Ray Tsai

+1 (858) 905-0735 · ray@himetsai.com · himetsai · himetsai · himetsai.com

EDUCATION

University of Oxford — Oxford, United Kingdom
M.Sc. in Mathematical Sciences — Grade: Distinction (Rank 13/77) — *Sep 2025 – Jun 2026*

University of California San Diego — La Jolla, CA
B.Sc. in Mathematics-Computer Science, Honors with High Distinction — GPA: 3.93/4.00 (Math 3.98) — *Sep 2021 – Jun 2025*

AWARDS

Physical Sciences Dean's Undergraduate Award for Excellence — *UC San Diego, 2025*

- "Awarded to top undergraduates (< 1%) in Mathematics, Chemistry & Biochemistry, and Physics for academic excellence and research promise." ($1000)

RESEARCH EXPERIENCE

University of Oxford, Mathematical Institute — Oxford, UK
M.Sc. Dissertation, advised by Prof. Alex Scott — *Oct 2025 – Jun 2026*

- Studied open problems in extremal/probabilistic combinatorics and Ramsey Theory by Paul Erdős.
- Gave an original and simpler proof of the probabilistic Erdős–Littlewood–Offord-type theorem.
- Dissertation *Induced Subgraphs in Ramsey Graphs*: a self-contained exposition of the anticoncentration arguments behind the recent resolution of the Erdős–McKay conjecture; awarded highest mark in the combinatorics cohort.

UC San Diego, Department of Mathematics — La Jolla, CA
Honors Thesis and Undergraduate Research, advised by Prof. Jacques Verstraete — *Mar 2023 – Jun 2025*

- Studied open problems in extremal graph and hypergraph theory.
- Proved novel bounds on extremal problems on graph families; manuscript in preparation for submission with Prof. Verstraete.
- Thesis *Double Turán Problems* awarded High Distinction in the Mathematics Honors Program (~12 students admitted per year).

University of Oxford, Mathematical Institute — Oxford, UK
Theoretical Machine Learning Research Project — *Oct 2025 – Jan 2026*

- Devised a mathematical framework unifying FGSM adversarial training and Input Gradient Regularization via the Finlay–Oberman bound, characterizing catastrophic overfitting as exploitation of first-order approximation error.
- Validated the theory in PyTorch on CIFAR-10 (PreActResNet-18): smooth activations (Softplus, PReLU) recover near-full robustness at a fraction of the cost of multi-step adversarial training.

UC San Diego, Department of Computer Science & Engineering — La Jolla, CA
Undergraduate Researcher, advised by Prof. Russell Impagliazzo — *Apr 2024 – Jun 2025*

- Studied connections between multicalibration in algorithmic fairness and the weak regularity lemma, via the smooth boosting algorithm underlying Impagliazzo's hardcore lemma.

WORK EXPERIENCE

UC San Diego, Department of CSE – Instructional Assistant — La Jolla, CA · *Jan 2025 – Mar 2025*

- Held office hours and graded for Design & Analysis of Algorithms (CSE 101), a 200+ student course.

MSI – Software Engineer Intern — New Taipei City, Taiwan · *Jul 2023 – Aug 2023*

- Fine-tuned Stable Diffusion in PyTorch to generate product marketing images, shipped in the *MSI AI Artist* desktop app.
- Built an automated install pipeline for inference backends, raising generation throughput by 80%.

Kook – Co-founder & Lead Software Engineer — San Diego, CA · *Dec 2021 – Dec 2022*

- Co-founded a startup building automated surfboard rental stations (UCSD Basement incubator).
- Led a 5-member team and built the React Native app, SQL backend, NFC auth, and C++ Arduino lock firmware.

PROJECTS

Are Kalshi Prices Probabilities? | himetsai.com/blog/kalshi — *Python, pandas, NumPy*

- Built an end-to-end pipeline over the Kalshi API (14k settled markets, 957k hourly candles) testing whether prices are calibrated probabilities: Brier decomposition, logistic calibration fits, martingale tests, event-clustered bootstrap CIs.
- Showed the apparent favorite-longshot bias (calibration slope 1.34) vanishes when bid-ask spread is ≤10¢ (slope 0.99).

SKILLS

Languages: Python, C++, TypeScript, JavaScript, SQL, LaTeX
Libraries & Tools: PyTorch, NumPy, pandas, Jupyter, Git, React/React Native, Linux