Translational AI Center (TrAC) Seminar Spring 2023

Amir Barati Farimani

February 17 at 12:00 noon (US Central Time)

Zoom: https://iastate.zoom.us/j/92178103551?pwd=dlNCa2l0ckVBTEVyR1JEN2Y3b21XQT09

Robust Representation Learning with Transformers for Engineering Problems

Abstract

With the rise of Artificial Intelligence (AI) and Machine Learning (ML) in recent years, many complex problems in vision and computer science have been solved that were intractable for decades. In mechanical engineering (ME), complex problems still exist that conventional techniques could not offer viable solutions. Recent advances in AI has provided us with opportunities to merge and apply them to challenges in mechanical engineering, however; to accurately model and predict an engineering system, the representation and formulation of that problem into AI frameworks remain a challenge. The domain knowledge of ME is needed to represent and beneficially use AI algorithms to achieve viable solutions. To this end, I will talk about how effectively different areas of engineering can take advantage of AI to find solutions by integrating the physics and engineering domain knowledge. I will focus on examples in transport phenomena and material discovery. I will then show how modern deep learning models, such as Transformers can be used to learn the Partial Differential Equations. In addition, I will demonstrate how integration of chemistry and physics into graph convolutional neural networks can enhance the accuracy of material property prediction.

Short Bio

Professor Farimani joined the Department of Mechanical Engineering at Carnegie Mellon University in the fall of 2018. He was previously a postdoctoral fellow at Stanford University. He received his PhD in Mechanical Engineering in 2015 from University of Illinois at Urbana-Champaign.

His lab at CMU focuses on the problems at the interface of Mechanical Engineering, data science and machine learning. His lab uses the state-of-the-art deep learning and machine learning algorithms and tools to learn, infer and predict the physical phenomena pertinent to mechanical engineering. Currently, he is teaching AI and ML to a large class of graduate students at CMU.

He received the Stanley I. Weiss best thesis award from the University of Illinois in 2016 and was recognized as an Outstanding Graduate Student in 2015. During his post-doctoral fellowship at Stanford, Dr. Barati Farimani has developed data-driven, deep learning techniques for inferring, modeling, and simulating the physics of transport phenomena and for materials discovery for energy harvesting applications.