AARUSH KHIRWADKAR

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EDUCATION

University of Illinois Urbana-Champaign Expected Graduation: **May 2030**
Ph.D. in Statistics

The University of Texas at Austin **May 2025**
B.S. in Mathematics, B.S. in Economics (Double major) **GPA: 3.74**

- Minor in **Business** (McCombs Summer Institute)
- Certificate in **Scientific Computation & Data Science**
- Relevant Coursework: (Graduate) Real Analysis, (Graduate) Mathematics for Economists, Math for ML & AI, Mathematical Statistics, Econometrics, Probability, Economic Statistics, Biostatistics

University College London (UCL) **Spring 2025**
Exchange Program – Mathematics

RESEARCH EXPERIENCE

Johns Hopkins University Applied Physics Lab – *Intern* **June 2024 – August 2024**
Group: FPS/KFA (System Modeling, Evaluation, & Planning)

- Formulated statistical methods to quantify and visualize error propagated through weapon system instrumentation; utilized Maximum Likelihood Estimation, Fisher Information, Markov chain Monte Carlo algorithms, and the Wishart distribution to find a lower bound on uncertainty about the 1-sigma covariance ellipse
- Developed a trajectory optimization model, integrating various differential equations to control parameters and satisfy technical requirements, using GPOPS-II
- Delivered technical presentations to 100+ staff members and documented research methodologies
- Participated in intern challenge, developed proposal to improve inclusivity for neurodiverse staff members

UT Austin - Institute for Organizational Excellence – *Research Assistant* **January 2023 – August 2023**

- Conducted statistical analyses (Vector Autoregression, Difference in Differences Analyses) for 15+ state agencies to analyze causal efficacy of strategic interventions
- Developed and delivered detailed reports to leadership, with complex data visualizations; coordinated with agency representatives to oversee the delivery of memos and reports
- Designed and administered surveys; engineered data pipelines to automate report generation while maintaining full data analysis capabilities

UT Austin - Innovations for Peace and Development – *Researcher* **January 2023 – May 2023**
Project: Data4Defense

- Analyzed qualitative research (government reports, news articles, think tank reports, and academic literature on defense-industrial policy) to build first-ever database of 40+ countries' defense offset policies
- Performed exploratory data analysis, cross-validation to test hypotheses regarding countries' offset policies
- Developed research proposal to implement spatial lag and linear regression models, setting the agenda for the following year

WORK EXPERIENCE

Wildfire Designs, LLC – *Founder* **December 2022 – April 2024**

- Founded a marketing analytics service that leveraged advanced data science techniques to drive digital marketing ROI for SMEs; managed projects and client relations
- Developed end-to-end analytics suite with data preprocessing (normalization, handling missing values), analysis (k-means clustering, DBSCAN, multivariate ANOVA, various regression analyses), and visualization functionalities, primarily for customer segmentation
- Implemented causal inference techniques such as A/B testing to evaluate efficacy of marketing campaigns

TEACHING

Teaching Assistant – **M 408C** (Differential & Integral Calculus, Prof. Erica Winterer) **August 2022** – **December 2022**

- Executed strategic lesson plans to improve ~150 students' performance in weekly homework and examinations
- Led weekly tutoring sessions for underperforming students, including personal mentoring and one-on-one sessions

TALKS & PRESENTATIONS

Covariance Uncertainty: Estimation & Visualization – *APL Intern Presentation* [Slides] **August 2024**

- Analyzed I.I.D. samples drawn from a bivariate normal distribution to quantify and visualize error around Maximum Likelihood estimate of 1-sigma covariance ellipse
- Utilized Fisher Information to calculate the asymptotic covariance matrix; visualized results using Cholesky Decomposition
- Estimated the 90% Highest Probability Density Region of the Wishart Distribution using a Binary Search algorithm and Markov Chain Monte Carlo methods

Decomposition of Quiver Representations – *Talk given at DRP Symposium* [Slides] **April 2024**

- Studied representation theory, utilizing the Krull-Schmidt theorem to construct 'unique' decomposition of representations
- Applied Gabriel's theorem to determine that a connected quiver Q has finite representation type if and only if it is of type ADE, with indecomposables in bijection with positive roots
- Developed an algorithmic construction of indecomposable representations for the quiver A_3

ACADEMIC PROJECTS

The Impact of Education Expenditure on Economic Growth

- Investigated the effects of government education expenditure on GDP growth rate using a Multiple Linear Regression model, finding no statistically significant relationship between overall education expenditure and GDP growth rates over five years; identified a negative correlation for pre-primary, primary, and secondary education spending, but a positive association for tertiary education expenditure
- Demonstrated that past economic health significantly predicts GDP growth, and that military spending has a negative impact on GDP growth
- Suggested policy changes for reassessment of investment in tertiary education to boost long-term economic growth
- Implemented Breusch-Pagan test (heteroskedasticity), VIF test (multicollinearity), Ramsey test (omitted variable bias), and Normality test to check Gauss-Markov assumptions

The Impact of the Presence of Fast Food Restaurants on Obesity

- Investigated the correlation between fast-food restaurant density and obesity rates across U.S. states using a Multiple Linear Regression model, finding that education and regional differences (in the South and Midwest) are stronger correlates with obesity than restaurant density
- Suggested that further studies should focus on socioeconomic and regional disparities
- Explored the effects of biases from self-reported data and potential confounding variables

Statistical Methods for Fantasy Premier League

- Implemented gradient boosted trees algorithm (XGBoost classifier) to a dataset of players' performances, identifying a pool of eligible players for selection
- Performed Monte Carlo simulations to determine optimal player selection strategies, focusing on Fixture (FDR) and Form
- Identified a trade-off between maximum points potential and consistency of scoring: Fixture-based selection has a higher ceiling (mean = 513 points, stdev = 98.01) but greater variability, while Form-based selection offers a steadier performance (mean = 420 points, stdev = 52.93)

EXTRACURRICULAR ACTIVITIES

Longhorn Racing Electric – *Brakes and Steering Systems Engineer* **August 2021 – May 2022**

- Designed Brakes and Steering subsystems, using Finite Element Analyses to validate performance and test requirements
- Collaborated with cross-functional teams to execute testing protocols, reducing production errors by ~10%
- Delivered a presentation during the Critical Design Review

HONORS & AWARDS

- Graduate Block Fellowship Grant recipient
- Halliburton STEM Scholarship
- Dean's Honor List (Fall 2022 – Cum laude ampla et magna, Spring 2024 – Magna cum laude)
- National Name Exchange

ADDITIONAL

Technical Skills: Python, MATLAB, R, Stata, JavaScript, MS Office Applications, SQL, CAD
Languages: English (fluent), Hindi (fluent), Marathi (fluent), French (conversational), Telugu (conversational)