includes not only information on a site of the data about the certain substance in other databases but also brief information on the most widespread properties of inorganic substances. The proposed principles were successfully realized at creation of the distributed system of databases on properties of inorganic compounds developed by A.A.Baikov Institute of Metallurgy and Materials Science of the Russian Academy of Sciences.

Keywords: database, distributed information system, inorganic substances and materials, reference database.

1.5. Software Development for Distributed System of Russian Databases on Electronics Materials

Valery Kornyshko and Victor Dudarev

Current state of Russian databases on substances and materials properties was considered. It was prepared a brief review of integration methods of given information systems and a distributed databases integration approach was proposed that based on metabase. Implementation details were mentioned on the posed database on electronics materials integration approach. It was considered an operating pilot version of given integrated information system implemented at IMET RAS.

Keywords: distributed database integration, metabase, Web services, database on electronics materials.

1.6. Analyzing the Data in OLAP Data Cubes

Galina Bogdanova and Tsvetanka Georgieva

OLAP applications provide a possibility to data analysis over large collections of historical data in the data warehouses, supporting the decision-making process. This paper presents an application that creates a data cube and demonstrates the effectiveness of the applying the OLAP operations when it necessary to analyze the data and obtain the valuable information from the data. It allows the analysis of factual data that is daily downloads of folklore materials, according to dimensions of interest.

Keywords: data cube, online analytical processing, multidimensional expressions

2. Knowledge Engineering

2.1. Classification of Biomedical Signals using the Dynamics of the False Nearest Neighbours (DFNN) Algorithm

Charles Newton Price, Renato J. de Sobral Cintra, David T. Westwick, and Martin P. Mintchev

Accurate and efficient analysis of biomedical signals can be facilitated by proper identification based on their dominant dynamic characteristics (deterministic, chaotic or random). Specific analysis techniques exist to study the dynamics of each of these three categories of signals. However, comprehensive and yet adequately simple screening tools to appropriately classify an unknown incoming biomedical signal are still lacking. This study is aimed at presenting an efficient and simple method to classify model signals into the three categories of deterministic, random or chaotic, using the dynamics of the False Nearest Neighbours (DFNN) algorithm, and then to utilize the developed classification method to assess how some specific biomedical signals position with respect to these categories. Model deterministic, chaotic and random signals were subjected to state space decomposition, followed by specific wavelet and statistical analysis aiming at deriving a comprehensive plot representing the three signal categories in clearly defined clusters. Previously recorded electrogastrographic (EGG) signals subjected to controlled, surgically-invoked uncoupling were submitted to the proposed algorithm, and were classified as chaotic. Although computationally intensive, the developed methodology was found to be extremely useful and convenient to use.

Keywords: Biomedical signals, classification, chaos, multivariate signal analysis, electrogastrography, gastric electrical uncoupling

2.2. Tracking Sensors Bottleneck Problem Solution using Biological Models of Attention

Alexander Fish and Orly Yadid-Pecht

Every high resolution imaging system suffers from the bottleneck problem. This problem relates to the huge amount of data transmission from the sensor array to a digital signal processing (DSP) and to bottleneck in performance, caused by the requirement to process a large amount of information in parallel. The same problem exists in biological vision systems, where the information, sensed by many millions of receptors should be transmitted and processed in real time. Models, describing the bottleneck problem solutions in biological systems fall in the field of visual attention. This paper presents the bottleneck problem existing in imagers used for real time salient target tracking and proposes a simple solution by employing models of attention, found in biological systems. The bottleneck problem in imaging systems is presented, the existing models of visual attention are discussed and the architecture of the proposed imager is shown.

Keywords: Bottleneck problem, image processing, tracking imager, models of attention

2.3. Neural Control Model of Chaotic Dynamic Systems

Cristina Hernández de la Sota, Juan Castellanos Peñuela, Rafael Gonzalo Molina, and Valentín Palencia Alejandro

The last decades have seen a dramatic growth, and many important theoretical advances, in the field of dynamic systems control. Artificial neural networks have been used to control nonlinear systems since they are able to compute complex functions concerning nonlinear decision. This work presents neural network architecture based on the backpropagation that can be used as controllers in order to stabilize unsteady periodic orbits. It also presents a neural network based method for transferring the dynamics among attractors, giving a more efficient system control. The procedure may be applied to every point of the basin, no matter how far away from the attractor they are. Finally, this work shows how two mixed chaotic signals can be controlled using a backpropagation neural net as filter, in order to separate and control both of them at the same time. The neural network provides a more effective control; it can be applied to the system at any point, even being too far from the desired state, avoiding long transient times. The control can be applied if there are only a few data of the system, and it will remain stable much more time even with small random dynamic noise. The net achieves a more effective control, improving the troubles arising with classical feedback methods. Moreover, the system computes a solution starting from any point, even being far away from the desired one, avoiding delays. Also with a few amount of data, the connectionist system can be applied, remaining stable during a long time even with small random dynamic noise.

Keywords: neural network, backpropagation, dynamic systems control, feedback methods.

2.4. Symbolic and Numeric Connectionist Models Solving NP-Problems

Luis Fernando de Mingo López and Francisco Gisbert

This paper presents some connectionist models that are widely used to solve NP-problems. Most well known numeric models are Neural Networks that are able to approximate any function or classify any pattern set provided numeric information is injected into the net. Neural Nets usually have a supervised or unsupervised learning stage in order to perform desired response. Concerning symbolic information new research area has been developed, inspired by George Paun, called Membrane Systems. A step forward, in a similar Neural Network architecture, was done to obtain Networks of Evolutionary Processors (NEP). A NEP is a set of processors connected by a graph, each processor only deals with symbolic information using rules. In short, objects in processors can evolve and pass through processors until a stable configuration is reach. This paper just shows some ideas about these two models.

Keywords: Natural Computation, Membrane Systems, Neural Networks, Networks of Evolutionary Processors.

2.5. From Textual to Computational Information Modelling

Jesús Cardeñosa, Carolina Gallardo, and Eugenio Santos

Information can be expressed in many ways according to the different capacities of humans to perceive it. Current systems deals with multimedia, multiformat and multiplatform systems but another « multi » is still pending to guarantee global access to information, that is, multilinguality. Different languages imply different replications of the systems according to the language in question. No solutions appear to represent the bridge between the human representation (natural language) and a system-oriented representation. The United Nations University defined in 1997 a language to be the support of effective multilinguism in Internet. In this paper, we describe this language and its possible applications beyond multilingual services as the possible future standard for different language independent applications

Keywords: Knowledge Representation, Information modelling

2.6. A New Approach for Eliminating the Spurious States in Recurrent Neural Networks

Víctor Giménez-Martínez, Carmen Torres, José Joaquín Erviti Anaut, and Mercedes Perez-Castellanos

As is well known, the Convergence Theorem for the Recurrent Neural Networks, is based in Lyapunov´s second method, which states that associated to any one given net state, there always exist a real number, in other words an element of the one dimensional Euclidean Space R, in such a way that when the state of the net changes then its associated real number decreases. In this paper we will introduce the two dimensional Euclidean space R^2, as the space associated to the net, and we will define a pair of real numbers (x, y), associated to any one given state of the net. We will prove that when the net change its state, then the product $x \cdot y$ will decrease. All the states whose projection over the energy field are placed on the same hyperbolic surface, will be considered as points with the same energy level. On the other hand we will prove that if the states are classified attended to their distances to the zero vector, only one pattern in each one of the different classes may be at the same energy level. The retrieving procedure is analyzed trough the projection of the states on that plane. The geometrical properties of the synaptic matrix W may be used for classifying the n-dimensional state-vector space in n classes. A pattern to be recognized is seen as a point belonging to one of these classes, and depending on the class the pattern to be retrieved belongs, different weight parameters are used. The capacity of the net is improved and the spurious states are reduced. In order to clarify and corroborate the theoretical results, together with the formal theory, an application is presented

Keywords: Learning Systems, Pattern Recognition, Graph Theory, Image Processing, Recurrent Neural Networks.

2.7. On Contradiction Degrees between Two Fuzzy Sets

Carmen Torres, Elena Castiñeira, Susana Cubillo and Victoria Zarzosa

Several methods have been proposed within fuzzy logic for inferring new knowledge from the original premises. However, there must be some guarantee that the results do not contradict each other nor they contradict the initial information. In [5] and [6], Trillas et al. introduced the concepts of both self-contradictory fuzzy set and contradiction between two fuzzy sets. Moreover, the need to study not only contradiction but also the degree of such contradiction is pointed out in [1] and [2] suggesting some measures for this purpose. Nevertheless, contradiction could have been measured in some other way. In [3] an axiomatic definition of measure of contradiction is proposed, both, for a set and between two sets. This paper continues along the lines of a study started out in [1] and [2] defining new degrees of contradiction between two fuzzy sets both depending on a given negation and without depending on any negation.

Keywords: fuzzy sets, t-norm, t-conorm, fuzzy strong negations, contradiction, measures of contradiction

2.8. An Approach to Collaborative Filtering by ARTMAP Neural Networks

Anatoli Nachev

Recommender systems are now widely used in e-commerce applications to assist customers to find relevant products from the many that are frequently available. Collaborative filtering (CF) is a key component of many of these systems, in which recommendations are made to users based on the opinions of similar users in a system. This paper presents a model-based approach to CF by using supervised ARTMAP neural networks (NN). This approach deploys formation of reference vectors, which makes a CF recommendation system able to classify user profile patterns into classes of similar profiles. Empirical results reported show that the proposed approach performs better than similar CF systems based on unsupervised ART2 NN or neighbourhood-based algorithm.

Keywords: neural networks, ARTMAP, collaborative filtering

2.9. Synthesis Methods of Multiple-valued Structures of Language Systems

Mikhail Bondarenko, Grigorij Chetverikov, Alexandr Karpukhin, Svetlana Roshka, and Zhanna Deyneko

The basic construction concepts of many-valued intellectual systems, which are adequate to primal problems of person activity and using hybrid tools with many-valued of coding are considered. The many-valued intellectual systems being two-place, but simulating neuron processes of space toting which are different on a level of actions, inertial and threshold of properties of neurons diaphragms, and also modification of frequency of following of the transmitted messages are created. All enumerated properties and functions in point of fact are essential not only are discrete on time, but also many-valued.

Keywords: intelligence system, hybrid logic, multiple-valued logic, multi-state element.

2.10. A Multistratal Modelling of the Head Dependents (Based on Evidence from the Clitic Doubling in Bulgarian)

Petya Osenova and Kiril Simov

Usually clitic doubling is considered in a connection with the simultaneously verb complement realisation of: a clitic and a full-fledged constituent. For example:

Petar da [2 mu] [1 ya] dade [1 kartinata] [2 na Ivan]

The challenge for formal accounts of such a phenomenon is that there exists different views on clitic doubling: (1) the same syntactic position is occupied by two constituents - the clitic and the complement itself; (2) the separation of the levels on which the clitic and the complement are realised. The first is rejected as unacceptable. Some of the approaches concerning the level separations are: lexical vs. syntactic division (Sag&Miller98), lexical vs. morphosyntactic vs. syntactic division (Avgustinova97). Generally, in each of the approaches it is accepted that the clitic does not occupy a syntactic position but just adds information to the argument structure of the verb and it is realised prosodically on the pre-syntactic level (lexical or morphosyntactic). These approaches are in accordance with the current lexicalised linguistic theories (like HPSG, LFG and others) where it is accepted that the argument structure is presented in the lexicon. The information for the arguments of a lexical sign is stored in the argument structure list (ARG-ST) and clitics only enrich the information there with grammatical features like gender, number and person. This allows the corresponding position to be occupied by full-fledged complements. The adjuncts are not presented on the argument structure list because of their optional nature.

From the data, however, it becomes obvious that the lexical signs contain also information about the possible adjuncts like in the following example:

Toj ste [1 mu] prochete stihotvorenieto si [1 na Ivan]

Here the dative clitic 'mu' is coreferential with the prepositional phrase 'na Ivan' which is an adjunct in this example. If the clitics are realized on the lexical level then the verb 'procheta' has the information that a dative adjunct 'na Ivan' is allowed.

This information, however, cannot be presented on ARG-ST list, because as we mentioned above it does not cover all the head dependents and thus another level is needed to account for the dependents, which are not complements (or subjects). In fact, the complement-adjunct distinction is yet a hazy one in linguistic theories, so in our opinion the head-dependent relation is first realised at the level of the event structure of the lexical sign (in terms of Pustejovsky's generative lexicon) and then mapped onto non-homogenious complement-adjunct distinctions.

Our proposal is as follows: (1) each lexical sign has an event structure presented in the lexicon (as proposed by Pustejovsky), (2) a part of the event structure describes the possible participants in the event (we call it participant list), (3) some of the participants have to be realised as complements and they are also presented on the ARG-ST list, (4) when the clitics are syntactically realised, they are always coreferential with some element on the participant list. When some of the participants is realised as a clitic and full-fledged dependent there are two mechanisms for their coreference. If the full-fledged dependent is a complement, then the coreference is mediated by the ARG-ST list and the standard priciples of the HPSG. In the case of adjunct dependent the coreference is ensured by the MOD feature of the adjunct.

The problem with the redundant information represented in the lexicon can be solved by constructing of a hierarchy of event structures and only specific information is stored locally in the lexical entry. For the construction of such a hierarchy one can rely on verb classes similar to the classes described by (Levin93).

3. Telecommunicational Systems of New Generation

3.1. Architecture and Principles of Control for Multi-Agent Telecommunicational Systems of New Generation

Adil V.Timofeev

Global multi-agent telecommunication systems (TCS) serve for providing to users informational and computing resources, distributed in computer networks (CN). Architecture of such TCN consists of four main subsystems:

- distributed communication system (DCS);
- network control system (NCS);
- distributed informational system (DIS);
- distributed transport system (DTS).

All mentioned systems of multi-agent TCS have distributed property, interconnection and interact actively between each other in a process of providing for users the informational and computing resources, storing in global CS.

3.2. Сравняване на възможностите за концептуално моделиране на Обобщените мрежи и Нормализираният структурен подход в областта на телетрафичните модели

Красимир Атанасов, Стоян Порязов

Разгледани са телекомуникационни мрежи с комутация на (виртуални) канали и чакане, всички основни видове загуби и детайлизирано поведение на потребителите. Предложени са два различни концептуални модела, на една и съща телекомуникационна система, разработени и представени графично посредством различни концепции: Обобщените мрежи, на Кр. Атанасов и Нормализираният структурен подход на Ст. Порязов.

Критериите за сравняване включват: детайлност на описанието, удобство при съставянето и употребата, степен на подпомагане на съставянето на съответни аналитичен и симулационен модели и др.

Направени са изводи, който могат да помогнат за усъвършенстване на графичното представяне и детайлността на описанието на концептуалните телетрафични модели.

Ключови думи: обобщени мрежи, телетрафични модели, нормализиран структурен подход.

3.3. Study on Procedures for Routing under Granting on Services in Packet Switching

Vassil Kadrev, Nikolai Penev

Under granting on services in packet mode in telecommunication networks, the basis factors for granting on minimum delay and number of transits on information are the procedures (protocols) for routing on the packets in the network (the signalizing-that). This protocols, realized in routers include mechanisms for best-route on different of metrics (the number of transits, delay)

and mechanisms for exchange on official (signalization) information - topology, number of hopes before grantee, delays on the packets, state on the communications to the neighbors routers and others. On existent different mechanisms for choice on route in the network - is mated choice on shortest path on different metrics (number of transits, delay, reliability on the lines and others) and routing with additional information (add before this moment delay, the prognosis for possible surcharge on the nodes and others).

On the base of an analytical model of a queuing teletraffic system is made analysis on different mechanisms for routing of the packets in telecommunication IP networks with different structure and capacity, as rolled for border estimation is used the most critical mode - stochastic choice on route.

3.4. Концептуални модели, кортежи и видове телетрафични задачи

Стоян Ат. Порязов, Емилия Т. Саранова

В първата част на статията се разглежда типична последователност на различни видове модели, използвана за изучаване на реални системи. Въвежда се понятието реализационен модел. Понятието “кортеж”, използвано в теорията на бази данни се разширява и прилага в методологията на моделирането. Във втората част на статията въз основа на разглежданията и концептуален модел са формулирани над 50 вида конкретни телетрафични задачи от три основни класа (изследващи човешкото поведение, техническите характеристики на телекомуникационна реална система и тези от смесен тип). Посочени са приложения на изложения подход и е показана полезността му при структуриране и провеждане на научните изследвания, илюстрирана в областта на телетрафичните модели.

Ключови думи: концептуален модел, реализационен модел, моделиране, кортеж, класове телекомуникационни задачи.

3.5. Determination of Necessary Conditions and Measurements for Solution of Human Behaviour Tasks in Telecommunication Systems

Emiliya Saranova

The overall terminal traffic in telecommunication system with (virtual) channel switching, in case with and without repeated calls and BPP-flow is treated. The term "tuple" is introduced for a set of system description values. A formulation, analysis and solutions of the tasks of human behaviour in Terminal Traffic Theory are made. The requirements for task solvability are formulated. A rule for determination of necessary number of measurable sub-tuples, for unique determination of unknown sub-tuples and system state independent values is derived. The results are usable for generalised measurement of users' behaviour and respective network designing and control.

Keywords: tuple, human behaviour, teletraffic, (virtual) channel switching, telecommunication systems.

4. Software Engineering

4.1. Applying Hierarchical MVC Architecture to High Interactive Web Applications

Micael Gallego-Carrillo, Iván García-Alcaide, and Soto Montalvo-Herranz

This paper presents a very new architecture for developing high interactive web applications. At the present time, there are many applications based on web. To manage, extend and correct them can be difficult due to the navigational paradigm they are based on. From here we would like to contribute to make these tasks easier taking advantage of experience obtained from the development of standalone applications in the past. Therefore, we would like to begin to settle the concepts and tools for a new framework.

There are other frameworks and APIs offering MVC architectures to web applications, but we think that they are not applying exactly the same concepts. While they keep on basing their architectures on the navigational paradigm, we are offering a new point of view based on an innovator hierarchical model. First, we present in this paper the main ideas of our proposal. Next, we expose how to implement it using different Java technologies. Finally, we make a first approach to our hierarchical MVC model. We also compare shortly our proposal with the previously cited technologies.

Keywords: Web Applications Engineering, Model, View, Controller, MVC.

4.2. A Sensitive Metric of Class Cohesion

Luis Fernández and Rosalía Peña

Metrics estimate the quality of different aspects of software. In particular, cohesion indicates how well the parts of a system hold together. A metric to evaluate class cohesion is important in object-oriented programming because it gives an indication of a good design of classes.

There are several proposals of metrics for class cohesion but they have several problems (for instance, low discrimination). In this paper, a new metric to evaluate class cohesion is proposed, called SCOM, which has several relevant features. It has an intuitive and analytical formulation, what is necessary to apply it to large-size software systems. It is normalized to produce values in the range [0..1], thus yielding meaningful values. It is also more sensitive than those previously reported in the literature. The attributes and methods used to evaluate SCOM are unambiguously stated. SCOM has an analytical threshold, which is a very useful but rare feature in software metrics. We assess the metric with several sample cases, showing that it gives more sensitive values than other well know cohesion metrics.

Keywords: Object-Oriented Programming, Metrics/Measurement, Quality analysis and Evaluation.

4.3. RKHS-Methods at Series Summation for Software Implementation

Svetlana Chumachenko and Ludmila Kirichenko

Reproducing Kernel Hilbert Space (RKHS) and Reproducing Transformation Methods for Series Summation that allow analytically obtaining alternative representations for series in the finite form are developed.

Keywords: The reproducing transformation method, Hilbert space, reproducing kernel, RKHS, Series Summation Method.

4.4. Examination of Archived Objects' Size Influence on the Information Security when Compression Methods are Applied

Dimitrina Polimirova–Nickolova, Eugene Nickolov

After giving definitions for some basic notions as risk and information security, archived objects with different size as well as different compression methods are examined and described. An experiment is made using different compression methods with different objects' size and type, followed by an analysis and an evaluation of the obtained results. In the end, some conclusions and recommendations for future work are suggested.

Keywords: Archived Objects, Archiving Programs, Information Security, Compressed Objects, Methods of Compression, Password, File Extensions.

4.5. Визуализация на алгоритми и структури от данни

Ивайло Петков, Сергей Георгиев

В статията се разглежда, web-базирано моделиране на абстрактни структури от данни и прилагането на избрани алгоритми върху тях. С цел използването на системата от по-широк кръг потребители е реализиран адаптивен потребителски интерфейс.

Keywords: граф, двоично дърво на наредба, Дийкстра, Форд-Белман, цикъл

4.6. Нов подход към конструирането на блок-схемни езици

Стоян Порязов

На определени етапи от анализирането и проектирането на сложни системи, блок-схемните езици имат редица предимства, в сравнение с текстовите. Въпреки това, в информатиката те имат по-малко приложение отколкото в електрониката, хидравликата и други области, където са задължителни. За това има няколко причини, по-важните от които са разгледани в статията.

Предложен е нов подход към конструирането на блок-схемни езици в областта на информационното моделиране.

Ключови думи: блок-схемни езици, графични знаци, информационно моделиране.

4.7. Симулация на някои основни грешки при измерване на оптични параметри чрез прилагане на обратна задача в оптиката и фазово-стъпков метод

Георги Стоилов

За решаване на обратната задача в оптиката е използвано обратно Фурие преобразуване на изображение, получено от преминаването на лазерен сноп през обекта. Предложено е използването на фазово-стъпков метод за намиране на разпределението на фазата. Това позволява изчисляването на коефициента на пропускане в комплексен вид за всяка точка на изследвания обект. Използването на опорно измерване елиминира влиянието на параметрите на измервателната система.

Показан е основният алгоритъм за изчисляване. Направена е компютърна симулация на влиянието на по-важните параметри на оптичната схема върху точността на измерване. Симулирани са грешки при позициониране на основните оптични елементи и неточно фазово отместване. Анализирано е използването на АЦП с различна разрешаваща способност. Дискутирани са условията и ограниченията за успешно прилагане на метода.

Този метод може да бъде използван за измерване и окачествяване на малки и микрообекти.

Ключови думи: 2D–оптични параметри, обратна задача в оптиката, фазово-стъпков метод, компютърна симулация

5. Informatics in Education and Cultural Heritage

5.1. Digitisation of Cultural Heritage: between EU Priorities and Bulgarian Realities

Milena Dobreva and Nikola Ikonomov

The paper presents the Bulgarian setting in digital preservation of and access to cultural and scientific heritage. It mentions key Bulgarian institutions, which take or should take part in digitisation endeavours. It also presents examples of building and adapting specialised tools in the field, and more specifically SPWC, ACT and XEditMan.

Keywords: digital preservation of and access to cultural and scientific heritage, legislative issues, SPWC, ACT, XEditMan

5.2. Programming Paradigms in Computer Science Education

Elena I. Bolshakova

Main styles, or paradigms of programming – imperative, functional, logic, and object-oriented – are shortly described and compared, and corresponding programming techniques are outlined. Programming languages are classified in accordance with the main style and techniques supported. It is argued that profound education in computer science should include learning base programming techniques of all main programming paradigms.

Keywords: programming styles, paradigms of programming, programming techniques, integration of programming techniques, learning programming paradigms

5.3. Tutoring Methods in Distance Course «Web-design Technologies»

Valeriy Bykov, Yuriy Zhook, and Ganna Molodykh

Methods of Organizational Forms of students' work at the example of distance course "Web-Design Technologies" are described, learning results analysis being carried by the author are suggested. Some concrete recommendations about Tutor's activities in distance learning process are proposed to improve the quality and efficiency of distance learning.

Keywords: Distance Course "Web-Design Technologies", methods and methodology of distance teaching, organizational forms of students' work, recommendations for effective tutoring.

5.4. Учебная модель компьютера как база для изучения информатики

Евгений А. Еремин

Предлагается в качестве общей основы изучения различных дисциплин курса информатики, связанных с вопросами software и hardware, использовать единую учебную модель компьютера. Дается обоснование данного подхода, перечислены разделы, где он является наиболее актуальным. Описаны собственные разработки автора по проблеме (включая программную поддержку) – учебная модель компьютера "E97" и компилятор с языка Паскаль для нее. Подчеркивается, что обсуждаемые идеи пригодны и для других учебных моделей.

Ключевые слова: модель компьютера, обучение, информатика, компилятор.

5.5. Historical Informatics in Practical Application: Virtual Museum of the Khazar State History

Boris S. Elkin, Alexander Ya. Kuzemin, Alexander F. Koshchy, and Alexander B. Elkin

The process of informatization having touched just about all areas of knowledge involved the historical science in the same manner between eighties and nineties of the XXth century. Computers have become not only more accessible to historians, technical characteristics of personal computers and their software are improved steadily, this transforms a computer into more and more attractive and effective instrument of historical investigation. It creates real possibilities for application of the newest information technologies to the work of a historian. Rapid growth of the computer industry resulted in creation of the International History and Computing Association in 1986, it coordinates activity of the historians from different countries who apply computer methods and technologies to their research practice and educational process. Since 1992, the scientific centers from NIS have joined the Association. The processes typical for the nineties consisting in the rise of the branch informatics in a number of the fields of science were the reason for creation of the Association. One of such new branches of science emerging on the border of the information science and social sciences and humanities is *the historical informatics* presented in the paper..

5.6. Distributed Information Measurement System for Support of Research and Education in Optical Spectroscopy

Sergey Kiprushkin, Nikolay Korolev, Sergey Kurskov, and Natalia Nosovich

The present paper is devoted to the distributed information measurement system for support of research and educational process with remote access to informational and technical resources within the Intranet/Internet networks. This system is characterized by the network integration of computer-based research equipment for the natural sciences. It provides multiple access to such resources in the networks functioning on the basis of Protocol Stack TCP/IP. The access to physical equipment is realized through the standard interface servers (CAMAC, GPIB), the server providing access to Intel MCS-196 microcontrollers, and the communication server, which integrates the equipment servers into uniform information system. The system is used for making research task solutions in optical spectroscopy, as well as for supporting educational process at the Department of Physics and Engineering of Petrozavodsk State University.

Keywords: distributed information measurement system, equipment server, CAMAC server, GPIB server, client-server technology, distance education.

6. Business Informatics

6.1. Business Informatics: Basic Concepts (Part 1)

Krassimir Markov, Krassimira Ivanova, and Ilia Mitov

The concept “Business informatics” we have start using before 1990. Now we have long time experience in this very important area of informatics. The paper represents our understanding of the basic concepts of Business Informatics.

6.2. Decision Support System for Investment Preference Evaluation under Conditions of Incomplete Information

Ivan Popchev and Irina Radeva

The proposed approach for decision support system of Investment Preference evaluation enables a categorization of public companies according to their financial stability and safety. The Investment Preference (IP) herein introduced is a qualitative criterion assumed to estimate the minimal probability of bankruptcy expressed via three categories Risky, Satisfactory and Excellent. Seven bankruptcy prediction models and Bulgarian public companies accounting information were used to illustrate the possibilities of the proposed approach. The objectives in this paper are to eliminate the subjectivity of an expert decision in evaluation of the limits of the IP categories Excellent, Satisfactory and Risky and to specify the IP categories’ classification functions.

Keywords: Economics, Evaluation, Decision making, Discriminant analysis, Iterative method

6.3. Levels of Business Structures Representation

Katalina Grigorova, Plamenka Hristova, Galina Atanasova, and Jennifer Q. Trelewicz

With the increasingly large number of software frameworks available to facilitate "business modeling", it is important to understand the implications of the level of abstraction provided by the frameworks. In this paper, we discuss three levels of abstraction of framework for business modeling, including the most typical and widely accepted representatives of each level. We show that XML is an emerging standard of data interchange and integration for business modeling. We discuss these frameworks in the context of database representation, which is important for storage and retrieval of models.

Keywords: Business Modeling, Modeling Languages, Modeling Techniques, XML.

6.4. Автоматизация отбора структурированной информации для подготовки управленческих решений

Андрей Д. Данилов

В статье рассматривается теоретическая и практическая возможность автоматизации отбора структурированной информации из баз и хранилищ предпрниятия для подготовки управленческих решений. В основе теоретического подхода лежит закон причинно-следственной связи, который используется для определения наличия фундаментального смысла в структурированной информации об объекте. Его наличие является критерием для использования такой структурированной информации в задачах подготовки и принятия управленческих решений.

Ключевые слова: Информационная структура объекта, как его определенная информационная модель; Фундаментальный смысл, содержащейся в стуктурированной информации об объекте; Закон причинно-следственной связи; Автоматизация отбора структурированной информации из баз и хранилищ; Хранилище структурированной информации, в которой содержится фундаментальный смысл.

6.5. Viable Model of the Enterprise – a Cybernetic Approach for Implementing the Information Technologies in Management

Todorka Kovacheva

The purpose of the current paper is to present the developed methodology of viable model based enterprise management, which is needed for modern enterprises to survive and growth in the information age century. The approach is based on Beer's viable system model and uses it as a basis of the information technology implementation and development. The enterprise is viewed as a cybernetic system which functioning is controlled from the same rules as for every living system.

Keywords: enterprise strategy, viable system model, enterprise model, neural network, artificial intelligence, cybernetics, business trends.

6.6. Analysis of Movement of Financial Flows of Economical Agents as the Basis for Designing the System of Economical Security (General Conception)

Alexander Ya. Kuzemin, Vycheslav V. Liashenko, Elena S. Bulavina, and Asanbek A. Torojev

Some directions in the financial flows stable functioning are analyzed. The method of attack of the financial flows mutual action in different countries is offered. The main components of the financial flows' investigation, their stability and possible ruptures from the standpoint of the adequate economical security system design are substantiated.

Keywords: financial flows, economical security, fund market, fund indices, bank activity.

6.7. Using ORG-Master for Knowledge Based Organizational Change

Dmitry Kudryavtsev, Lev Grigoriev, Valentina Kislova, and Alexey Zablotsky

Enterprises in growing markets with transitional economy nowadays encounter extreme necessity to change their structures and improve business processes. In order to support knowledge processes within organizational change initiative enterprises can use business modeling tools. On one hand software vendors suggest many tools of this kind, but on the other hand growing markets with transitional economy determine quite special requirements for such tools. This article reveals these requirements, assesses existing business modeling tools using these requirements and describes ORG-Master as a tool specially created for support of process improvement initiatives in the growing markets with transitional economy.

Keywords: Business information modeling, business modeling, knowledge process, organizational change, business process improvement, growing markets, transitional economy.

6.8. Нормализация на представянето на бизнес-процеси

Стоян Порязов, Дженифер Трелевич, Христина Даскалова, Емилия Саранова

Въз основа на анализ на бизнес-терминологията и методите на информационното моделиране се предлага подход за нормализиране на представянето на бизнес-процесите. Подходът включва: терминологично, операционно и структурно нормализиране.

Ключови думи: бизнес-процеси, нормализиране

7. INFRAWEB Project

7.1. Semantic Web Service Development on the Base of Knowledge Management Layer - INFRAWEBS Approach

Joachim Nern, Tatiana Atanasova, Gennady Agre, András Micsik, László Kovács, Janne Saarela and Timo Westkaemper

The paper gives an overview about the ongoing INFRAWEBS project and describes the main layers and software components embedded in an application oriented realisation framework. An important part of INFRAWEBS is a Semantic Web Unit (SWU) – a collaboration platform and interoperable middleware for ontology-based handling and maintaining of SWS. The framework

provides knowledge about a specific domain and relies on ontologies to structure and exchange this knowledge to semantic service development modules. INFRAWEBS Designer and Composer are sub-modules of SWU responsible for creating Semantic Web Services using Case-Based Reasoning approach. The service and user agent (SUA) unit is responsible for building up the communication channels between users and various other modules. It serves as a generic middleware for deployment of Semantic Web Services. These software toolsets are developing for creating and maintaining of full-life-cycle Semantic Web Services with specific application support.

Keywords: Semantic Web Services, Fuzzy Set, Ontologies, Case-Based Reasoning, Multi-Agent Systems

7.2. Adjusting WSMO API Reference Implementation to Support More Reliable Entity Persistence

Ivo Marinchev

In the presented paper we scrutinize the persistence facilities provided by the WSMO API reference implementation. It is shown that its current file data-store persistence is not very reliable by design. Our ultimate goal is to explore the possibilities of extending the current persistence implementation (as an easy short-run solution) and implementing a different persistent package from scratch (possible long-run solution) that is more reliable and useful. In order to avoid "reinventing the wheel", we decided to use relational database management system to store WSMO API internal object model. It is shown later that the first task can be easily achieved although in not very elegant way, but we think that the later one requires some changes in the WSMO API to smooth out some inconsistencies in the WSMO API specification in respect to other widely used Java technologies and frameworks.

Keywords: Semantic Web Services, Web Service Modelling Ontology (WSMO), WSMO API, WSMO4J.

7.3. INFRAWEBS Capability Editor – A Graphical Ontology-Driven Tool for Creating Capabilities of Semantic Web Services

Gennady Agre, Peter Kormushev, and Ivan Dilov

The current INFRAWEBS European research project aims at developing ICT framework enabling software and service providers to generate and establish open and extensible development platforms for Web Service applications. One of the concrete project objectives is developing a full-life-cycle software toolset for creating and maintaining Semantic Web Services (SWSs) supporting specific applications based on Web Service Modelling Ontology (WSMO) framework. SWSs are self-contained, self-describing, semantically marked-up software resources that can be published, discovered, composed and executed across the Web in a task driven semi-automatic way. A main part of WSMO-based SWS is service capability – a declarative description of Web service functionality. A formal syntax and semantics for such a description is provided by Web Service Modeling Language (WSML), which is based on different logical formalisms, namely, Description Logics, First-Order Logic and Logic Programming. A WSML description of a Web service capability is represented as a set of complex logical expressions (axioms). The paper describes a specialized user-friendly tool for constructing and editing WSMO-based SWS capabilities. Since the users of that tool are assumed to be SWS providers, which are not the specialists in first-order logic, it is proposed a graphical way for constricting and

editing the axioms abstracting away as much as possible from a concrete syntax of logical language used for implementing them.

Our analysis has shown that the main problems arising during axiom creating are associated with using of correct names of concepts, attributes, relations and parameters as well as their types rather than with expressing logical dependences between axiom parts. So the process of constructing logical expressions in the tool is ontology-driven, which means that in each step of this process the user may select only such elements of existing ontologies that are consistent with already constructed part of the axiom. From this point of view the created axiom is always semantically consistent with ontologies used for it construction. After discussing the main design principles of the Editor, its functional architecture is briefly presented. The tool is implemented in Eclipse Graphical Environment Framework and Eclipse Rich Client Platform.

7.4. INFRAWEBS BPEL-Based Editor for Semantic Web Services Description

Tatiana Atanasova

INFRAWEBS project considers usage of semantics for the complete lifecycle of Semantic Web processes, which represent complex interactions between Semantic Web Services. One of the main initiatives in the Semantic Web is WSMO framework, aiming at describing the various aspects related to Semantic Web Services in order to enable the automation of Web Service discovery, composition, interoperation and invocation.

In the paper the conceptual architecture for BPEL-based INFRAWEBS editor is proposed that is intended to construct a part of WSMO descriptions of the Semantic Web Services. The semantic description of Web Services has to cover Data, Functional, Execution and Qos semantics. The representation of Functional semantics can be achieved by adding the service functionality to the process description. The architecture relies on an operational (functional) semantics of the Business Process Execution Language for Web Services (BPEL4WS) and uses abstract state machine (ASM) paradigm. This allows describing the dynamic properties of the process descriptions in terms of partially ordered transition rules and transforming them to WSMO framework.

7.5. Семантично описание на уеб услуги и възможностите на BPEL4WS

Владислава Григорова

Използването на възхода на семантичните уеб технологии дава възможност за увеличаване на гъвкавостта на съществуващите индустриални стандарти.

В статията се разглеждат видовете семантично описание на уеб услугите и степента на тяхната реализация в BPEL4WS (език за моделиране на бизнес процеси за уеб услуги) съответно на абстрактно и изпълнимо ниво.

Предложени са начини за използване на BPEL4WS за целите на семантичните уеб услуги в посока на тяхната полуавтоматична интеграция.

7.6. Разглеждане на интеграцията на бизнес-приложенията като услуга

Христина Даскалова, Владислава Григорова

В статията се разглежда процесът на многостранна интеграция на бизнес-приложенията, който изисква построяване на обща инфраструктура, придобива формат на услуга и води до отказ от индивидуално построяване на собствената инфраструктура на всеки участник в процеса.

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