Cybernetics and Systems: An International Journal

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/ucbs20

CURRENT RESEARCH ADVANCES AND IMPLEMENTATIONS IN SMART KNOWLEDGE-BASED SYSTEMS: PART I

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Version of record first published: 05 Mar 2013.

To cite this article: Edward Szczerbicki , Manuel Graña , Jorge Posada & Carlos Toro (2013): CURRENT RESEARCH ADVANCES AND IMPLEMENTATIONS IN SMART KNOWLEDGE-BASED SYSTEMS: PART I, Cybernetics and Systems: An International Journal, 44:2-3, 95-97

To link to this article: http://dx.doi.org/10.1080/01969722.2013.762247

Cybernetics and Systems: An International Journal, 44:95–97

ISSN: 0196-9722 print/1087-6553 online
DOI: 10.1080/01969722.2013.762247

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EDITORIAL INTRODUCTION

New approaches are needed that could move us toward developing effective systems for problem solving and decision making, systems that can deal with complex and ill-structured situations, systems that can function in information-rich environments, systems that can cope with imprecise information, systems that can rely on their knowledge and learn from experience—that is, intelligent systems. One of the main efforts in intelligent systems development is focused on knowledge and information management, which is regarded as the crucial issue in smart decision-making support. The carefully selected papers in this Guest Edition of *Cybernetics and Systems* represent a sample of such effort. The overall aim of this issue is to provide guidelines to develop tools for smart processing of knowledge and information. Still, the guide does not presume to give ultimate answers. Rather, it poses ideas and case studies to explore and the complexities and challenges of modern knowledge management issues. It also encourages the reader to become aware of the multifaceted interdisciplinary character of such issues. The premise of this issue is that the reader will leave it with a heightened ability to think—in different ways—about developing, evaluating, implementing, and supporting intelligent knowledge- and information-based management systems in real-life environments.

A number of international conferences contribute each year in a substantial way to the above-mentioned development. This Guest Edition is based on some cutting-edge contributions provided by one of the most dynamic and innovative conference series in the area that was held in Spain in 2012: the International Conference on Knowledge-Based and Intelligent Information & Engineering Systems (KES'2012, San Sebastian, Spain) This important international event attracted hundreds of papers in a number of relevant areas such as smart information technology projects management, data mining,

The Guest Editors gratefully acknowledge the assistance and support provided by Professor Robert Trappl, Editor-in-Chief of *Cybernetics and Systems: An International Journal*; Karin Vorsteher from the CBS Editorial Office; and a number of anonymous referees who reviewed the manuscripts of the papers included in this Guest Issue.

complexity and control, industrial design, manufacturing, bio-inspired systems, vision, search, robotics, education, planning, scheduling, reasoning, and many more. This Guest Edition of *Cybernetics and Systems* contains carefully selected and peer-reviewed papers that expand significantly on those topics of KES'2012 that may be of special interest to cybernetics and smart systems communities.

SELECTED RESEARCH CONTRIBUTIONS

The selection opens with the paper titled "An Empirical Evaluation of Interest Point Detectors," which introduces and evaluates a cutting-edge image interest point detection algorithm measuring several parameters, such as efficiency, robustness to image domain geometric transformations, affine or projective transformations, as well as invariance to photometric transformations such as light intensity or image noise. The paper offers a number of excellent insights into the area of image analysis and computer vision–based applications dealing with extraction of information from the images acquired by a camera sensor.

In the following paper, titled "A Proposal for a Knowledge Market Based on Quantity and Quality of Knowledge," the authors propose a vision of a future knowledge market based on a quantification scheme that offers a novel method of estimating in an automated way both the quality and quantity of knowledge of agents (knowledge market players) acting on a multi-agent platform. The main contribution of the presented research is the integration of formal mechanisms for knowledge quality and quantity measurement and the use of these values to set a price for knowledge and select the most suitable agent for negotiation. This contribution defines a new direction for future research and progress in the area of knowledge markets and knowledge sharing.

The next paper, titled "A Hybrid Method for Fuzzy Ontology Integration," introduces a novel concept of combining heuristics and consensus-based conflict resolution for fuzzy ontology integration. The authors provide a very comprehensive background description of the above concept and continue with illustrative examples and experiments showing that the proposed approach is effective for both completeness and accuracy of the integration process.

The paper that follows is titled "Agent-Based Approach to the Design of RBF Networks" and proposes an interesting and promising application of a multi-agent population learning algorithm to the task of radial basis function (RBF) network initialization and training. The presented approach allows for an effective network initialization and precise estimation of its output weights. The agent-based population learning algorithm is used to select prototypes (feature vectors) constructed over the original training data sets.

In the proposed implementation of the algorithm, RBF initialization and training are performed by a team of agents executing various local search procedures and cooperating with the aim of finding the best solution to the RBF design solution at hand. The authors ran a comparison analysis between their approach and other approaches presented in the current literature on this research subject.

The last paper of the presented selection is titled "Prediction Based on Integration of Decisional DNA and a Feature Selection Algorithm RELIEF-F." This paper investigates how the combination of decisional DNA–based knowledge representation and a popular feature selection algorithm RELIEF-F can improve the quality of prediction. The proposed approach is general and extensible in terms of both designing future algorithms and application to other domains. The proposed architecture is a suitable and comprehensive tool for knowledge discovery. The enhancement of using the RELIEF-F measure helps to automate the process of knowledge extraction. The illustrative empirical experiment presented in the paper shows that the discussed structure can be used as an effective and precise prediction tool. It also enables users to make their knowledge shareable, transportable, and easily understood.

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