Oliver A. Orejola

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Summary

Research scientist formally trained in mathematics with experience in high-dimensional probability theory, time series analysis, machine learning, and random matrix theory. Passionate about mathematics, ethical AI, building models and pioneering the new and cutting edge in all things tech.

Education

Tulane University, New Orleans, LA   **May 2024**
  Ph.D. Mathematics, Advisor: Gustavo Didier Ph.D.

University of Colorado Boulder, Boulder, CO   **May 2016**
  B.A. Physics & Mathematics, *Magna Cum Laude*, Advisor: Elizabeth Gillaspy Ph.D.

Technical Skills and Core Competencies

Statistics	Probability Theory	Time Series Analysis	Machine Learning	NLP
Python	SQL	R	Git	LaTeX
Pandas	Scikit-learn	TensorFlow/PyTorch	Numpy/Scipy	LangChain/LlamaIndex
Docker	MLOps	Web Scraping	Data Visualization	Research

Research & Professional Experience

Tulane University, New Orleans, LA

Graduate Student Researcher   **Aug. 2019 - May 2024**

- Proved asymptotic results concerning the consistency of wavelet eigenvalue analysis for self-similarity estimation in high-dimensional fractional time series data.
- Developed a novel statistical test for detection of self-similarity in a high-dimensional setting with results published in the high-impact signal processing conference EUSIPCO.
- Published foundational AI research on the formal semantics of clandestine operations in the competitive International Joint Conference on Artificial Intelligence.
- Leveraged novel tools to analyze Federal Reserve economic data and identified statistically significant cointegration among macroeconomic time series.
- Developed augmented model selection based spectral clustering method which demonstrated superior performance to classical clustering techniques (e.g. k-means and Gaussian Mixture Modeling).
- Collaborated with an international group of physicists in developing applications of signal processing methods yielding multiple conference presentations and publications.

Instructor   **Fall 2021 - Summer 2024**

- Developed and led an introductory Python course in data analysis and machine learning for graduate students.
- Instructed a class of more than 80 non-technical undergraduate audience developing their modern statistics skills.
- Assisted in the development and modernization of an introductory statistics curriculum for a $1.9 million course.

Summer Teaching Assistant   **Summer 2022**

- Managed 4 groups of 4 advanced high school students and assisted in developing their critical thinking and technical writing skills through exercises and proof writing in elementary game theory.

Teaching Assistant   **Fall 2018 - Spring 2021**

- Supported the instruction and evaluated the performance of students in a wide variety of advanced mathematics courses. Courses include applied mathematics, introduction to statistics, and mathematical statistics.

Willis Towers Watson, Denver, CO

Benefits Analyst   **Oct. 2016 - July 2018**

- Calculated and reviewed pensions via Excel for the employees of a 1.6 billion dollar corporate client.
- Improved calculation and legal document review processes for pension deployment by implementing tiered coordinated review decreasing SLA breaches by 20%.
- Utilized SQL to query the client's Oracle database of approx. 200,000 plan participants for specific groups of more than 100 individuals whose pensions require specialized calculations.

Colorado School of Mines, Golden, CO

Summer Researcher — May 2016 - Aug. 2016
- Simulated Adiabatic Quantum computation for various NP-Hard problems including the economic knapsack problem.
- Improved simulation efficiency by over 50% through the implementation of vectorization.

PhET Interactive Simulations, Boulder, CO

Quality Assurance Analyst — Oct. 2013 - Feb. 2016
- Tested educational mathematics and physics simulations which are delivered to over 1.4 billion users on more than 12 platforms for physical correctness, usability, and user accessibility.
- Developed standardized quality assurance testing practice and procedures improving testing efficiency by over 20%.
- Provided IT support for the organization by tracking operating system versions, setting up new software, and troubleshooting system errors.

University of Colorado Boulder, Boulder, CO

Undergraduate Student Researcher — May 2015 - May 2016
- Determined that Cohomologous 2-cocycles defined on a k-graph are also Homotopic with results presented and awarded the Outstanding Presentation Award at Mathfest.

Publications

"A consistent graph Laplacian-based method for the estimation of Hurst modes" with Didier, G. (in preparation) (2024)

"On the asymptotic empirical spectral distribution of wavelet random matrices based on mixed-self-similar measurements " with Didier, G., Wendt, H. and Abry, P. (in preparation) (2024)

"Essays on random matrix theory and applications" (2024) *Ph.D. Thesis: Tulane University*

"On the empirical spectral distribution of large wavelet random matrices based on mixed-Gaussian fractional measurements in moderately high dimensions" with Didier, G., Wendt, H. and Abry, P. (submitted: currently on arXiv) (2024)

"Identifying high-dimensional self-similarity based on spectral clustering applied to large wavelet random matrices" with Didier, G., Wendt, H. and Abry, P. (2024) *32nd European Signal Processing Conference (EUSIPCO)*

"Bootstrap based test for the unimodality of estimated Hurst exponents. Performance assessment in high-dimensional analysis setting" with Lucas, C.G. Didier, G., Wendt, H. and Abry, P. (2023) *29th Francophone Colloquium Signal and Image Processing (GRETSI)*

"Shhh! The Logic of Clandestine Operations" with Naumov, P. (2023) *32nd International Joint Conference on Artificial Intelligence (IJCAI)*

"Hurst multimodality detection based on large wavelet random matrices" with Didier, G., Wendt, H. and Abry, P. (2022) *30th European Signal Processing Conference (EUSIPCO)*

"Cohomologous 2-cocycles are Homotopic 2-cocycles: k-graphs and C^*-algebras" (2016) *Undergraduate Honors Thesis: University of Colorado at Boulder*

Programming Projects

"Cointegration and Causality: Statistical Analysis of Apple's Supply Chain" — *Data Science* — Fall 2023
- Implemented multiple statistical tests for cointegrated pairs.
- Tested and demonstrated Granger Causality structure witin Apple's supply chain.

"Political Wikipedia Edit trends: Indicators for important events" — *Intro Data Science* — Fall 2022
- Scraped large amounts of Wikipedia text web page data. Implemented random forests for anomaly detection on Wikipedia edit history.
- Examined temporal relationship between edit anomalies and important events.

"Neural Nets for PDE's: Parameter to Solution map" — *Deep Learning* — Spring 2022
- Built models with TensorFlow which solves partial differential equations given the equation's parameters.
- Utilized a variant of the Physics Informed Neural Network (PINNs) methodology.

"Predicting Horse Races" — *Data Analysis* — Fall 2021
- Implemented auto-regressive binomial and multinomial logistic linear models to predict horse races.

Service & Leadership

SIAM Tulane Student Chapter *Vice President* — Aug. 2020 - June 2022

Graduate Studies Student Association *Mathematics Department Representative* — Jan. 2019 - July 2022