EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

Black Box Optimization in the Era of Intelligent Cyber Physical Systems

ABSTRACT - Technological advancement, including Artificial Intelligence, Advanced Learners, has led to the development of new classes of Systems that pose new challenges for optimal design and control. In this exciting and evolving environment, black box optimization has started to attract increasing attention. In fact, several next generation systems do not satisfy assumptions that allow to apply traditional methods to verify the stability/quality of the developed designs/control strategies. As a result, industries that are increasingly marketing CPSs (e.g., automotive, additive manufacturing, bio-pharmaceutical) have a compelling need for new methods with provable guarantees about the quality and safety of the devices.

In this talk, we refer at large to Black Box Optimization methods, where the focus is on families of algorithms that deliberately inject randomness in the search process (whether or not the original dynamics is stochastic). In this context, we try to develop algorithms to be applied in cases where, (1) there is no homogeneous dynamics of the systems, (2) high dimensions need to be considered (and they all matter!), and (3) we can construct clever approximations of the system behavior. We show three new algorithms that: (1) alternate local and global search to make use of local knowledge while exploring the space of possible solutions; (2) decompose the original problem and try to learn, from lower dimensional formulations, good guesses for the original problem; (3) use information coming from approximations of the original problem that are either very quick to evaluate or are easy to optimize over. The common aspect among the proposed methods is the ability of the procedure to adapt to the information as it becomes available from the sampling process.

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SPEAKER BIO – Giulia Pedrielli is currently Assistant Professor for the School of Computing, Informatics, and Design Systems Engineering at Arizona State University. She graduated from the Department of Mechanical Engineering of Politecnico di Milano. She develops her research in stochastic methods for performance evaluation and simulation based optimization of next generation cyber physical systems. She is focusing on real time control problems and how to extend simulation based algorithms in this context, in applications related to individualized cancer care, bio-manufacturing, design and control of self-assembled RNA structures, and unmanned vehicles control verification.

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