Arun Bharadwaj Suresh

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EDUCATION

PhD in Mathematics   **Aug 2021 - Present**
University of Missouri   *Columbia, Missouri, USA*
Dual B.S. (Honors) + M.S. in Mathematics   **Aug 2016 - May 2021**
Georgia State University   *Atlanta, Georgia, USA*

SKILLS

Technical (Math/Stat): Regression analysis, (G)LMs, Tree based algorithms, Topological Data Analysis, Statistical Learning.
Programming Languages: Python, R, SQL, Julia, C++.
Presentation tools: Tableau, Power-BI, Google slides.
Organizational tools: Obsidian, Jira, Confluence, Notion.
Certificates: Data Analytics, Adv. Data Analytics (Google), Adv. Learning Algorithms (DeepLearning.ai), AWS (in Progress)

PROJECTS

Predicting passenger survival aboard the Titanic - Kaggle competition
- **Placed in the top 3.8%** of Kaggle's Titanic machine learning competition, with a champion model **accuracy of 81.34%**.
- Performed EDA and engineered nine new features from the dataset, **five** of which were **highly correlated with survival.**
- Evaluated various ML models, finally selecting a **bagged RF model** for its stability (**sd 0.06%**) across cross-validation folds.

Predicting user churn with Waze data
- Conducted EDA on Waze app data utilizing the PACE framework to uncover insights and trends pointing to user retention.
- Built regression and machine learning models to analyze and predict user churn.
- The champion **XGB-classifier** exhibited a **validation accuracy of 81%** and a **recall of 16.5%.**

Robust Subspace Recovery and Topological Data Analysis
- Employed (S)RSR to extract a prominent subspace contained in high dimensional noisy data, enabling dimension reduction.
- Implemented a topological ML pipeline leveraging *topological* features to classify shapes, achieving comparable performance to industry standard while reducing the size of the input feature matrix to **a tenth the size used in traditional models**.
- The model achieved an **out-of-bag evaluation** of **100% on synthetic data** and about **82.5% on real life data**, displaying robustness and accuracy.

Numeripy
- **Developed a Python package** that offers a comprehensive suite of numerical ODE solvers and matrix algebra tools.
- Garnered significant adoption with an average of **60 downloads per month** and over **6,035 total downloads** to date.

Nucleation of market bubbles
- **Built a model** to **detect financial market bubbles** adapting the Avrami-JMAK equations from physical nucleation theory.
- Fitted the model to the 2007 housing bubble data to identify **scale-invariant indicators** (such as the financial analogue of the critical radius r^*) indicating the formation and collapse of market bubbles with high accuracy across various industries.
- When restricted to prior bubble phases of selected stocks, the model only suffered a **percentage error of 12%**.

WORK EXPERIENCE

PhD Candidate and Graduate Teaching Assistant   **Aug 2021 - Present**
University of Missouri, MO, USA   *Columbia, Missouri, USA*
- Instructed 60+ undergraduates each semester in freshman and sophomore level mathematics, with an average teaching evaluation score of 4.85/5.
- Mentored three batches of 25 incoming graduate students at the annual teaching workshop, providing actionable insights to promote effective pedagogy

Graduate Research Assistant   **Jun 2023 - Aug 2023**
University of Missouri, MO, USA   *Columbia, Missouri, USA*
- Collaborated on two papers concerning signal recovery from phaseless measurements given that the signals satisfy a sparse or semi-algebraic (eg: output of a ReLU neural network) prior.

LEADERSHIP AND ACADEMIC ACHIEVEMENTS

- **Founder, Mentor:** *Directed Readings Program at University of Missouri* - Mizzou's undergraduate readings program
- **Founder, Coordinator:** *The Continuum group at Georgia State University*, GSU's first competitive problem solving team.
- **Awards:** Huckaba Scholarship (MU), Excellence in graduate teaching (MU), V.V. Lavroff Award for exceptional student achievements (x2, GSU), Kirkland Sattlemeyer scholarship (GSU Hons.), Campus Atlanta Scholarship (GSU).

RELEVANT PUBLICATIONS

- Tamir Bendory, Nadav Dym, Dan Edidin, **Arun Suresh**. 2024. A transversality theorem for semi-algebraic sets with application to signal recovery... *SIAM journal on mathematics of data science.* [Submitted.]
- Tamir Bendory, Nadav Dym, Dan Edidin, **Arun Suresh**. 2023. Phase retrieval with semi-algebraic and ReLU neural network priors. *SIAM journal on mathematics of data science.* [Submitted]
- Dan Edidin, **Arun Suresh**. 2023. The generic crystallographic phase retrieval problem. *Journal of Applied and Computational Harmonic Analysis.* [Submitted]