Xiaozhi Liu

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Education

Northwestern Polytechnical University, Xi'an, China, BS in Information and Computing Science — Sept 2018 – Jul 2022

- School of Mathematics and Statistics
- **Supervisor**: Prof. Jianchao Bai
- **GPA**: 88.01/100 (Rank: 4/43)

  During my junior year, I achieved a GPA of **97.89/100**, ranking first in the entire college (**1/104**).
- **Key Coursework**: Ordinary Differential Equations (100), Differential Geometry (99), Mathematical Statistics (99), Modern Algebra (98), Optimization Methods (98), Functional Analysis (96)

Beihang University, Beijing, China, Ph.D. in Applied Mathematics — Sept 2022 – Present

(Admitted through the Direct Ph.D. Program for Outstanding Undergraduates, bypassing the graduate entrance examination.)

- School of Mathematical Sciences & **Shen Yuan Honors College** (selected among only **35** students university-wide)
- **Supervisor**: Prof. Yong Xia
- **GPA**: 91.45/100 (Rank: 6/27)
- **Key Coursework**: Matrix Theory (97), Convex Analysis (95), Multivariate Statistical Analysis (93), Complex Analysis (93), Stochastic Processes (91), Theory and Methods For Optimization (90)

Research Interests

- Sparse Optimization Algorithms
- Line Spectral Estimation
- Atomic Norm Minimization

  I'm interested in numerical methods for optimization with sparse structures and their applications in signal processing and wireless communications.

Research Experience

Research on Randomized Algorithms and Their Applications in Supervised Learning — May 2020 – May 2022

- Provincial-Level Undergraduate Innovation Project, Rated as **Excellent**.
- **Role**: Project Leader.
- **Research Focus**: Investigating supervised learning problems in machine learning. My primary contributions include designing a proximal gradient descent algorithm with inertial steps. The work involved:
  1. Rigorously proving the algorithm's convergence and linear convergence rate under the assumption of strong convexity of the objective function.
  2. Testing the numerical performance of the new algorithm using an SVM model on the MNIST dataset.

Application of the BERT Model in Cloze Tests for Natural Language Processing (NLP) — Nov. 2020 – Jan. 2021

- ASC International Student Supercomputer Challenge, **Second Prize**.
- **Role**: Project Leader.
- **Research Focus**: Tackling cloze tests in NLP. Starting from scratch, I independently studied the BERT model under the PyTorch framework. My key tasks included:
  1. Implementing the training and testing of the CLOTH dataset using Python programming.
  2. Leveraging a high-performance computing platform (Linux environment) for GPU parallel computing to enhance the model's computational efficiency.

Super-Resolution Parameter Estimation and Completion in 5.5G Massive MIMO Communication Systems Sep. 2022 – Present

- National Key Research and Development Program of China.
- **Role**: Core Technical Member.
- **Research Focus**: Addressing issues related to the estimation of wireless channel state information (CSI) and the optimization of hybrid beamforming (HBF) algorithms in 5.5G Massive MIMO systems. My primary contributions include:
  1. Designing and analyzing fast and efficient algorithms for Direction of Arrival (DOA) estimation.
  2. Authoring three research papers on this topic.
  3. Open-sourcing the related algorithms on GitHub.

Publications & Preprints

A Unified Algorithmic Framework for Dynamic Compressive Sensing 2023

Xiaozhi Liu, Yong Xia

arXiv: 2310.07202.

Cubic NK-SVD: An Algorithm for Designing Parametric Dictionary in Frequency Estimation 2024

Xiaozhi Liu, Yong Xia

arXiv: 2408.03708. (code)

Revisiting Atomic Norm Minimization: A Sequential Approach for Atom Identification and Refinement 2024

Xiaozhi Liu, Jinjiang Wei, Yong Xia

arXiv: 2411.08459.

Presentations

A Unified Algorithmic Framework for Dynamic Compressive Sensing October 12-15, 2023

- 21st Annual Meeting of CSIAM, Kunming, Yunnan.

Cubic NK-SVD: An Algorithm for Designing Parametric Dictionary in Frequency Estimation September 13-15, 2024

- 1st ORSC conference on Data Science and Operations Research Intelligence, Beijing.

Honors & Awards

National Scholarship for Undergraduate Student (**Top 0.2% nationwide**) 2021
Ph.D. Freshman Scholarship (**awarded to only 3 students in the college**) 2022
Outstanding Graduate (link) 2022
"Tribute to Modern Chinese Scientists" Scholarship (**awarded to only 12 students university-wide**) 2021
Third Prize, "Huawei Cup" National Graduate Student Mathematical Contest in Modeling 2023
Second Prize, ASC International Student Supercomputer Challenge 2022
Second Prize, International Mathematical Contest in Modeling (MCM) 2021
First Prize, National Undergraduate Mathematics Competition, Shaanxi Province 2020
First Prize, ChinaUndergraduate Mathematical Contest in Modelling (CUMCM), Shaanxi Province 2020

Skills

Programming Languages: Python, Matlab, C, Julia, LaTeX

Machine Learning: PyTorch, TensorFlow

High Performance Computing: Linux

Languages: English: Fluent (CET-4: 593, CET-6: 523, Certificate of PETS Level 5); Mandarin: Native Speaker