

UNIVERSITY OF CENTRAL FLORIDA DEPARTMENT OF COMPUTER SCIENCE & FACULTY CLUSTER INITIATIVE

## Learning Sciences Cluster Candidate "Physics Guided Machine Learning: A New Paradigm for Scientific Knowledge Discovery"

## Mr. Xiaowei Jia



Abstract - Data science and machine learning models, which have found tremendous success in several commercial applications where large-scale data is available, e.g., computer vision and natural language processing, has met with limited success in scientific domains. physics-based Traditionally, models of dynamical systems are often used to study engineering and environmental systems. Despite their extensive use, these models have well-known limitations several due incomplete or inaccurate to representations of the physical processes being modeled. Given rapid data growth due to advances in sensor technologies, there is a tremendous opportunity to systematically advance modeling in these domains by using machine learning methods. However, capturing this opportunity is contingent on a paradigm shift in data-intensive scientific discovery since the "black on a paradigm snift in data-intensive scientific discovery since the "black box" use of ML often leads to serious false discoveries in scientific applications. Because the hypothesis space of scientific applications is often complex and exponentially large, an uninformed data-driven search can easily select a highly complex model that is neither generalizable nor physically interpretable, resulting in the discovery of spurious relationships, predictors, and patterns. This problem becomes worse when there is a scarcity of labeled samples, which is quite common in science and engineering domains engineering domains.

My work aims to build the foundations of physics-guided machine learning by exploring several ways of bringing scientific knowledge and machine learning models together. My work has the potential to greatly advance the pace of discovery in a number of scientific and engineering disciplines where physics-based models are used, e.g., hydrology, agriculture, climate science, materials science, power engineering and bomedicine.

About the candidate - Xiaowei Jia is a Ph.D. candidate under the supervision of Prof. Vipin Kumar in the Department of Computer Science and Engineering at the University of Minnesota. He received his M.S. degree from State University of New York at Buffalo in 2015 and his B.S. degree from University of Science and Technology of China in 2012. His research interests include physics-guided data science, spatio-temporal data mining, deep learning, and remote sensing applications. He has published over 30 papers in major journals in data mining (e.g., TKDE) and hydrology (e.g., WRR), as well as top-tier conferences (e.g., SIGKDD, ICDM, SDM, and CIKM). Xiaowei was the recipient of UMN Doctoral Dissertation Fellowship (2019) and the UMII-MnDrive Fellowship Award (2018), the Best Conference Paper Award in ASONAM 16, and the Best Student Paper Award in BIBE 14.



Date: Monday, 3/2/20

Time: 9:30-10:30am

Location: Research 1, Rm 103

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