IEEE Central Coast Event – 15 May 2019 @ 6PM

Dr. Katie Byl PhD – UCSB ECE Robotics Presents: Mesh-based Tools to Analyze Deep Reinforcement Learning Policies for Underactuated Biped Locomotion

FREE EVENT

Location – Rusty's Pizza

5934 Calle Real, Goleta, CA 93117

6:00 PM – Complimentary Pizza, Salad, Beverage

6:25 PM – Central Coast Status

6:30 PM – Dr. Byl's Presentation

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Mesh-based Tools to Analyze Deep Reinforcement Learning Policies for Underactuated Biped Locomotion

Control of biped robots involves many challenges: their dynamics are nonlinear, hybrid and underactuated, and they must operate (without falling) in stochastic environments. Recently, deep learning has been applied to generate successful control policies for simulations of a variety of legged robots, and there are a few examples with real robots, as well. Much of our work is recently motivated by the desire to understand when and how such approaches can succeed and to provide better tools for understanding and quantifying resulting closed-loop performance. Compared with more traditional methods of control design, deep learning is currently notoriously fragile and lacking in robustness guarantees.

Intuitively, one would expect that including perturbations and/or other types of noise during training of a deep learning policy would likely result in more robustness of the resulting control policy. However, one would like to have a quantitative and computationally-efficient means of evaluating the degree to which this might be so. Rather than relying on Monte Carlo simulations, our goal is to provide more sophisticated tools to assess robustness properties of such policies.

In this talk, I will present a mesh-based approach to analyze stability and robustness of the policies obtained via deep reinforcement learning for various biped gaits of a five-link planar model. Our work is motivated by the twin hypotheses that contraction of dynamics, when achievable, can simplify control and that control policies obtained via deep learning may therefore exhibit tendency to contract to lower-dimensional manifolds within the full state space, as a result. The tractability of our mesh-based tools in this work provides some evidence that this may be so.

Dr. Katie Byl Ph.D. UCSb

Katie Byl received her B.S., M.S., and Ph.D. degrees in mechanical engineering from MIT. Her research is in dynamic systems and control, with particular interest in modeling and control techniques to deal with the inherent challenges of underactuation and stochasticity that characterize bio-inspired robot locomotion and manipulation in real-world environments. Past research funding includes DARPA's M3 program, the DARPA Robotics Challenge (with JPL), the Army's Institute for Collaborative Biotechnologies (ICB) and Robotics CTA programs, an NSF CAREER award (2013), the Hellman Foundation (2012), and an Alfred P. Sloan Research Fellowship in Neuroscience (2011). Katie has worked on a wide range of research topics in the control of dynamic systems, including magnetic bearing control, flapping-wing microrobotics, piezoelectic noise cancellation for aircraft, and vibration isolation for gravity wave detection, and she was once a professional gambler on the now-infamous MIT Blackjack Team.