Seminar Series

Thursday April 6th, 2017
1:30PM - 2:30PM
UConn, Storrs Campus – Rowe 318
To view live webcast click here

From Verified Model to Verified Code for Medical Cyber-Physical Systems

Medical Cyber-Physical Systems (CPS) like implantable pacemakers are capable of delivering therapies without intervention from medical experts. The autonomous therapy delivery is achieved by software with increasing complexity, which presents unique safety challenges. The biggest challenge for developing safe medical CPS software is the variability of physiological scenarios that the system may encounter. In this seminar, I will discuss two approaches that I adopted to capture the physiological variability during model-based closed-loop validation of medical CPS. I have developed a heart model structure which can represent the electrical behaviors of a large number of heart conditions. In the first approach, the behaviors of the heart models can be captured by more abstract heart models following rigorous abstraction rules. Then through closed-loop model checking, the safety of the pacemaker model can be verified under all possible heart conditions. A formal framework has also been developed to refine heart models in order to provide valid and interpretable counter-examples. In the second approach, physiological variability is captured by creating a large number of heart models with different model parameters within physiological ranges. These heart models can be used for closed-loop simulation/testing of implantable cardiac devices, which can provide quantitative evaluation of device performance and help planning clinical trials for the device. These models and frameworks enabled model-based closed-loop validation of medical CPS early in the device life cycle, and can potentially provide rigorous guarantee that the devices are making accurate diagnosis and delivering appropriate therapies.

Zhihao Jiang

Dr. Zhihao Jiang is currently a Postdoctoral Researcher in the Department of Electrical & Systems Engineering at the University of Pennsylvania. He received his PhD in Computer Science and MS in Robotics from University of Pennsylvania in 2016 and 2010, respectively. His research interest is to apply formal methods and model-based design to improve the safety and efficacy of life-critical systems. His research has been published at top conferences and journals such as Proceedings of IEEE, IEEE Computer Magazine.

Upcoming Distinguished Lectures

5/08/17 – Ignacio Grossmann
Challenges in the Application of Mathematical Programming Approaches to Enterprise-wide Optimization of Process Industries

Upcoming Seminars

4/7/17 – Ilias Bilonis
Uncertainty Quantification using Embarrassingly Small Numbers of Simulations and Experiments

4/10/17 – Nick Sahindis
The ALAMO Approach to Machine Learning: Best Subset Selection, Adaptive Sampling, and Constrained Regression

4/17/17 – Dane Boysen
Democratizing Energy TECHNOLOGY

5/22/17 – James Davis

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