### METHODS OF REASONING AND KNOWLEDGE REPRESENTATION

**M.I. Zabezhailo**. To the Some New Possibilities to Control Computational Complexity of Hypotheses Generation in JSM-method (Part II).

Some new possibilities to optimize exhaustive search in intelligent data analysis by means of JSMmethod of automated hypotheses generation are discussed. Special search control technique basing on the so called pseudo trees and their skeletons is presented. Combinatorial characteristics of pseudo trees and their skeletons are analyzed. Some algorithms for pseudo trees reconstruction starting from their skeletons formation are presented. The announced algorithms are related to the controlled navigation in the set of all JSM-hypotheses reconstructed form given sample (initial JSM-base of facts). The concept of the approximate JSM-method is formulated and developed. Some additional abilities to accelerate JSM-data processing basing on parallel calculations, cloud computing techniques and some problem-oriented hardware components are demonstrated.

**Keywords**: JSM-method of automated hypotheses generation, computational complexity and search optimization, decomposition techniques for search optimization, controlled approximations for the set of all JSM hypotheses reconstructed from the given sample of initial examples and counterexamples

A.A. Zuenko. Constraint inference based on the matrix representation of finite predicates

This paper proposes methods of constraint inference and heuristic search for solving constraint satisfaction problems with the variables defined on finite domains. The developed methods use the matrix representation of finite predicates which allow to not convert constraints into binary relations and implement an effective reduction of the search space.

**Keywords**. Constraint satisfaction problem, algebra of n-tuples, reduction of the search space, heuristic search, combinatorial search.

### COGNITIVE STUDIES

#### O.P. Kuznetsov. On conceptual semantics

Basic provisions of the conceptual semantics offered by the known linguist S.Pinker are discussed. As well as other concepts of cognitive semantics, this concept emphasizes a fundamental role of physical human nature in formation of its cognitive processes. Pinker's important thesis – the statement about existence of language of thinking, which serves for representation of word meanings in a brain and is primary in relation to verbal language.

Keywords: conceptual semantics, language of thinking, cognitive models, discourse.

#### N.V. Chudova. Processing of experience as a function of the Image of the World

The problem of links between the Image (Model) of the World, aggressiveness, and non-constructive processing of experience is considered. The obtained in our empirical research data show that hostility and psychological disadvantage associating via non-constructive experiencing. It is shown that the hostility and the hardiness are defined by two different models of the World and act as opponents one another. The hostile Image of the World based on an unconstructive thinking makes people intolerant to stress leading to certain narcissistic psychological problems. The hardiness in turn is based on a constructive thinking, primarily manifesting in readiness for the search activity providing the ability to handle stress, to cope with problems at the behavioral level, and not to transform ones to psychological. **Keywords**: image of the World, hostility, hardiness, constructive thinking, search activity.

# INTELLIGENT SYSTEMS AND TECHNOLOGIES

**M.P. Pashkin, A.V. Smirnov**. Using Ontological Models for Individual Selection of Mobile Network Operators' Products for Subscribers

Under pressure from growing competitive activity, mobile network operators have to look for new ways to stimulate communication services used by subscribers. To achieve this goal, operators develop new products in order to appeal to mass segments of subscribers. However, such strategy fails to attract subscribers effectively and operators are forced to develop mechanisms to select and recommend products based on subscribers individual needs and preferences. This article describes an ontology-driven conceptual models of a mobile network operator's product and algorithm which has been developed to select appropriate products for subscribers. The presented results will be used to implement a recommender system, closely integrated with the "Product Catalog of a Mobile Network Operator" information system.

**Keywords**: intelligent system, recommender system, ontological model, context, a mobile network operator's product.

V.L. Stefanuk. Behavior of finite automata in fuzzy environment: theory and applications

The behavior of Tsetlin's linear automaton being put in a fuzzy environment is considered. Previously it has been studied in random environments, the latter permitting the use of classic Markov Chains. Our paper relies on the two theoretical results obtained by the present author before, namely the theory of Generalized Markov Chains (Markov-Stefanuk chains) and the axiomatic description of the operations with fuzzy evidences. The explicit expressions obtained in the present paper demonstrate a deep analogy with Tsetlin's results. Besides, a possibility of the use of asymptotic optimality for measuring the membership functions for singletons are discussed. It is concluded that the results open a possibility to create an analog of the collection of statistics for the area of fuzzy systems.

Keywords: finite automata behavior, fuzzy environment, random environment, learning, asymptotic optimality, generalized Markov chain, fuzzy singletons

## A.V. Shvets, D.A. Deviatkin, I.V. Smirnov, I.A.Tikhomirov, K.V. Popov, K.N. Yarygin.

Investigation of systems and methods for scientometric analysis of scientific publications

The paper contains an overview of the methods and systems of scientometric analysis of scientific publications, the methods for identifying promising areas of research. The results of experiments for identification of research areas using different methods in the domain "regenerative medicine" are considered. Conclusions about the prospects of these methods, their disadvantages, as well as directions for further research are provided.

**Keywords**: scientometric analysis and support of scientific activities, map of science, regenerative medicine.

V.V. Borisov, S.N. Andreev, Y.A. Fedulov. Analysis of complex linguistic objects based on fuzzy estimation models

In the paper the relevance of building fuzzy estimation models (fuzzy similarity models) aimed at solving a wide scope of linguistic problems under conditions of uncertainty is outlined. Classification of fuzzy similarity models depending on the type of characteristics aggregation is proposed and analysis has been carried out. Fuzzy similarity models have been developed; different approaches to solving problems of linguistic analysis using these models are suggested.

This paper deals with some issues of building fuzzy models within the third approach, using as example fuzzy models for the estimation of similarity of linguistic objects. Such models usage makes the basis for

solving several problems of linguistic analysis including those viewed in this paper: estimation of the degree of similarity of the original text (poem) and its translations using different groups of characteristics; estimation of the similarity of parts of the compared poems (chapters); classification of texts and their features according to certain rules.

This paper contains the results of the texts estimation of the original poem by Coleridge "The Rime of the Ancient Mariner" and its two translations by N. Gumilev and W. Levik.

Keywords: linguistic analysis, fuzzy estimation (similarity) model

**I.M. Azmuhamedov, O.M. Protalinskij.** Methodology modeling of bad formalizable weakly structured social engineering systems

The opportunity of application of fuzzy cognitive modeling to management social engineering systems (SES). Formulates the principles and methods of building fuzzy cognitive models formalizable and poorly structured SES.

**Keywords:** bad formalized and poorly structured social engineering system, fuzzy cognitive modeling, Fishburne, similarity index weight, synthesis of control solutions.

# DECISION MAKING

**A.B. Petrovsky, V.N. Lobanov.** Multiple criteria choice in the attribute space of large dimension: multi-method technology PAKS-M

The paper describes the new multi-method technology for multiple criteria choice PAKS-M (Progressive Aggregation of Classified Situations by many Methods) The technology provides reducing a dimension of the attribute space, constructing several hierarchical systems of composite criteria and integral index of decision quality, which are aggregate initial attributes, ordering and/or classifying multi-attribute objects by using different combinations of several methods of decision making. The technology is based on expert knowledge and/or decision maker preferences, significantly reduces the time and complexity of solving the problems of multiple criteria choice, allows a decision maker to conduct a meaningful analysis of the obtained results. The developed technology has been applied in practice to multiple criteria selection of the advanced computing complex.

**Keywords:** multiple criteria choice, reduction of attribute space dimension, hierarchical aggregation of attributes, composite criterion, integral index, evaluation of prospects, computing complex

A.G. Madera. Interval stochastic uncertainty of estimates in multiple criteria decision making problems

The paper proposes a method of multicriteria optimization under interval stochastic uncertainty of estimates given by the subject for the relative importance of one criterion over the other and the different alternatives to each other for each criterion. The method is an extension of the deterministic analytic hyerarchy process AHP for multicriteria optimization. It is use deterministic point estimates of the importance of criteria and alternatives for each criterion . While deterministic AHP allows to select the best alternative by a point maximum value of a global priority in the developed article interval stochastic AHP the global priorities are interval, making it difficult to make the best decision . To select the best interval alternative in this article introduce two criteria, whose values are maximized. The first criterion corresponds to the maximum of the lower and upper bounds of the intervals of global priorities of alternatives. The second criteria is the maximum of interval stability of alternatives. Application of the proposed approach is illustrated by a specific example. Also a comparison with the results obtained on the basis of interval arithmetic, show the failure of the latter, carried out.

**Keywords:** interval stochastic assessment, analytic hierarchy process, uncertainty, decision making, criteria, alternatives.