FUPENG SUN

School of Mathematics and Statistics, Beijing Institute of Technology, Beijing, 102488, China
Email: fupengsun1@gmail.com, fupeng_sun@bit.edu.cn
Homepage: https://fupeng-sun.github.io/homepage/
Phone: (+86)135-2066-2878

EDUCATION

- **M.S.2020 - present.** Beijing Institute of Technology, China, School of Mathematics and Statistics, **GPA 94.0/100.0**, **Ranking 1/100**.
- **B.S.2016 - 2020.** Beijing Institute of Technology, China, School of Mathematics and Statistics, B.S Degree in Mathematics, **GPA 93.5/100.0**, **Ranking 1/130**.
- **September 2018 - March 2019**, Rutgers University, the United States, School of Arts and Science, **GPA 4.0/4.0**.

SUMMARY OF RESEARCH

My research interests focus on topology, geometry, Bayesian inference and their applications in data science, biological engineering and game theory.

My research experience covers:

- Applying information geometry to design new estimates for classical statistical models.
- Geometrical and topological analysis of ECG classification.
- Applying Bayesian inference to obtain equilibrium of sequential elimination contests (SEC).
- Developing algorithms for geometrical data processing.

My expecting research fields include Bayesian inference, computational geometry, topological data analysis (TDA) and engineering fields with potentials to implement tools with statistics and geometry, such as ECG analysis, robotic controlling, operation research and artificial intelligence.

PROFESSIONAL ABILITIES

- **Analysis**: Proficient in Calculus; Skilled in Real Analysis, Complex Analysis, Differential Equations, Functional Analysis.
- **Algebra**: Proficient in Linear algebra; Skilled in Abstract algebra, Lie group and Lie algebra.
- **Geometry**: Proficient in Point Set and Algebraic Topology, Classical Geometry; Skilled in Riemannian Geometry; Learning in Complex Geometry.
- **Applied**: Skilled in Statistics, Graph theory, Data structure, Computational topology and Geometry, Machine Learning, Image and Signal Processing; Learning in Game Theory, Optimization.

RESEARCH EXPERIENCES

- **Bayesian inference based on information geometry and data processing based on geometrical methods, funded by National Natural Science Foundation of China**

  September 2019 - present Principal Researcher

  - **Information Geometry on Lie Groups and Its Applications under Grant No. 61179031, 2015 - present.**
    - Provide the principal ideas to obtain new estimates of Pareto Models based on Bayesian inference and information geometry [1].
    - Provide the principal ideas to design data processing algorithms, including control algorithms for $SPD(n)$ [5], cluster algorithm SKMEANS [7], point cloud denoising AWCD [6]. AWCD shows that it is feasible to describe the information by curvatures.
    - Finish MATLAB codes for SKMEANS, AWCD.
    - Finish PYTHON codes for topological persistence on Environmental Sound Classification [8].

- **ECG classification based on geometrical and topological methods, funded by National Key Research and Development Project of China**

  December 2020 - present **The First** Researcher

  - **Research and Development of AI Identification Alarm System and Equipment for Public Stadium under Grant No.2020YFC2006201, 2020 - 2023.**
    - Provide the principal ideas to design ECG classification algorithms based on geometrical methods (WSCEC) [2] and topological methods [4]. WSCEC shows that it is feasible to describe the pathological features of ECG by curvatures.
    - Finish PYTHON codes for WSCEC.
  - **Patent in process**
    - The first inventor of Computer-aided Classification Method of Heart Disease via Curvature of Statistical Manifold (Application Number: 202210595419.0).
    - The second inventor of Heart Disease Identification Based on Persistent Homology and Fourier Transform (Application Number: 2021116103987).

- **Study of Operations Research**

  January 2021 - present **The First Two** Researcher

  - **Cooperation with Assistant Professor Chiwei Yan in University of Washington(UW)**
    - Characterize players' Perfect Bayesian Equilibrium strategies of two-stage sequential elimination contests (SEC) under incomplete information [3].

- **Study of Graph Theory, funded by Fundamental Research Funds for the Central Universities**

  January 2021 - present Present Reseacher

  - **Research on Some Related Problems of Schur Positive Conjecture under Grant No.2021CX11012, 2021 - 2021.**
    - Literature review and group discussion.

- **Study of Graph Theory, funded by General Program of National Natural Science Foundation of China**

  January 2022 - present Present Reseacher

  - **Research on Some Related Problems of 3+1 Conjecture of Chromatic Symmetric Function under Grant No.12171034, 2022 - 2025.**
    * Literature review and group discussion.

- **Work in Beijing Key Lab on Mathematical Characterization, Analysis, and Applications of Complex Information(MCAACL)**

  September 2018 - present Principal Researcher

PUBLICATIONS

1. **F.Sun**, Y.Cao, S.Zhang, H.Sun, The Bayesian Inference of Pareto Models Based on Information Geometry, *Entropy*, 2021, 23(1), 45. [published]

2. **F.Sun**, Y.Ni, Y.Luo, H.Sun, ECG Classification based on Wasserstein Scalar Curvature, *Entropy*, 2022, 24(10), 1450. [published]

3. **F.Sun**, Y.Sun, C.Yan, L.Jin, Sequential Elimination Contests with All-Pay Auctions, *arXiv*, 2022, doi: arxiv-2205.08104. [preprint]

4. Y.Ni, **F.Sun**,Y.Luo, Z.Xiang, H.Sun, A Novel Heart Disease Classification Algorithm based on Fourier Transform and Persistent Homology. *2022 IEEE International Conference on Electrical Engineering, Big Data and Algorithms (EEBDA 2022)*, Changchun, China. [published]

5. N.W.Aung, **F.Sun**, S.Zeng, H.Sun, Control Algorithms for Positive Definite Matrix Manifolds. *Transactions of Beijing Institute of Technology*, 2021, 41(2), 221-225.(in Chinese) [published]

6. Y.Luo, A.Yang, **F.Sun**, H.Sun, AWCD: An Efficient Point Cloud Processing Approach via Wasserstein Curvature. *2021 IEEE International Conference on Artificial Intelligence and Computer Applications (ICAICA 2021)*, Dalian, China. [published]

7. H.Sun, Y.Song, Y.Luo, **F.Sun**, A Clustering Algorithm Based on Statistical Manifold. *Transactions of Beijing Institute of Technology*, 2021, 41(2), 226-230.(in Chinese) [published]

8. Y.Cao, S.Zhang, F.Yan, W.Li, **F.Sun**, H.Sun, Unsupervised Environmental Sound Classification Based On Topological Persistence, *2019 IEEE International Conference on Signal, Information and Data Processing (ICSIDP 2019)*, Chongqing, China. [published]

HONORS AND AWARDS

- Self-improvement Star Scholarship of Chinese University Students, *Ministry of Education of the People's Republic of China*, 2022. **(Only 1832 students obtained this scholarship in China, 2022)**

- FEIZHENYONG Scholarship, *Beijing Institute of Technology (BIT)*, 2022. **(Highest Honor in School of Mathematics and Statistics in BIT)**

- National Scholarship for Graduate Students, *Ministry of Education of the People's Republic of China*, 2022.

- First prize, Bejing Site, the 8th China International College Students' "Internet + " Innovation and Entrepreneurship Competition, *Organizing Committee of China International College Students' "Internet + " Innovation and Entrepreneurship Competition*, 2022.

- Excellent Students of Beijing, *Beijing Municipal Education Commission*, 2022.

- Outstanding Social Research Individual in Summer Vacation, *Beijing Institute of Technology (BIT)*, 2022.
- National Scholarship for Graduate Students, *Ministry of Education of the People's Republic of China*, 2021.
- The Model of Excellence in Character and Learning, *Beijing Institute of Technology (BIT)*, 2021.
- Excellent Student Model, *Beijing Institute of Technology (BIT)*, 2021.
- Outstanding Graduates of Beijing, *Beijing Municipal Education Commission*, 2020.
- Outstanding Graduates, *Beijing Institute of Technology (BIT)*, 2020.
- The Model of Excellence in Character and Learning, *Beijing Institute of Technology (BIT)*, 2020.
- Excellent Peer Mentor, *Beijing Institute of Technology (BIT)*, 2020.
- National Scholarship, *Ministry of Education of the People's Republic of China*, 2019.
- Excellent Students of Beijing, *Beijing Municipal Education Commission*, 2019.
- Second Prize, National College Students Mathematical Competition (CMC), *Chinese Mathematical Society (CMS)*, 2019.
- National Encouragement Scholarship,*Ministry of Education of the People's Republic of China*, 2018.
- National Scholarship, *Ministry of Education of the People's Republic of China*, 2017.
- Thrid Prize, National College Students Mathematical Competition (CMC), *Chinese Mathematical Society (CMS)*, 2017.
- Outstanding Social Research Individual in Winter Vacation, *Beijing Institute of Technology (BIT)*, 2017.

WORK AND VOLUNTEER EXPERIENCES

- **Beijing Institute of Technology(BIT)**
  - **School of Beijing**
    - November 2019 - present, teaching Assistant on basic courses of Mathematics.
  - **School of Mathematics and Statistics**
    - March 2021 - July 2021, teaching Assistant on Graph Theory.
  - π **Plan for Rural Children**
    - December 2020 - present, establish public welfare fund and organize volunteer program of school teaching to help rural children.
- **Beijing Fengtai Care Center for Retarded Children**
  - Volunteer Program of Teaching for 200 hours.

SKILLS AND HOBBIES

- **Computer**: **MATLAB**, **Python**, Latex, Office.
- **Languages**: Chinese(native), English.
- **Others**: Painting, swimming, badminton, soccer, basketball.