

Guest Editorial

Knowledge-Based Systems at the Expert Systems and Related Technologies Laboratory of the Research Institute for Informatics

Knowledge-based systems and especially expert systems are a remarkable class of artificial intelligence applications. A knowledge-based program is characterized by a clear separation between the knowledge it contains (the so-called knowledge base) and the inference mechanisms which are used for knowledge processing. This dichotomy largely contributes to the maintenance and evolution of the programs, two aspects which are essential for artificial intelligence systems.

A special attention in knowledge-based systems is paid to finding the most adequate knowledge representation modalities and, related to each representation paradigm, to the most powerful inference mechanisms. There are several knowledge representation paradigms: rules, objects (frames), logic.

All the papers of this issue are some way or another related to the object-oriented knowledge representation due to the fact that the laboratory started with and developed around the XRL object-oriented knowledge processing environment. As the laboratory has grown up, new research themes have revealed which are no more related to XRL but the general orientation is still toward objects.

The presented papers do not cover all the researches carried out in the laboratory. There are also other researches in knowledge-based systems for software engineering (mainly intelligent reverse engineering), rule-based systems, parallel processing, and neural networks, which were reported somewhere else.

The first paper, **"Intelligent Computer-Aided Design in the XRL Object-Oriented Knowledge**

Processing Environment," describes the applications of the XRL environment. XRL is a multiple paradigm system which integrates structured objects with production rules, constraints, a blackboard problem-solving architecture, and self-generation capabilities. XRL has been developed over about 8 years and includes several original ideas presented by its authors (Mihai Barbuceanu and Stefan Trausan-Matu) at international conferences.

Many of the current researches in the laboratory have their roots in the ideas produced during the development of XRL. The second paper, **"O3 - A Rational Construction of an Open Object-Oriented Language,"** presents a descendant of XRL. O3 is a very powerful and flexible language which can be used as a substrate for advanced knowledge processing systems. The next two papers, **"Constraint-Based Programming for Object-Oriented Knowledge Processing"** and **"A Constraint-Space Based CSP Solving Method,"** are the result of the researches based on the idea that the implementation of a constraint processing module could enhance the representation and processing capabilities of XRL. Now, constraint processing is a research theme as such, independent of XRL and with a wide range of applications: expert systems, modelling and simulation, resource allocation, scheduling.

"ESYS: Interactive Knowledge Acquisition from Multiple Experts Using Personal Construct Theory" is a paper which presents a system for knowledge acquisition. This system is written in Actor from Windows and it can be taken as a

starting point for generating knowledge bases for the knowledge-based systems developed by the laboratory. It can also be used for building consultancy applications.

Knowledge acquisition - a very important activity in knowledge-based systems development - is a research topic discussed also in the next paper: **"MODEL: An Enhanced Term Classification Language for Describing Knowledge Level Models"**. This paper, together with **"Towards an Uniform Language for Knowledge Representation Including Procedural Knowledge Expressed Declaratively"** enters another research area of the

laboratory, namely term subsumption languages. This class of languages offers strong knowledge representation facilities. They extend the frame-based representation paradigm along a formally sound dimension.

The last paper, **"Lexicon Design Using a Paradigmatic Approach,"** illustrates the results obtained by a research group which is involved in natural language processing. One of the next steps of this group is the usage of the O3 language.

Stefan Trausan-Matu
Mihai Barbuceanu