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 – present **Undergraduate Math Honor Thesis on MBQC**, *UCSD*
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 – present **Capstone in Communication Complexity**, *UCSD*
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 – present **Undergraduate Research in Algebraic Geometry**, *UCSD*
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 – Spring 2025 **HDSI Responsible Data Science Program**, *UCSD*
Investigated relationship between education and incarceration through data science methodologies. Culminated in a presentation to faculty at the Halicioğlu 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 dicussion, 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 – Dec. 2025	**Machine Learning Intern**, *gani.ai*, Jakarta, Indonesia (Remote) Implemented internal LLM fine-tuning pipelines for legal document drafting.
Jun. 2025 – Aug. 2025	**Software Engineering Intern**, *Merah Putih Ltd.*, Jakarta, Indonesia (Remote) Created web dashboards from scratch for financial transaction management.

Awards and Honors

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

Projects

Fall 2024 – present	**UCSD Historial Enrollment Project** 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.