Tianyu Gao

ericgtyu@gmail.com · (+86) 173-9623-3372 · https://github.com/Eric-Gty

Education

Sichuan University (SCU), Chengdu, China 2017 – Present

Undergraduate student in Software Engineering (SE)

Overall GPA for compulsory classes: 3.71 / 4.0 (Ranked as 25/ 264, Top 9.4%)

Research Interests: Recommender System, Machine Learning, Deep Learning, Computer Vision

Research Experience

Abstract Reasoning Jan. 2020 – Present

Individual Research Chengdu, China

Brief introduction: This project aims at improving the spatial-temporal reasoning and logical induction ability of the AI system. In the visual domain, abstract reasoning is a crucial key to the human ability to identify complex rules and scenes. Specifically, the idea of contrastive learning and image representation learning can contribute greatly to the performance in this field. I have tried many different approaches to solve this problem, including analyzing the image similarity, designing the contrastive module, and using the knowledge distillation. Inspired by the idea of self-supervised learning, I'm working on designing a comprehensive pretext task that can offer superior generalization and reasoning ability for the downstream task training process.

- Personal contributions are described as follows:
  - Analyzed literature in many fields that may inspire me in doing research about abstract reasoning.
  - Implemented methods using image similarity, contrastive module, and knowledge distillation.

Class-Imbalanced Problem in Recommender System Dec. 2019 – Aug. 2020

Individual Research, collaborated with Yuexin Wu, Ph.D. Chengdu, China

Brief introduction: This project aims at solving the biased prediction problem in the rating prediction task of the recommender system. During the early literature review process, we found that all existing rating prediction methods generate biased prediction results, thus their performance on rare ratings in training data is usually unsatisfactory. To address this problem, we came up with two solutions: 1) utilizing the proposed time-varying attention mechanism and dual-optimizer (i.e., regression optimizer and classification optimizer). 2) Inspired by the superior ability of Extreme Value Distribution (EVD)-based methods in modeling the distribution of rare data, a novel Gumbel distribution-based prediction model is proposed for obtaining better results. As the first attempt in this field to address the biased prediction problem, our work was praised by reviewers of ICDM 2020.

- Personal contributions are described as follows:
  - Proposed the novel time-varying attention mechanism, dual-optimizer, and interaction component.
  - Selected the proper EVD and designed the sampling strategy for different rating levels.
  - Finished and find-tuned two proposed methods (using Pytorch).

Graph Representation Learning Aug. 2019 – Nov. 2019

Individual Research Beijing, China

Brief introduction: This project aims at using the Graph Neural Network (GNN)-based method for detecting Sybils (i.e., Malicious users) in online social networks, which is a basic security research problem. Moreover, it's a further extension of my previous project "Data-Driven Security and Privacy". Since the complex interactions between users help construct the graph structure, we can accurately detect Sybils by applying GNN-based methods (e.g., Graph convolutional network, etc.). The prerequisites of this project including my existing knowledge about Sybil detection and Stanford CS224W (for graph machine learning).

- Personal contributions are described as follows:

- Abstracted the massive data of users so that they can be fed into GNN-based methods.
- Implemented and fine-tuned several GNN-based methods (using Pytorch Geometric).

Predicting Molecular Properties July 2019 – Aug. 2019

NUS SOC Summer Workshop, Advisor: Dr. Lek Hsiang Hui (Senior Lecturer) Singapore

Brief introduction: This project is based on a Kaggle competition, which our team participated in when joining the summer workshop in NUS SOC. The aim of this project is to make predictions at a molecular level with interactions between atoms. The methodology can be concluded into three main categories: 1) Using feature engineering and traditional machine learning (ML)-based classifiers. 2) Utilizing CNN-based deep learning methods. 3) Since the structure of interactions between atoms can be abstracted into the graph, the graph-based methods (e.g., Graph neural network) can be considered using in this task. Our team explored all the above three categories and gave a report to our supervisor. The final poster is available **here**.

- Personal contributions are described as follows:
  - Implemented several supervised classifiers and quantified the overall prediction performance.
  - Led my team to reach Top 15% of the leaderboard within two weeks, thus received the **letter of recommendation** and obtained **A+** for our project, which is the highest score in the summer workshop.

Data-Driven Security and Privacy Oct. 2018 – Sep. 2019

Research in SCU Cyber-security Lab, Advisor: Prof. Jin Yang Chendgu, China

Brief Introduction: This project aims to build up the Agents of Network Danger Evaluation model by utilizing the combination of Artificial Immune System (AIS) and deep learning (DL) methods. It's my first ever research project that collaborates with Prof. Jin Yang and some Ph.D. students. For the first six months, my main work focus on the AIS branch. After that, working as the **leader** of the DL branch, my project achieved promising results, thus obtained the **National-level** Chinese University Student's Innovation Training Program (The highest level program for undergraduates, only four projects are selected as the National-level in 2019).

- Personal contributions are described as follows:
  - Proposed the novel dynamically equations for immune cells, mature-lymphocyte, and immune tolerance.
  - Applied the idea of dynamic immunological surveillance period to enhance the self-learning ability of AIS.
  - Proposed a novel Bidirectional Long Short-Term Memory (Bi-LSTM)-based variant, named Bi-SN-LSTM, which utilizing the scaled exponential linear unit for improving its convergence speed.
  - Implemented the end-to-end framework with ConvNet and the proposed Bi-SN-LSTM (using Tensorflow), and obtained the state-of-the-art performance on the benchmark dataset.

Publications and Manuscripts

- Yuexin Wu*, **Tianyu Gao***, Jin Yang. "GRP: A Gumbel-based Rating Prediction Framework for Imbalanced Recommendation". Under Reviewing in WWW 2021. (* denotes equal contribution)
- Yuexin Wu, **Tianyu Gao**, Sihao Wang, Zhongmin Xiong. "TADO: Time-varying Attention with Dual-Optimizer Model". In *IEEE International Conference on Data Mining (ICDM)*, 2020.

  Acceptance rate: 183/930 = 19.7%
- **Tianyu Gao**, YueXin Wu, Jin Yang, Wenjun Peng, Luyu Jiang. "Imbalanced Rating Prediction in Recommender System via Extreme Value Distribution-based Method". Under reviewing in *Knowledge-Based Systems*, 2020.
- **Tianyu Gao**, Jin Yang, Wenjun Peng, Luyu Jiang, Yihao Sun, Fangchuan Li. "A Content-based Method for Sybil Detection in Online Social Networks via Deep Learning". *IEEE ACCESS*, 8, pp.38753-38766, 2020.
- Jin Yang, Tao Li, Gang Liang, Yunpeng Wang, **Tianyu Gao**, and Fangdong Zhu. "Spam transaction attack detection model based on GRU and WGAN-div". *Computer Communications,* 161, pp.172-182, 2020.
- Jin Yang, Tao Li, Beibei Li, Gang Liang, Guozhu Wen, **Tianyu Gao**. "An Encrypted Network Malicious Traffic Detection Model Based on Reinforcement Learning and ResNet". Under reviewing in *PLOS ONE*, 2020.

Honors and Awards

- The 9TH China Software Cup College Student Software Design Competition, 2020
  - Project name: Software Protection Based on Signature Technology Under Linux
  - **National *2nd Prize***, **Leader**
- The 5TH China University Student Computer Design Competition, 2020
  - Project name: Malicious User Detection System on Social Platforms Based on Deep Learning
  - **Provincial *1st Prize*** and **National *2nd Prize***, **Leader**
- The 6TH China College Students "Internet+" Innovation & Entrepreneurship Competition, 2019
  - Project name: "AI-Know" Network Security Service Platform
  - **Provincial *2nd Prize***, **Leader**
- Chinese University Students Innovation and Entrepreneurship Training Program, 2019
  - Project name: Fake User Detection on Social Networks Based on TY-NET-CNN
  - **Province-level, Leader**
- Sichuan University **Outstanding Student Award for Graduates Grade**, 2020
- Sichuan University **Outstanding Student Award**, 2020
- **Bao-Gang Scholarship** (The most valuable social scholarship in SCU, a total of six students among all the colleges won this scholarship), 2020
- Sichuan University Comprehensive **First-Class** Scholarship, 2020
- Double-Special Student (**Highest honor in SCU**), 2019 - Present
- Zili-Zhidong Scholarship (A total of four people won this honor in College of Software Engineering), 2019
- Sichuan University Comprehensive Second-Class Scholarship, 2019
- Sichuan University **Outstanding Student Award**, 2019
- ICBC-IBM National University Student Financial Technology Innovation Summer Camp, 2018
  - Topic: Applications of Blockchain-related Technology in the Financial Field
  - **Outstanding Student Award**
- Chinese University Students Innovation and Entrepreneurship Training Program, 2018
  - Topic: Development of Web-based Software Project Requirement Content Management Platform
  - University-level, **Leader**
- Sichuan University Comprehensive Third-Class Scholarship, 2018
- Sichuan University Outstanding Student Leader Award, 2018

Skills and Academic Services

- Programming Languages: Python > C++ == C > Matlab
- Deep Learning Library: Pytorch > Tensorflow
- Mandarin Chinese: Native Speaker; English: Fluent
- Reviewer: IEEE ACCESS, ISAIC 2020
- About to give a presentation in ICDM 2020; Recently invited to give a presentation in ISAIC 2020

Referees

- Prof. Jin Yang,
  Email: jinyang66@stu.scu.edu.cn,
  College of Cybersecurity, Sichuan University
- Dr. Lek Hsiang Hui (Senior Lecturer),
  Email: lekhsian@comp.nus.edu.sg,
  Department of Information Systems and Analytics, National University of Singapore