LINGXIAO ZHAO

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EDUCATION

Carnegie Mellon University — Pittsburgh, PA, USA
Ph.D. in Machine Learning Joint Public Policy — Aug. 2018 to Now
Advisor: Prof. Leman Akoglu

Carnegie Mellon University — Pittsburgh, PA, USA
M.S. in Electrical and Computer Engineering — Aug. 2016 to Dec. 2017
GPA: 3.90/4.00

Xi'an Jiaotong University — Xi'an, Shaanxi, China
B.S. in Electrical Engineering — Aug. 2012 to July 2016
GPA: 91.05/100, Rank: 7/370

RESEARCH INTEREST

Graph is a powerful representation that captures interactions between identities. GNNs achieve state-of-art performance in a variety of graph-based tasks, while being not well-understood. My work focuses on solving some fundamental problems of GNNs, such as breaking depth-limitation, relaxing homophily requirement, learning better structure, and improving expressiveness.

PUBLICATIONS

Preprint Papers

1. *From Stars to Subgraphs: Uplifting Any GNN with Local Structure Awareness*
   Under submission to 2022 ICLR
   https://arxiv.org/abs/2110.03753
   Lingxiao Zhao, Wei Jin, Leman Akoglu, Neil Shah

2. *Graph Condensation for Graph Neural Networks*
   Under submission to 2022 ICLR
   Wei Jin, **Lingxiao Zhao**, Shichang Zhang, Yozen Liu, Jiliang Tang, Neil Shah

3. *Deep Graph-Level Anomaly Detection*
   Under submission
   Saurabh Sawlani, **Lingxiao Zhao**, Leman Akoglu

Published Papers

1. *On Using Classification Datasets to Evaluate Graph Outlier Detection: Peculiar Observations*
   2021 Big Data Journal
   https://arxiv.org/pdf/2012.12931.pdf
   Lingxiao Zhao, Leman Akoglu

2. *Fast Attributed Graph Embedding via Density of States*
   2021 IEEE ICDM
   https://arxiv.org/pdf/2110.05228.pdf
   Saurabh Sawlani, **Lingxiao Zhao**, Leman Akoglu

3. *Graph unrolling networks: Interpretable neural networks for graph signal denoising*
   2021 IEEE Transactions on Signal Processing
   https://arxiv.org/pdf/2006.01301.pdf
   Siheng Chen, Yonina C. Eldar, **Lingxiao Zhao**

4. *Beyond Homophily in Graph Neural Networks: Current Limitations and Effective Designs*
2020 NeurIPS
https://arxiv.org/abs/2006.11468
Jiong Zhu, Yujun Yan, **Lingxiao Zhao**, Mark Heimann, Leman Akoglu, Danai Koutra

5. *Connecting Graph Convolutional Networks and Graph-Regularized PCA*
2020 ICML Workshop, under submission to 2021 NeurIPS
https://arxiv.org/pdf/2006.12294.pdf
Lingxiao Zhao, Leman Akoglu

6. *PairNorm: Tackling Oversmoothing in GNNs*
ICLR (26.5%), Addis Ababa, Ethiopia, April 2020
https://arxiv.org/pdf/1909.12223.pdf
Lingxiao Zhao, Leman Akoglu

7. *A Quest for Structure: Jointly Learning the Graph Structure and Semi-Supervised Classification*
27th **ACM CIKM** (17%), Turin, Italy, Oct. 2018.
https://arxiv.org/pdf/1909.12385.pdf
Xuan Wu*, **Lingxiao Zhao***, Leman Akoglu. (* equal contribution)

SELECTED RESEARCH PROJECTS

From Stars to Subgraphs: Uplifting Any GNN Mar. 2021 to Oct. 2021
Proposed the first general framework to boost expressiveness of any GNN

- Designed a general framework to uplift any GNN, by generalizing MPNN's aggregation field from stars to subgraphs and encoding subgraphs with the (base) GNN.
- Proved the expressiveness is strictly better than 1-WL, while being not less powerful than 3-WL.
- Designed effective and efficient realizations: different encodings and distance-to-centroid feature.
- Designed SubgraphDrop that greatly reduces memory cost and still keeps same performance.

Tackling oversmoothing problem in GNNs March 2019 to Sept. 2019
Proposed the first normalization layer in GNNs, with Prof. Leman Akoglu

- Studied oversmoothing thoroughly with SGC, which decouples the effect of oversmoothing on performance drop of increasing layers from overfitting and vanishing gradient problems.
- Proposed an efficient and effective normalization layer, PairNorm, that "pushes" oversmoothed node representations away from each other. PairNorm greatly improves robustness of depth.
- Studied a new setting: Semi-Supervised Learning with large percentage missing feature problem, where PairNorm greatly boost performance for all three types of GNN (SGC,GCN,GAT).

Optimal Graph Learning for Semi-Supervised Learning Sep. 2017 to Feb. 2018
Supervised By Prof. Leman Akoglu, Project Link: https://pg-learn.github.io

- Designed a hyper-loss over validation set measuring task-based "optimal" graph for SSL.
- Proposed an algorithm minimizing the hyper-loss based on hyper-gradient of the graph.
- Boosted the runtime 10x faster by using tensor-form update and efficient sparse operation.
- Paralleled it by incorporating and modifying HyperBand, an adaptive resource allocation alg.

COMPUTING SKILLS

Languages: Python, MATLAB, Java, C, C++, LaTeX, Bash
Frameworks: Pytorch, Tensorflow
Large-Scale Computing:
- Streaming: MapReduce, Hadoop, Spark, Pig
- Parallel: Python/Matlab/Java Parallel
Web: HTML, CSS, Bootstrap, Jekyll