Open positions for the Marie Sklodowska-Curie fellows at the Centre for Information Technologies and Applied Mathematics

Centre for Information Technologies and Applied Mathematics (CITAM) is an interdisciplinary research group with the activities at the intersection of computer science and informatics, mathematics, control systems technologies, and process engineering. In particular, the Centre's work is concentrated on the following topics:

- knowledge discovery from large databases (with applications in biomedicine);
- computational creativity;
- research and development for advanced IT supported applications in education, including e-learning;
- algebraic hypercompositional structures and their applications;
-ordered algebras;
- dynamic-systems modeling from data and application of these models for control design.

Topic **1** : Connections between algebraic hypercompositional structures and fuzzy sets.

One of the significant developments in the field of algebraic hypercompositional structures, both of a theoretical and applicable character, is represented by the fuzzy hyperstructures, like a generalization of classical hyperstructures. Many complicated problems in economics, engineering, environment, social science, medical science and many other fields involve uncertain data and they cannot be solved using only classical mathematics methods. There are several well-known theories to describe uncertainty, like fuzzy sets, intuitionistic fuzzy sets, rough sets, soft sets, vague soft sets, etc. During this project, new connections between fuzzy sets and hypergroups, hyperrings, or hypermodules will be investigated, based on concrete examples from real-life.

Scientific requirements:

Ph.D. in Mathematics. The candidate is expected to have a very good background in the field of Algebra, in particular in algebraic structures, graph theory and fuzzy sets, and to participate actively in the current and future fields of research of the Centre.

Topic 2 : Cross-Context Knowledge Discovery in Science and Education

Solving many challenging problems, such as understanding complex diseases, designing new drugs, designing new devices, predicting consequences of certain activities in complex ecosystems or learning situations, requires knowledge from different contexts to be connected and used in new circumstances. On the other hand, scientists and other

professionals tend to be more and more specialized in their relatively narrow domains of expertise. Knowledge technologies provide increasingly needed methods and software tools to support experts in cross-context knowledge discovery from large databases. The holder of the MSC-IF fellowship will focus on development and advanced applications of such technologies. In particular, the emphasis will be on knowledge discovery from large textual databases, from heterogeneous data collected in spatio-temporal databases and other sorts of structured and unstructured data specific for a chosen field of application in science and/or education.

Scientific requirements:

PhD in Computer Science, Applied mathematics or Computational Linguistics. The candidate is expected to have a solid background and practical experience in at least two of the following topics: Data Mining, Text Mining, Databases, Natural Language Processing, Knowledge Discovery from Databases, E-learning. Besides, the candidate should have affinity for theoretical research with interest in practical applications and participate actively in the current and future fields of research of the Centre.

Topic 3 : Dynamic-systems modeling from data and application of these models for control design

The Gaussian-process model is a flexible, probabilistic, non-parametric and kernel model with uncertainty predictions. It offers a range of advantages for modeling from data and has been therefore used also for dynamic systems identification and control systems design. The holder of the MSC-IF fellowship will focus on methods for the modelling of dynamic systems with Gaussian-process models and applications of these models. These applications should take advantage of Gaussian-process model's properties and include, but are not limited to: control systems design, fault detection, on-line and off-line modeling of various dynamic systems, etc. Some challenging issues: multiple-output systems, evolving models, closed-loop stability analysis, robust control design, etc.

Scientific requirements:

Ph.D. in Engineering, Physics or Applied Mathematics. The candidate is expected to have affinity for theoretical research with interest in practical applications, a solid background in mathematical probability, system identification and control systems design and an active participation in the current and future fields of research of the Centre.

Contact person

Prof. dr. Irina Cristea (irina.cristea@ung.si)