Dwaipayan Saha
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Education

- **Columbia University** — New York City, NY
  P.h.D & M.S. in Industrial Engineering and Operations Research — *Aug 2024 - Present*
  - **Coursework**: Linear & Nonlinear Optimization, Stochastic Modeling 1, Diffusion Models & Continuous Time Reinforcement Learning (A+), Combinatorial Optimization, Stochastic Modeling 2, Generative AI & Applications
  - **Awards**: Provost Diversity Fellow
- **Princeton University** — Princeton, NJ
  B.S.E. in Computer Science — *Aug 2020 – May 2024*
  - **GPA**: 3.932/4.000 | **Major GPA:** 4.000/4.000
  - **Certificates**: Applied & Computational Mathematics, Statistics & Machine Learning, Optimization & Quantitative Decision Science
  - **Graduate Coursework**: Advanced Algorithm Design (A+), Statistical Data Science, Modern Statistics, Probability Theory, Fundamentals of Deep Learning (A+), Stochastic Calculus (A+), High Dimensional Probability, Information Theory
  - **Undergraduate Coursework**: Natural Language Processing, Regression and Applied Time Series, Theoretical Machine Learning, Economics and Computation (A+), Analytic Combinatorics (A+), Network Game Theory, Programming Systems, Algorithms and Data Structures, Computer System Design, Advanced Programming Techniques
  - **Awards**: Summa Cum Laude (Highest Honors), Outstanding Student Teaching Award, Tau Beta Pi, Sigma Xi, USAMO Qualifier, Mandelbrot National Rank 33rd, 4 time AIME Qualifier

Research Experience

- **Consistent Counterfactual Estimation for Dynamic Treatments** — New York City, NY
  Advised by: Anish Agarwal — *Oct 2024 – Present*
- **Spectral State Space Models** — Princeton, NJ
  Google DeepMind Lab - Advised by: Elad Hazan — *Jan 2024 – May 2024*
- **Analysis of Prophet Inequalities for Combinatorial Auctions** – [paper] — Princeton, NJ
  Princeton Theoretical Computer Science Lab - Advised by: Matthew Weinberg — *Sep 2023 – May 2024*
- $O(1)$ **Prophet Inequality for Subadditive Combinatorial Auctions** – [paper] — Princeton, NJ
  Princeton Theoretical Computer Science Lab - Advised by: Matthew Weinberg — *Sep 2022 – May 2023*

Work Experience

- **Snap Research** — Santa Monica, CA
  Research Intern — *Jun 2024 – Sep 2024*
  - Developed compressive memory techniques and efficient approximations for full attention matrices, enabling the handling of sequences up to length 5000 for behaviorally learned user embeddings
  - Trained encoder models with custom attention modules using PyTorch DDP and Dask for scalability and designed embedding evaluation techniques
- **Goldman Sachs - Quantitative Investment Strategies** — New York City, NY
  Quantitative Research Intern — *Jun 2023 – Aug 2023*
  - Analyzed 15TB proprietary dataset efficiently using Dask and distributed computation across multiple computing clusters
  - Developed prediction models using ML and statistical analysis, conducted backtesting for portfolio optimization
- **Merovingian Data** — Mendoza, Argentina
  Machine Learning Intern — *Jun 2022 – Aug 2022*
  - Devised and integrated ML models into existing code to create analytic solutions that enhance Merovingian products
  - Developed algorithms for data collection, feature engineering, and uploading to Merovingian cloud infrastructure

- **FanZone** Boston, MA
  Software Engineering Intern *Jun 2021 – Aug 2021*
  - Engineered frontend components (CSS, React, Material UI) for web and iOS app to provide exclusive content of top athletes
  - Programmed API calls to the Firebase backend and integrated Stripe API for payment and subscription processing

Academic Final Projects

- **A Simple Framework for Intrinsic Reward-Shaping for RL using LLM Feedback** – [github] [paper]
  Advised by: Sanjeev Arora
  - Developed an LLM-based framework for generating and refining intrinsic reward functions in RL agents
  - Devised methods to incorporate reward-shaping feedback in RL algorithms, including deep Q-learning and PPO
  - Demonstrated the superiority of LLM-informed approach over traditional methods on gym-retro environments and Pokemon
- **Robustification of Natural Language Proof Generation with Verifier Guided Search** – [github] [paper]
  Advised by: Danqi Chen
  - Finetuned `T5-Small` and used `BFloat16` in training the prover and implemented diverse beam search for decoding
  - Provided alternative pseudo negative sampling techniques and performed ablations studies in training the verifier
- **Prophet Inequalities for Subadditive Combinatorial Auctions** – [arxiv]
  Advised by: Matthew Weinberg and Huacheng Yu
  - Surveyed constructive posted price mechanisms achieving state of the art $O(\log \log m)$ and $O(\log m)$ bounds
  - Presented new work on the existence of a constant factor prophet inequality
- **LeCaR Caching with Multi Armed Bandits** – [github] [paper]
  Advised by: Amit Levy
  - Developed a variant of LeCaR caching algorithm with reinforcement learning, MAB, and multiplicative weights technique

Teaching

- **Princeton University** Princeton, NJ
  Teaching Assistant *Sep 2021 – May 2024*
  - COS521: Advanced Algorithm Design - Teaching Assistant (Fall 23)
  - COS226: Algorithms and Data Structures - Grading Manager (Fall 23 - Spring 24)
  - COS445: Economics and Computation - Grader (Spring 23, Spring 24)
  - COS398: Theoretical and Empirical Analysis of Streaming Algorithms - Teaching Assistant (Spring 23)
  - COS226: Algorithms and Data Structures - Precept Assistant (Fall 21 - Spring 22)

Technical Skills

- **Languages**: Python, R, JAVA, C, Go, HTML, CSS, JavaScript
- **Web/Database Skills**: ReactJS, NodeJS, Firebase, SQLAlchemy, Flask
- **Frameworks/Libraries**: Git, TEX, NumPy, Pandas, Dask, TensorFlow, Huggingface, PyTorch, JAX

Extracurriculars

AI @ Princeton | Princeton Club Tennis (Nationals) | Princeton Math Club