

Ryan Y. Batubara

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Education

2022–2026 **University of California, San Diego (UCSD)**, La Jolla, CA, GPA: 3.97/4.
B.S. Mathematics-Computer Science, B.S. Data Science double major.

Research Experience

Fall 2025 **Undergraduate Math Honor Thesis on MBQC, UCSD**

– present Examined the universality of various conditions on the comparability graph for measurement-based quantum computation (MBQC). Part of the prestigious math honors program that around 10 students do yearly. In progress. Joint work with Du (Dan) Van.

Advised by Dr. Daniel Grier, Kunal Marwaha, and Jackson Morris.

Fall 2025 **Capstone in Communication Complexity, UCSD**

– present Used communication complexity to investigate lower bounds for data science algorithms, like multi-agent learning and data streams. In progress. With Ivy Hawks, Darren Ho, and Ciro Zhang.

Advised by Dr. Shachar Lovett.

Winter 2024 **Undergraduate Research in Algebraic Geometry, UCSD**

– present Implemented GPU-accelerated controlled reduction to discover many first examples in algebraic geometry. Some of this work is in arXiv preprint 2502.12428, some in progress. With Alex Pan and Maximus Mellberg.

Supervised by Jack Garzella, Yongyuan (Steve) Huang, and Dr. Kiran Kedlaya.

Fall 2024 – **HDSI Responsible Data Science Program, UCSD**

Spring 2025 Investigated relationship between education and incarceration through data science methodologies. Culminated in a presentation to faculty at the Haliciolu Data Science Institute (HDSI). With Leonardo Bangayan, Varick Hasim, Donald Taggart, and Serena Xie.

Advised by Conan Minihan and Dr. Benjamin Smarr.

Publications

In Preparation

- R. Batubara, J. Garzella, Y. Huang, and M. Mellberg. GPU-accelerated zeta functions of projective hypersurfaces.

Preprints

- R. Batubara, J. Garzella, and A. Pan. K3 surfaces of any Artin–Mazur height over \mathbb{F}_5 and \mathbb{F}_7 via quasi- F -split singularities and GPU acceleration. In arXiv preprint 2502.12428. Submitted to the *Journal of Symbolic Computation*.

Teaching

- Fall 2025 **Tutor**, *CSE101: Design and Analysis of Algorithms*, UCSD
Graded, held tutor hours for 300+ students under Dr. Russell Impagliazzo and Dr. Qipeng Liu.
- Fall 2025 **Tutor**, *DSC10: Principles of Data Science*, UCSD
Wrote exams, held tutor hours for 400+ students under Dr. Janine Tiefenbruck and Dr. Peter Chi.
- Summer 2025 **Grader**, *MATH170A: Numerical Analysis*, UCSD
Graded homework for 60+ students under Dr. Jiawang Nie.
- Summer 2025 **Tutor**, *DSC20: Programming and Data Structures for Data Science (Remote)*, UCSD
Wrote exams, led discussion, and graded for 20+ students under Dr. Brendan Tomoschuk.
- Spring 2025 **Tutor**, *CSE190: Introduction to Quantum Computing*, UCSD
Wrote homework, held office hours, and graded for 100+ students under Dr. Daniel Grier.
- Winter 2025 **Grader**, *MATH103B: Modern Algebra II*, UCSD
Graded homework for 100+ students under Dr. Jack Wesley.
- Fall 2023 – present **Lead-Peer Mentor**, *CSE-PACE Cohorts*, UCSD
Introduced 300+ first-year computing majors to UCSD and computing topics under Dr. Mia Minnes, Dr. Joe Politz, and Dr. Kristen Vaccaro.

Readings and Coursework

- Relevant Coursework Math: Honors Algebra, Honors Analysis, Honors Graph Theory, Topology, Combinatorics.
Computer Science: Graduate Quantum Complexity, Algorithms, Theory of Computation, Programming Languages, Systems for Scalable Analytics, Data Visualization.
- Fall 2024 Reading on May's *Concise Algebraic Topology*. Led by Jack Garzella.
- Spring 2024 Reading on Atiyah and MacDonald's *Commutative Algebra*. Led by Jack Garzella, Yongyuan (Steve) Huang, and Matt Broe.
- Winter 2023 Math Directed Reading Program on Post-Quantum Cryptography. Led by Dr. Jun Lau.

Professional Experience

- Sep. 2025 – **Machine Learning Intern**, *gani.ai*, Jakarta, Indonesia (Remote)
- Dec. 2025 Implemented internal LLM fine-tuning pipelines for legal document drafting.
- Jun. 2025 – **Software Engineering Intern**, *Merah Putih Ltd.*, Jakarta, Indonesia (Remote)
- Aug. 2025 Created web dashboards from scratch for financial transaction management.

Awards and Honors

- Fall 2022 – present UCSD Revelle Provost Honors.
Honors for high quarter-by-quarter GPA.
- 2024 SDSU Big Data Hackaton Best Geospatial Thinker.
- 2019 World Mathematics Invitational Bronze at Fukuoka, Japan.
- 2018 World Mathematics Invitational Bronze at Seoul, South Korea.

Service

- Fall 2025 – **Vice President**, *Society of Undergraduate Mathematics Students*, UCSD
present Organized technical workshops with Mathworks and socials for the undergraduate math community.
- Fall 2023 – **Technical Lead**, *Quantum Computing Student Association*, UCSD
- Spring 2025 Introducing quantum computing; helped host Qiskit Fall Fest; collaborations with Harvard.
- Fall 2023 – **Workshops Chair**, *Society of Undergraduate Mathematics Students*, UCSD
- Spring 2025 Held intro to proof and MATLAB workshops; lightning talks; integration bee, among many others.

Projects

- Fall 2024 – **UCSD Historial Enrollment Project**
present Scraped, organized, and plotted UCSD class enrollment and waitlists using Rust and Python.
- Fall 2024 **Linear Dependent Type Theory for Quantum Computation**
Survey on no-cloning compatible type systems for quantum programming languages.
Graduate class project for CSE 291: Quantum Complexity. With Arnav Dandu.