

Social–Behavioral Aware Optimization of Cyber Physical Systems

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(Food and drinks will be served!)

Abstract. Cyber-Human-Physical Systems are a particular class of systems where not only there is an integration between the cyber and the physical component, but where the system operation is inherently affected by human behaviors, and in turn it affects the humans that use its services. The inclusion of such a human component introduces novel challenges in the optimization of the functionality of such systems, since human behavior and psychological perception should be appropriately modeled. In this talk we first consider the problem of cascading failures in smart grids. We exploit the paradigm of the Internet of Things (IoT) to learn the user habits and realize flexible loads on the user side. The problem involves the System operator, the Load Serving Entities, and the users' Smart Homes. The System Operator detects the contingency and determines how much load needs to be curtailed to prevent a cascading failure. Each Load Serving Entity determines how to distribute the load curtailment to the users. Finally, the Smart Home learns the user habits and calculates the best schedule of appliances in order to minimize the impact on the user habits and meet the load curtailment prescribed by the Load Serving Entity. Subsequently, we consider the problem of optimizing the energy consumption in a single Smart Home. We use large scale online surveys to derive a psychological model of user perception of smart appliances as well as appliances interdependencies. Using these psychological models we formulate an optimization problem to find a schedule of appliances that maximizes the user psychological perception within an energy budget constraint. We show that this problem is NP-Hard and provide an efficient algorithm based on simulated annealing.

Bio. Simone Silvestri is currently an Assistant Professor in the Department of Computer Science of the University of Kentucky in Fall 2017. Before joining UK, Dr. Silvestri was an Assistant Professor at the Missouri University of Science and Technology. He also worked as a Post-Doctoral Research Associate in the Department of Computer Science and Engineering at Pennsylvania State University, working in the research group of Dr. Thomas La Porta. He received his Ph.D. in Computer Science in 2010 from the Department of Computer Science of the Sapienza University of Rome, Italy. Dr. Silvestri's recent research interests focus on social behavioral aware optimization and control of cyber-physical-human systems, on understanding the vulnerabilities of Smart Grids due to infrastructure interdependencies, and on the use of unmanned aerial vehicles to monitor the effects of climate change and in homeland security scenarios. His research is funded by several national and international agencies such as NIFA, NATO and the NSF. His papers appeared in several international journals and conferences including IEEE Transactions on Mobile Computing, IEEE Transactions on Smart Grids, ACM Transactions on Sensor Networks, IEEE INFOCOM, and IEEE ICDCS. He also received the Best Paper Award at IEEE ICNP in 2009. He served in the Technical Program Committee of more than thirty international conferences, including IEEE INFOCOM, IEEE ICNP, IEEE SECON and IEEE GLOBECOM.

