INGERSOLL-RAND

Endowed Lecture Series 2016/2017

Grado Department of Industrial & Systems Engineering

Dr. Nick Sahinidis

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Monday, January 23, 2017
2:15 p.m. – 3:15 p.m., 518 Whittemore Hall
Reception: 3:15 p.m. – 4:00 p.m., 260 Durham Hall

The ALAMO approach to machine learning: Best subset selection, adaptive sampling, and constrained regression

A central problem in modern computational science is that of learning an algebraic model from data obtained from simulations or experiments. We present a methodology that is designed to use a small number of data points to learn models that are as accurate and as simple as possible. The approach relies on integer programming techniques to build low-complexity models. The models are then improved systematically through the use of derivative-free optimization solvers to adaptively sample new simulation or experimental points. Physical constraints and insights are enforced to the model through the solution of semi-infinite optimization and global optimization subproblems. The proposed methodology has been implemented in the ALAMO software for automated learning of algebraic models. We present extensive computational results with ALAMO and comparisons between ALAMO and a variety of machine learning techniques, including Latin hypercube sampling, simple least-squares regression, and the lasso.

Dr. Sahinidis joined Carnegie Mellon in 2007 after a sixteen-year long career at the University of Illinois at Urbana, where he taught in Industrial Engineering and Chemical Engineering. His research has included the development of theory, algorithms, and the BARON software for global optimization of mixed-integer nonlinear programs. Scientists and engineers have used BARON in many application areas, including the development of new Runge-Kutta methods for partial differential equations, energy policy making, modeling and design of metabolic processes, product and process design, engineering design, and automatic control. Several companies have also used BARON in the automotive, financial, and chemical process industries.

Professor Sahinidis' research activities have been recognized by a National Science Foundation CAREER award in 1995, the INFORMS Computing Society Prize in 2004, the Beale-Orchard-Hays Prize from the Mathematical Programming Society in 2006, the Computing in Chemical Engineering Award in 2010, the Constantin Carathéodory Prize in 2015, and the National Award and Gold Medal from the Hellenic Operational Research Society in 2016. Professor Sahinidis has been an INFORMS Fellow since 2014. He was Chair of the INFORMS Optimization Society and served as the Programming Coordinator for the Computing and Systems Technology Division of the American Institute of Chemical Engineers.