Bang-Shien Chen

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EDUCATION

M.Sc. in Mathematics   *Sep 2023 - present*
National Taiwan Normal University (NTNU)
Overall GPA: 4.3/4.3
Research Advisor: Prof. Jann-Long Chern
Co-Advisor: Prof. Chih-Wei Huang

B.Sc. in Mathematics   *Sep 2018 - Jun 2022*
National Taiwan Normal University (NTNU)
Overall GPA: 3.18/4.3 | Last two year GPA: 3.73/4.3

ACADEMIC EXPERIENCE

Research Visitor hosted by Prof. Shuzhong Zhang, University of Minnesota.   *Jun 2024 - Aug 2024*

Teaching Assistant of Linear Algebra by Prof. Chu-Chin Hu.   *Sep 2023 - Jun 2024*

Research Assistant of Prof. Jann-Long Chern.   *Jul 2022 - Jan 2023, May 2023 - Aug 2023*

RESEARCH EXPERIENCE

Graduate   *Sep 2023 - Present*

- Fractional programming technique for Geman-McClure robust estimator [1].
- Research on Robotics localization problems with optimization and ML-based approaches.

Between undergraduate & graduate   *Jul 2022 - Jan 2023, May 2023 - Aug 2023*

- Encoding arbitrary matrix onto quantum circuits by matrix decomposition [2].
- Generating quantum feature maps for quantum support vector machine [3].

Undergraduate   *Oct 2021 - Jun 2022*

- Research on Netflix's recommendation systems with ML-based approaches.

AWARDS & ACHIEVEMENTS

NCTS Research Abroad Program | *link*   *Jul 2024 - Aug 2024*
A research abroad program financially supported by the Mathematics Division of National Center of
Theoretical Sciences (NCTS), worked with Prof. Shuzhong Zhang at the University of Minnesota.

Taiwan-Japan Joint Workshop, Presentation Award | *link*   *Feb 2024*
Out of 40 speakers in the 14th Taiwan-Japan Joint Workshop for Young Scholars in Applied
Mathematics.

IBM Qiskit Hackathon Taiwan, 1st Prize | *link*   *Jul 2022*
Out of 12 teams in the final round of the Hackathon.

Taiwan-Japan Joint Workshop, Presentation Award | *link*   *Feb 2022*
Out of 42 speakers in the 12th Taiwan-Japan Joint Workshop for Young Scholars in Applied
Mathematics.

Academic Excellence Award, 2 times *Fall semester 2021, Spring semester 2022*
Given to students with the best academic performance in the department.

F.J. Yu's Scholarship *Spring semester 2022*
Given to students with the best overall GPA in mathematical courses.

PROJECTS

FracGM: A Geman-McClure solver [1] | *GitHub*

- A fast Geman-McClure robust estimator with conditionally global optimality guarantees.
- FracGM-based rotation and registration solvers, outperforming existing state-of-the-art methods in both accuracy and robustness.

Block Encoding matrices onto quantum circuits [2] | *GitHub*

- A low gate-cost block encoding method for encoding arbitrary matrices onto quantum circuits.
- Solving linear equation systems with our block encoding technique and comparison with the Harrow-Hassidim-Lloyd algorithm.

IBM Qiskit Hackathon: Solving large combinatorial optimization problem | *GitHub*

- New approach by constructing a learnable quantum ansatz using matrix decomposition.
- Results and presentation of IBM Qiskit Hackathon Taiwan 2022 1st prize group.

Generate quantum feature maps for SVM [3] | *GitHub*

- Auto-generate quantum feature maps by genetic algorithm with multi-objective fitness function using penalty weights.
- Introduce variational methods to construct the feature map based on matrix decomposition.

Neural network based recommendation system | *GitHub*

- A personalized movie recommendation using neural networks based on the paper: Deep Neural Networks for Youtube Recommendations.

PUBLICATION & PRESENTATION

Publications

[1] **Chen, B. S.**, Lin, Y. K., Chen, J. Y., Huang, C. W., Chern, J. L., Sun, C. C. (2024). *FracGM: A Fast Fractional Programming Technique for Geman-McClure Robust Estimator.* To appear in IEEE Robotics and Automation Letters, doi: 10.1109/LRA.2024.3495372.

[2] Chern, J. L., **Chen, B. S.** (2023). *Efficient Block Encoding Circuit to Solve Linear Equation Systems.* Available at SSRN 4374837.

[3] **Chen, B. S.**, Chern, J. L. (2022). *Generating quantum feature maps for SVM classifier.* arXiv:2207.11449.

Presentations

1. Workshop on Advances in Continuous Optimization 2024, RIKEN Center for Advanced Intelligence Project, Tokyo, Japan, November 25-26, 2024.
2. 2024 NCTS Student Workshop on Scientific Computing, National Taiwan University, Taipei, Taiwan, May 6, 2024.

3. 14th Taiwan-Japan Joint Workshop for Young Scholars in Applied Mathematics, Meiji University, Tokyo, Japan, February 27-29, 2024.

4. Workshop on Advances in Continuous Optimization 2023, The University of Tokyo, Tokyo, Japan, July 24-25, 2023.

5. 2022 Summer school on Quantum Computer, Asia University, Taipei, Taiwan, August 21 - September 24, 2022.

6. Seminar on Quantum Theory and Computation, National Taiwan Normal University, Taipei, Taiwan, April 26 - May 24, 2022.

7. 12th Taiwan-Japan Joint Workshop for Young Scholars in Applied Mathematics, (virtual), February 28 - March 1, 2022.

SKILLS

Research: Optimization, Machine Learning, Robotics, Computer Vision, Quantum Computing

Programming: Python, C++, Matlab, SAS, JavaScript, LaTeX

Languages: Chinese (Native), English (Professional), Korean (Elementary)

- TOEFL: 109 | GRE: 320