

Tianpu Zhang

✉ zhangtianpu@hotmail.com | 🌐 github.com/zhangtianpu | 🏠 zhangtianpu.github.io | 📍 Beijing, China

EDUCATION

The North China University of Technology

Sept. 2020 – Jun. 2023

Master of Computer Technology

Beijing, China

- **Research:** Beijing Key Laboratory on Integration and Analysis of Large-scale Stream Data
- **Supervisor:** Associate Professor Weilong Ding
- **Research Interest:** Deep Learning, Spatio-temporal Big Data, Smart City
- **Academic project:** As an algorithm researcher, I developed a couple of models based on deep learning technology to predict traffic flow running at the Highway Big Data Analysis System of Henan which is the most populous province in China. During this project, RNN-based method incorporated a novel spatial hidden state into each cell to remember the spatial context which was applied to construct a traffic network dynamically. At the same time, GCN was used at each cell of RNN to extract spatio-temporal features to achieve accurate prediction results.

Beijing University of Civil Engineering and Architecture

Sept. 2015 – June 2017

Bachelor of Geographic Information Science

Beijing, China

- **Academic project:** As a java engineer, I took part in a project held by my tutor, which develop a WebGis system. During this project, I used GeoServer and OpenLayers to display geographic information and constructed a website by using Bootstrap and ECharts which were used to show statistical data.

Conference

- [1] **Zhang, Tianpu**, Weilong Ding, Mengda Xing, Jun Chen, Yongkang Du, and Ying Liang. "Geographic and Temporal Deep Learning Method for Traffic Flow Prediction in Highway Network." In International Conference on Collaborative Computing: Networking, Applications and Worksharing, pp. 385-400. Springer, Cham, 2021.

- Using a hybrid model incorporating a variant of GCN and LSTM, we propose a method that effectively captures the geographic spatial relationships among toll stations. Additionally, our model considers the dynamic temporal relationship of historical traffic flow, extreme weather conditions, and calendar variations.

Journal

- [1] **Tianpu Zhang**, Weilong Ding, Tao Chen, Zhe Wang, Jun Chen, "A Graph Convolutional Method for Traffic Flow Prediction in Highway Network", Wireless Communications and Mobile Computing, vol. 2021, Article ID 1997212, 8 pages, 2021. <https://doi.org/10.1155/2021/1997212>

- Using a variant of GCN, the Hybrid Graph Convolutional Network (HGCN), takes into account various factors including time, space, weather conditions, and date type to enhance the accuracy of traffic flow predictions at highway stations.

- [2] Xing, Mengda, Weilong Ding, **Tianpu Zhang**, and Han Li. "STGCN: a spatio-temporal complete graph convolutional network for remaining useful life prediction of power transformer." International Journal of Web Information Systems (2023).

- Using a variant of STGCN, spatiotemporal features are learned from the combination of attention, TCN, and GCN. we propose a novel multi branch structure to efficiently compute feature maps from two heterogeneous data sources, and a novel similarity aggregation method to compute the spatial Uncertain Adjacency Matrix (UAM) within the complete graph.

- [3] Xing, Mengda, Weilong Ding, Han Li, and **Tianpu Zhang**. "A Power Transformer Fault Prediction Method through Temporal Convolutional Network on Dissolved Gas Chromatography Data." Security and Communication Networks 2022 (2022).

- Based on the TCN network, a new power transformer fault prediction method was proposed, which is composed of three processing stages including missing imputation and outlier detection, dissolved gas prediction, and fault classification.

Arxiv

- [1] **Zhang Tianpu**, Weilong Ding, and Mengda Xing. "Attention-based Dynamic Graph Convolutional Recurrent Neural Network for Traffic Flow Prediction in Highway Transportation." arXiv preprint arXiv:2309.07196 (2023).
- Using a variant of GCN and GRU, an ADGCRNN model is proposed, which consists of three functioning modules. (1) Three temporal resolutions of data sequence are effectively integrated by self-attention to extract characteristics. (2) Multi-dynamic graphs and their weights are dynamically created to compliantly combine the varying characteristics. (3) Dedicated gated kernel emphasizing highly relative nodes is introduced on these complete graphs to reduce overfitting for graph convolution operations.
- [2] Ding, Weilong, **Tianpu Zhang**, Jianwu Wang, and Zhuofeng Zhao. "Multi-graph Spatio-temporal Graph Convolutional Network for Traffic Flow Prediction." arXiv preprint arXiv:2308.05601 (2023).
- Based on three distinctive semantic networks from physical, statistical, and latent perspectives, we constructed a completely convolutional model named MSTGCN to improve the prediction of traffic flow.
- [3] Ding, Weilong, **Tianpu Zhang**, and Zhe Wang. "Phased Deep Spatio-temporal Learning for Highway Traffic Volume Prediction." arXiv preprint arXiv:2308.06155 (2023).
- A deep spatio-temporal learning method is proposed to predict daily traffic volume in three phases including feature pre-processing phase, spatio-temporal learning phase and decision phase.

IN SUBMISSIONS

- [1] **Tianpu Zhang**, Weilong Ding, Mengda Xing, Zijian Liu and Qi Yu. Spatio-temporal Heritable Neural Networks for Traffic Flow Prediction. SIAM International Conference on Data Mining (SDM24).
- We proposed STHNN, an encoder-decoder model that learns long-term global spatio-temporal correlations by merging features at different resolutions. Our method utilizes a novel spatial hidden state in each GRU cell to capture the spatial heritability of historical local spatial features. Through an Update Graph module, historical and current features are aggregated, enabling the updated spatio-temporal hidden states to better align with real traffic conditions.

INDUSTRY EXPERIENCES

Yunqishidai Technology Co., Ltd

July. 2019 – Aug. 2020

Data Analysis Engineer

Beijing, China

- **Introduction of Company:** As a third-party vendor, it works for the state grid to provide technical support to the development state grid new energy cloud platform.
- **Job Responsibility:** My duty was to build data storage and analysis platform through big data technology to support the state grid new energy cloud platform which is a system facilitating citizens electricity transactions. Meanwhile, an electricity power predictive system for photovoltaic power stations and a recommendation system for news in the renewable energy field was designed by using machine learning technology.

Unicom big data Co., Ltd

Nov. 2018 – Mar. 2019

Data Analysis Engineer

Beijing, China

- **Introduction of Company:** As one of the three major telecom operators in China, Unicom Big Data has petabytes of data.
- **Job Responsibility:** My main work was to use big data technologies such as hive, spark, etc. to analyze the customs behavior to build user portrait and extract relevant data from the data warehouse according to customer needs.

UNIVERSITY PROJECTS

Highway Management System of Henan

Dec. 2022 Sep. 2020

Henan provincial Highway Administration

Beijing, China

- Through the use of Hive, MapReduce, and Spark technologies, an analysis was conducted on over 1 billion records of traffic data from 343 toll stations in Henan Province from January 2016 to April 2018. The analysis aimed to calculate the daily traffic volume for each station.
- Combining with GCN and TCN, Multi-graph spatio-temporal graph convolutional network (MSTGCN) constructed spatial network based on three different semantics to capture spatio-temporal correlations and improve prediction accuracy.
- Introducing a novel hidden state within GRU and combining with GCN and self-attention mechanism, spatio-temporal heritable neural networks (STHNN) model can dynamically capture correlations in spatio-temporal networks with high prediction accuracy.

SKILLS

Languages: Python, Pytorch, Java, Scala, SQL (Hive, MySQL, Oracle, Redis), JavaScript (React.js), HTML/CSS,

Deep Learning: CNN, LSTM, GRU, TCN, GCN, Attention, Transformer

Machine: Learning: LR, GBDT, RandomForest, XGBoost, K-means, DBSCAN

Big Data: Mapreduce, Spark, Hive, Hbase, Flume, Stock, kafka

Web Technology: Spring, SpringMVC, Mybatis

Tools: Linux, shell, GitHub, Markdown, LaTeX

ACHIEVEMENTS

Outstanding Master Graduates of Beijing	Jul. 2023
Outstanding Postgraduate Students at North China University of Technology	Nov. 2022
National Scholarship for Postgraduates	Oct. 2022
The Second Prize of The Third Provincial English Proficiency Competition for Colleges and University	June 2022
Outstanding Postgraduate Students at North China University of Technology	Dec. 2021
The First Prize Academic Scholarship for Postgraduates at North China University of Technology	Oct. 2021

LANGUAGES

English IELTS : 6.5

Mandarin Native Proficiency