LION 12

LEARNING AND INTELLIGENT OPTIMIZATION CONFERENCE

June 10-15, 2018

Elite City Resort, Kalamata, Greece

http://www.caopt.com/LION12/

Invited Speakers:

Lefteris Kirousis
University of Athens, Greece

George Michailidis
University of Florida, USA

Yaroslav D. Sergeyev
University of Calabria, Italy

Michael N. Vrahatis
University of Patras, Greece

Local Organizing Committee Chair:

Dimitris Souravlias
Helmut-Schmidt University, Germany

Technical Program Committee Chairs:

Roberto Battiti
University of Trento, Italy

Mauro Brunato
University of Trento, Italy

Ilias Kotsireas
Wilfrid Laurier University, Canada

Panos Pardalos
University of Florida, USA

Web Chair:

Andrea Mariello
University of Trento, Italy

Monday, June 11, 2018

9:15 - 10:15 Invited Talk, Michael N. Vrahatis

The first proofs of the very important and pioneering intermediate value theorem (also called Bolzano's theorem), given independently by Bolzano in 1817 and Cauchy in 1821, were crucial in the procedure of arithmetization of analysis (which was a research program in the foundations of mathematics during the second half of the 19th century). A straightforward generalization of Bolzano's theorem to continuous mappings of an n-cube (parallelotope) into $\mathbb{R}^n$ was proposed without proof by Poincaré in 1883 and 1884 in his work on the three body problem. The Poincaré theorem was soon forgotten and it has come to be known as Miranda's theorem which partly explains the nomenclature Poincaré-Miranda theorem as well as Bolzano-Poincaré-Miranda theorem. This theorem is closely related to important theorems in analysis and topology as well as it is an invaluable tool for verified solutions of numerical problems by means of interval arithmetic. Also, it has been shown that this theorem is equivalent to the Brouwer fixed point theorem (1912) and it is closely related to the theorems of Borsuk (1933), Kantorovich (1948) [Nobel Laureate in Economic Sciences in 1975] and Smale (1986) [Fields Medalist in 1966]. Recently a generalization of the Bolzano theorem for simplices has been proposed [Vrahatis M.N., Generalization of the Bolzano theorem for simplices, Topology and its Applications, 202, 40-46, 2016]. The obtained proof is based on the Knaster- Kuratowski-Mazurkiewicz covering principle (1929) (or KKM lemma for short). This lemma constitutes the basis for the proof of many theorems (including the famous Brouwer fixed point theorem). It is worth noting that three pioneering classical results, namely, the Brouwer fixed point theorem (1912), the Sperner lemma (1928), and the KKM lemma (1929) are mutually equivalent in the sense that each one can be deduced from another. The KKM lemma has numerous applications in various fields of pure and applied mathematics. In particular, among others, in the field of mathematical economics, the very important and pioneering extension of the KKM lemma due to Shapley (1973) [Nobel Laureate in Economic Sciences in 2012] customarily called the Knaster-Kuratowski-Mazurkiewicz-Shapley theorem constitutes the basis for the proof of many theorems on the existence of solutions in game theory and in the general equilibrium theory of economic analysis.

Various generalizations of the Bolzano theorem are presented that are particular useful for the existence of a solution of a system of nonlinear equations in several variables as well as for the existence of fixed points of functions and the localization of extrema of objective functions. These generalized theorems require only the algebraic sign of the function that is the smallest amount of information (one bit of information) necessary for the purpose needed, and not any additional information. Thus, these generalized theorems are of major importance for tackling problems with imprecise (not exactly known) information. This kind of problems occurs in various scientific fields including mathematics, physics, economics, engineering, computer science, biomedical informatics, medicine and bioengineering among others. This is so, because, in a large variety of applications, precise function values are either impossible or time consuming and computationally expensive to obtain.

10:45 - 11:15 Special session: Graphical model selection and applications

Organizers: Valeriy Kalyagin, Mario Guarracino

10:45 - 11:15 Valeriy Kalyagin, Alexander Koldanov, Petr Koldanov and Panos Pardalos. Optimality of multiple decision statistical procedure for Gaussian graphical model selection.

Gaussian graphical model selection is a statistical problem that identifies the Gaussian graphical model from observations. Existing Gaussian graphical model selection methods focus on the error rate for incorrect edge inclusion. However, when comparing statistical procedures, it is also important to take into account the error rate for incorrect edge exclusion. To handle this issue we consider the graphical model selection problem in the framework of multiple decision theory. We show that the statistical procedure based on simultaneous inference with UMPU individual tests is optimal in the class of unbiased procedures.

11:15 - 11:45 Jakob Bossek and Christian Grimme. Solving Scalarized Subproblems within Evolutionary Algorithms for Multi-Criteria Shortest Path Problems.

The NP-hard multi-criteria shortest path problem (mcSPP) is of utmost practical relevance, e. g., in navigation system design and logistics. We address the problem of approximating the Pareto-front of the mcSPP with sum objectives. We do so by proposing a new mutation operator for multi-objective evolutionary algorithms that solves single-objective versions of the shortest path problem on subgraphs. A rigorous empirical benchmark on a diverse set of problem instances shows the effectiveness of the approach in comparison to a well-known mutation operator in terms of convergence speed and approximation quality. In addition, we glance at the neighbourhood structure and similarity of obtained Pareto-optimal solutions and derive promising directions for future work.