

Millend Roy

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EDUCATION

Columbia University

Ph.D. in Operations Research (CGPA : 4.14/4.00)

M.Phil. in Operations Research (CGPA : 4.14/4.00)

M.S. in Operations Research (CGPA : 3.75/4.00)

Advisor : Prof. Agostino Capponi

New York, USA

Sep 2023 - May 2028

Aug 2024 - May 2027

Sep 2023 - Aug 2024

Indian Institute of Technology - IIT, Dhanbad

B.Tech in Electrical Engineering (CGPA : 9.51/10, *Institute Silver Medalist*)

Advisor : Dr. Bhukya Krishna Naik

Dhanbad, India

Jul 2017 - May 2021

WORK EXPERIENCE

BP America, Inc., *Quantitative Strategist Intern, FTR Trading in Power Markets*

Jun 2026 - Aug 2026

Scale AI, Inc., *GenAI Specialist, Human Frontier Collective Intern*

May 2025 - Aug 2025

Microsoft Research Lab India, *Societal impact through Cloud & AI Research Fellow*

Feb 2021 - Jul 2023

Hurrey Tech Ventures R&D, *Data Science*: led team to SAP ET Innovation Awards'20

Apr 2020 - Sep 2020

RESEARCH PROJECTS

FFT-Accelerated Field Integration on Trees via Backbone Decomposition.

Jan 2026 - Present

Under Supervision of Prof. Krzysztof Choromanski

- Formulated scalable tree field integration for graph-structured kernels, targeting efficient computation of distance-based vertex interactions that arise in *graph kernels*, *mesh interpolation*, and *masked Transformer attention*.
- Developed a backbone decomposition algorithm using path/spider-chain structure, anchor-depth aggregation, and one-/two-dimensional FFT-based Toeplitz and Hankel convolutions to accelerate exact tree-kernel aggregation.
- Proved $O(n \log n)$ runtime for key tree families and designed downstream evaluations including tree-based Relative Positional Encoding (RPE) masks for Vision Transformers, graph classification with learned rational f -kernels, and mesh/point-cloud interpolation benchmarks.

PREFER: Personalized Review Summarization with Online Preference Learning.

Oct 2025 - May 2026

Under Supervision of Prof. Agostino Capponi and Prof. Vineet Goyal

- Formulated *personalized review summarization* as an online learning problem to address (i) user-information overload and the limitations of (ii) one-size-fits-all product review summaries.
- Processed *583K+* reviews and *1.33M+* sentences using sentence embeddings, PCA, clustering, and soft aspect assignments to discover latent semantic aspects.
- Built PREFER, which combines latent aspect discovery, personalized evidence selection, LLM-based abstractive rewriting, and online preference updates via scalar feedback using entropic mirror descent.
- Evaluated on AMAZON REVIEWS'23 dataset across (i) cross-user, (ii) stationary, and (iii) drifting-preference settings, achieving up to 99.95% preference-evidence alignment and demonstrating decreasing surrogate regret across seeds.

CapOptix: An Options-Framework for Capacity Market Pricing Models.

Apr 2024 - Oct 2025

Graduate Research Assistant with Prof. Agostino Capponi and Prof. Vijay Modi

- Studied “*missing money*” problem in electricity markets where high-capital, low-variable-cost generators (e.g., renewables) struggle to recover fixed costs through volatile spot prices.
- Developed a regime-switching model for electricity prices and *derived option premiums* using *Monte-Carlo* simulations under multiple stochastic regimes; embedded *CVaR-based risk metrics* for decision-making under price-uncertainty.
- Conducted experiments for New York & German energy mixes (having different renewable penetration rates).
- Results show a *10-15% improvement* in cost recovery when compared with existing capacity remuneration mechanisms.

EnCortex: A framework for decision management in Energy Systems.

Jul 2021 - Jul 2023

Project: Vasudha at Microsoft Research India with Dr. Akshay Nambi, Dr. Shivkumar Kalyanaraman

- Built core easily-extensible energy *abstractions* for: *Price Arbitrage*, *Portfolio Optimization* and *Demand Bidding*.
- Paired with modular optimizers including *stochastic*, *mixed integer linear programming* and *reinforcement learning* techniques enhancing developer productivity and surpassing state-of-the-art benchmarks by 5-6%.
- MLOps* for fine-tuning RL models: *Behaviour Cloning*, *OfflineRL* and *Transfer Learning*, with efficiency gains of 3%.

RESPONSIBILITIES: TEACHING, REVIEWING, AND PRESENTATIONS

Ph.D. Enhanced Teaching Assistant at Columbia University for :

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| • Statistical Analysis and Time Series (IEOR 4709) by Prof. Agostino Capponi. | <i>Jan 2026 - May 2026</i> |
| • Algorithmic Trading (IEOR 4733) by Prof. Christopher Perez. | <i>Jan 2025 - May 2025</i> |
| • Applications Programming for Financial Engineering (IEOR 4500) by Dr. Anran Hu. | <i>Sep 2024 - Dec 2024</i> |
| • Analysis of Algorithms (CSOR 4231) by Dr. Rachel Cummings. | <i>Jan 2024 - May 2024</i> |

Reviewer: KDD'26, NeurIPS'26, IEEE Transactions on Energy Markets Policy and Regulation

INFORMS Annual Meeting'26, San Francisco, CA, USA. (Invited Speaker) *Nov 2026*

INFORMS Annual Meeting'25 PG&E Analytics Award Session, Atlanta, GA, USA. *Oct 2025*

Future Energy Summit'25, Boston, MA, USA. (Invited Speaker) *Feb 2025*

SELECTED PUBLICATIONS

Preprints/ Working Paper

* - equal contribution

3. *PREFER: Personalized Review Summarization with Online Preference Learning*. **Millend Roy**, Agostino Capponi, Vineet Goyal. Submitted, 2026.
2. *CapOptix: An Options-Approach based Framework for Capacity Market Pricing Models*. **Millend Roy**, Agostino Capponi, Vladimir Pyltsov, Yinbo Hu, Vijay Modi. Revising, 2026.
1. *EnCortex: A Scalable Framework for Decision Management in New-age Energy Systems*. **Millend Roy***, Vaibhav Balloli*, Anupam Sobti, Tanuja Ganu, Akshay Nambi. In: ArXiv 2025.

Journal

2. Machine Learning Based Adaptive Fault Diagnosis in Active Distribution Network. Sourav Kumar Sahu, **Millend Roy**, Soham Dutta, Debomita Ghosh, Dushmantha Kumar Mahanta. In: *Electric Power Systems Research EPSR'23*.
1. A Data-Driven Fault Detection Approach using Smart Meters in Modern Distribution System. Soham Dutta*, Sourav Kumar Sahu*, **Millend Roy**, Pradip Kumar Sadhu. In: *Sustainable Energy, Grids and Networks SEGN'23*.

Conference

5. AlphaSearch: Agentic AI for Price Arbitrage in Energy Systems. **Millend Roy***, Vladimir Pyltsov*. In: *32nd SIGKDD Conference 2026 on Knowledge Discovery and Data Mining, KDD'26 AI4Sciences, Jeju, Korea*.
4. Dynamic Incentive Design for Demand Response in MicroGrids. **Millend Roy**, Vladimir Pyltsov, Ruturaj Godse, Tony Dear. In: *2025 16th ACM Conference on Sustainable Energy Systems, E-ENERGY '25, Rotterdam, Netherlands*.
3. Reliable Energy Consumption Modeling for an Electric Vehicle Fleet. **Millend Roy**, Akshay Nambi, Anupam Sobti, Tanuja Ganu, Shivkumar Kalyanaraman, Shankar Akella, Jaya Subha Devi, and S A Sundaresan. In: *2022 5th ACM Conference on Computing and Sustainable Societies. COMPASS'22. Seattle, WA, USA*.
2. A Deep Learning Framework for Enhancing Maritime Coastal Security. **Millend Roy**, Abhinav Gautam, Aayush Sugandhi. *2021 2nd IEEE International Conference for Emerging Technology. INCET'21. Belgaum, Belagavi, India*
1. Renewable Energy and Demand Forecasting in a Smart Grid. Vishnu Vardhan Sai Lanka*, **Millend Roy***, Shikhar Suman, Shivam Prajapati. In: *2021 IEEE Innovations in Energy Management, IEMRE'21. Kolkata, India*.

SKILLS

Languages	Python, C++, C, Matlab, Simulink, Tableau, Docker, Git, Dataiku.
Frameworks	PyTorch, CrewAI, AgenticIBM, StableBaselines, RLlib, Rsome, Scikit-Learn, Keras, NumPy, Pandas, SciPy, Matplotlib, Seaborn, Streamlit, Gurobi, Google OR-Tools, Cvxpy.
Courses	Agentic AI, Machine Learning, Algorithmic Game Theory, Computational Reinforcement Learning, Linear, Convex and Combinatorial Optimization, Stochastic Processes, Analysis of Algorithms.

SELECT AWARDS AND HONORS

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| • Selected for JPMorganChase Quantitative Trading and Research Mentorship Program'26. | <i>May 2026</i> |
| • Winner of <i>GridTech Hackathon'26</i> , sponsored by NY Power Authority and National Grid. | <i>Apr 2026</i> |
| • Ranked 2nd in the <i>PG&E Energy Analytics Challenge</i> by IISE ESD and INFORMS QSR Sections. | <i>Jun 2025</i> |
| • Recipient of Columbia Piyasombatkul Fellowship at Columbia Engineering. | <i>Sep 2023</i> |
| • <i>ASEAN India Hackathon'21 Global Finalist</i> . | <i>Jan 2021</i> |
| • Winner of the Grand Finale of <i>Smart India Hackathon'20</i> . | <i>2020</i> |
| • <i>Samsung Innovation Awards Finalists</i> . | <i>2020</i> |
| • Recipient of Science Academies' Summer Fellowship from IASc-INSANA-NASI, India. | <i>2019</i> |