Tianjun Ke

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Education

Renmin University of China   *Sept 2020 - June 2024**
BS in Statistics   *(Expected)*
- **Overall GPA**: 3.95/4.0
- **Ranking**: 1/61

Shenzhen Middle School   *Sept 2017 - June 2020*
High School

Publications

CLIP as Multi-Task Multi-Kernel Learning
  Yucong Lin*, Tianjun Ke*, Xingpeng Xia, Jiaheng Yin, Jiaxing Xu, Tianxi Cai, Junwei Lu
  Submitted

Revisiting Logistic-softmax Likelihood in Bayesian Meta-Learning for Few-Shot Classification
  Tianjun Ke*, Haoqun Cao*, Zenan Ling, Feng Zhou
  Submitted

MIN: Multi-channel Interaction Network for Drug-Target Interaction with Protein Distillation
  Shuqi Li, Shufang Xie, Hongda Sun, Yuhan Chen, Rui Yan, Tao Qin, Tianjun Ke
  Submitted

* denotes equal contribution

Research Experience

Research Interest: My research interest lies in the intersection of statistics and computer science, focusing on giving statistical analyses of modern learning methods. My research topics include machine learning theory, Bayesian statistics, reinforcement learning, and AI4Science.

Research on In-context Learning (ICL) with Hawkes Process   *July 2023 - Current*
Core group member, supervised by Prof. Junwei Lu, Harvard University
- Objective: Investigate the dynamics of ICL in transformers with a single linear self-attention layer trained by gradient flow in the Hawkes process setting.
- Analyze the proof sketch of several latest papers on ICL with linear attention on linear regression tasks.
- Engage in the exploration of adapting ICL in the Hawkes process setting.

Research on statistical inference after adaptive sampling in linear Markov Decision Process (MDP)   *May 2023 - July 2023*
Core group member, supervised by Prof. Junwei Lu, Harvard University
- Objective: Provide a theoretical foundation for statistical inference after adaptive sampling in linear MDP.
- Studied the theory and algorithms of statistical Reinforcement Learning with the book *Reinforcement Learning: Theory and Algorithms*.
- Derived theoretical analysis for linear MDP in a hypothetical "forward" algorithm.
- Temporally suspended this project as most UCB algorithms in linear MDP consider a "backward" setting which is fairly complex to analyze.

Revisiting Logistic-Softmax Likelihood in Bayesian Meta-Learning for Few-Shot Classification   *Feb 2023 - May 2023*
Core group member, supervised by Prof. Feng Zhou, Renmin University of China
- Objective: Uncover the theoretical properties of the logistic-softmax likelihood besides conditional conjugacy in Gaussian process models.
- Introduced logistic-softmax with temperature and proved its unique limiting behavior.
- Theoretically and empirically showed that softmax can be viewed as a particular case of logistic-softmax and logistic-softmax induces a larger family of data distributions than softmax.
- Derived an analytical mean-field approximation for posterior inference through data augmentation.
- Implemented the model in PyTorch, conducted extensive few-shot classification experiments on several benchmark datasets, and established sota results for classification accuracy and uncertainty calibration.
- Paper submitted to NeurIPS 23, co-first author.

CLIP as Multi-Task Multi-Kernel Learning
July 2022 - May 2023

Core group member, supervised by Prof. Junwei Lu, Harvard University

- Objective: Provide a theoretical interpretation of CLIP utilizing the Reproducing Kernel Hilbert Space (RKHS) framework.
- Reformulated the notion of CLIP by a solid RKHS framework: reduced the problem of estimating the optimal CLIP mapping ϕ to selecting an optimal RKHS by multiple kernel learning.
- Proved optimal convergence rate of the proposed multi-task multi-kernel estimator.
- Implemented the model in PyTorch and accelerated optimization by block coordinate gradient descent with closed-form updates.
- Conducted extensive simulation experiments for empirical investigation and verification of theoretical properties.
- Paper submitted to NeurIPS 23, co-first author.

Research on Drug-Target Interaction and Cell Classification
Sep 2022 - Feb 2023

Group member, supervised by Prof. Rui Yan, Renmin University of China

- Objective: Utilize conservation score for automatic residue selection and noise reduction in drug-target interaction.
- Empirically verified that residues in the binding pocket are more conservative than that in the non-pocket area through experiments on the PDBbind v2020 dataset and coauthored a paper submitted to Artificial Intelligence.
- Investigated prospective deep learning methods for cell classification in scRNA-sequencing data, consisting of contrastive learning, hyperbolic learning, and graph neural networks.

Work Experience

Internship at Department of Intelligence and Digitalization, China Resources Trust
Jun 2022 - Jul 2022

China Resources Trust

- Learned about the process management of enterprise-level software development.
- Independently handled the setup of testing environments and the development of application scenarios.
- Developed statistical analysis functionalities and implemented approval workflows in the test environment of the workflow engine platform.

Skills

Computer skills	C/C++, R, Python (DL Framework: Pytorch, Keras; Parallel Computing Framework: Pyspark)
Math skills	Probability, Statistics, Mathematics Analysis, Linear Algebra, Measure Theory, Real analysis, Point Process, Functional Analysis, Financial Mathematics

Awards

2023	**Bronze Prize in Programming Contest of RUC**, Renmin University of China
2022	**National Scholarship (Awarded to 3 out of 179 candidates)**, China
2022	**National Third Prize in the 12th Market Research and Analysis Competition**, Commerce Statistical Society of China
2021	**Academic Excellence Award (Top 3% GPA)**, Renmin University of China

Languages

Chinese	Native
Cantonese	Native
English	**GRE** 331+4, **TOEFL** 111
Japanese	N2

Service

Lab Mentor
Sep 2022 - Current

MedAI Lab (directed by Prof. Yucong Lin, Beijing Institute of Technology)

- Instruct new lab members with basic coding skills in PyTorch and elementary AI and statistical knowledge.
- Design and deliver a series of statistical lectures on machine learning, covering topics such as simulation experiments and learning theory.

Interests

Film	I am a big cinephile and my favorite film of all time is *The Lighthouse*.