

# Tianjun Ke

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## Education

### Renmin University of China

Sept 2020 - Current

BS in Statistics

- **Overall GPA:** 3.95/4.0
- **Ranking:** 1/61
- **Research Interest:** My research interest lies in the intersection of statistics and computer science, focusing on machine learning theory, Bayesian statistics, and reinforcement learning.

## Research Experience

### 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 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  $\phi$  to selecting an optimal RKHS by multiple kernel learning.
- Established 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.

### Revisiting Logistic-Softmax Likelihood in Bayesian Meta-Learning for Few-Shot

Feb 2023 - May 2023

#### Classification

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.

### 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 PDBbind v2020 dataset and coauthored a paper "MIN: Multi-channel Interaction Network for Drug-Target Interaction with Protein Distillation", submitted to Artificial Intelligence.
- Investigated prospective deep learning methods for cell classification in scRNA-sequencing data.

## 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, Learning Theory

## Awards

2020, 2023 **Bronze Prize in Programming Contest of RUC**, Renmin University of China

2022 **National Scholarship (awarded to 3 out of 179 candidates)**, China

2021 **Academic Excellence Award (sponsored by JD Group for Top 3% GPA)**, Renmin University of China

## Languages

**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.