Electrical & Computer Engineering

S E M I N A R

Louisiana State University

New Representation Learning Algorithms: Graph and Beyond

Yanfu Zhang

University of Pittsburgh

Abstract—A central question when designing an AI system in the real world is, "how to learn representations of the data that make it easier to extract useful information when building classifiers or other predictors?" Satisfactory answers are attainable for certain data, such as images, texts, or audio. However, various types of data are gathered as graphs, such as social networks, protein interaction networks, brain connectomes, etc. Despite the emerging and powerful graph neural network techniques, researchers are yet unanimous in the answer dedicated to learning embeddings from graphs due to their high irregularity, complexity, and sparsity. I have been focusing on addressing the critical challenges in graph representation learning.

In this talk, I will first introduce my recent research results on solving two key problems in graph representation learning. i) A significant limitation of the famous graph convolutional network is over-smoothed embeddings with deeper networks. ii) The scalability to big data, though facilitated by self-supervised pretraining, loses the focus on local structure. After that, I will expand the horizons beyond the nodes and discuss how they interact with the algorithm design. i) Graph-level embeddings are desired instead of node-level embeddings in some applications. ii) Data distribution implies graph structure—even if it is not explicitly given. Besides addressing the efficacy of representation learning, I also designed fairness-aware machine learning algorithms to tackle the bias in model training and data processing. I applied my new representation learning methods to successfully solve various real-world applications, such as brain disease early diagnosis, drug repositioning, and social media network predictions.

Bio—Yanfu Zhang is a Ph.D. candidate in Computer Engineering at the University of Pittsburgh, supervised by Prof. Heng Huang. His research interests span graph neural networks, efficient and robust representation learning, and fairness-aware machine learning, with applications to medical images, multi-omics, and other relevant data mining and machine learning problems. His works have been published in top-tier conferences and prestigious journals, such as KDD, ICML, NeurIPS, ICCV, ECCV, WebConf (WWW), ICDM, IPMI, MICCAI, Nuclei Acids Research, and PNAS Nexus. He served as a program committee member of KDD, MICCAI, ICCV, etc.

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