LINGXIAO ZHAO

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EDUCATION

Carnegie Mellon University — Pittsburgh, PA, USA
Ph.D. in Information Systems — 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. Graph neural networks (GNNs) achieve state-of-art performance in a variety of graph-based tasks, while they are not well-understood. Recently my work focuses on solving some fundamental problems of GNNs, such as breaking depth-limitation, relaxing homophily requirement, and learning better structure. In the meantime, I am passionate about applying designed algorithms to large-scale real-world graph-structured problems.

PUBLICATIONS

Preprint Papers

1. *Beyond Principle Component Initialization*
   Working and preparing for submission, 2020.
   Lingxiao Zhao and Kai Hu

2. *Counterfactual Explanations for Anomalies: A Complementary View to Diagnostics*
   Working, 2018.
   Tuan M. V. Le, **Lingxiao Zhao**, Leman Akoglu

Published Papers

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

2. *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)

RESEARCH PROJECTS

New projects in working — Oct. 2019 to Now
With Prof. Leman Akoglu

- Facing heterophily: making GNNs robust to heterophily [*with Prof. Danai Koutra*]
- Oversmoothing continue: more interesting ideas and applications!

– Structure-learning continue: an efficient approach of learning the graph structure for GNNs.

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).
– PairNorm is an efficient and effective "patch" for all type of GNNs. We explore more in future.

Optimal Counterfactual Explanation for Anomaly Detection March 2018 to Sept. 2018
Supervised By Prof. Leman Akoglu

– Proposed to explain tree-based anomaly detection model using counterfactual explanation.
– Designed a cluster and correlation sensitive cost function for optimal counterfactual.
– Designed a density-based "possible-world" constraint for optimal counterfactual.
– Built the constrained optimization problem as MINLP and solve it using BARON.
– Proposed a natural gradient & evolution strategy based method to estimate the "gradient" of discontinuous tree-ensemble models. And designed an approximation solver using augmented Lagrangian based on the estimated gradient. Boost the runtime a lot.

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.
– Paper is accepted by CIMK 2018, co-first author. Presented in CIKM 2018, Italy.

COMPUTING SKILLS

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

HONORS and AWARDS

- **SIGIR Student Travel Grant** for attending CIKM 2018 Sep. 2018
- 2^{nd} Prize in Challenge Cup (National Innovation Competition) Nov. 2015
- Outstanding Student Pacesetter (Only **10** students in **3800** undergraduates) Oct. 2015
- National Scholarship (Rank **4/370** and **5/370**, respectively) Oct. 2015, Oct. 2014
- **Outstanding Winner** (highest) In MCM/ICM[1] (Only 19 teams **(0.19%)** worldwide) April. 2014
- The 1^{st} Prize of Mathematical Modeling in Shaanxi Province Oct. 2014

[1]The Mathematical Contest in Modeling/The Interdisciplinary Contest in Modeling: comap.com