Translational AI Center (TrAC) Seminars Spring 2022

Cody Fleming
March 4 at 12:00 noon (US Central Time)
https://iastate.zoom.us/j/92178103551?pwd=dlNCa2l0ckVBTEVyR1JEN2Y3b21XQT09

Towards Autonomous Systems That Leverage First Principles and Black Boxes

Abstract

This talk will focus on the opportunities and challenges associated with settings that consist of things we ``know'' (for example, closed-form equations based on first principles from physics) alongside of things we ``don't know'' (e.g. purely data-driven models that are challenging to characterize in a straightforward way, such as deep learning). Furthermore, in the context of safety-critical systems such as transportation, aviation, and many others, it is vital to have assurances that the planning and control systems will behave appropriately, in all settings. Given this context, we will then present a data-and model-driven predictive controller that can handle control and planning problems in which some of the constraints or parts of the objective function are known, while others are entirely unknown to the controller but can be predicted with black-box deep learning models. The talk will try to make the connection between some aspects of control theory and the formal treatment that is inherent in this field, with machine learning more broadly and reinforcement learning in particular. Finally, we will discuss trajectory prediction in the context of dense, multi-agent settings and how a few simple observations about physics can help deep learning systems to learn social rules and norms.

Short Bio

Cody Fleming is an associate professor in Mechanical Engineering at Iowa State University. Dr. Fleming is interested in developing theory and methods to assure the safety and security of controls systems and autonomy more broadly. His application areas include aviation, air traffic management, urban air mobility, and automotive. He received his PhD in Aeronautics and Astronautics from MIT and before joining Iowa State, he was on the faculty at the University of Virginia.