Bhargav Ganguly

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Education

Purdue University — **West Lafayette, IN, USA**
Ph.D. in Industrial Engineering and Operations Research — *Jan. 2021 - Present*

Indian Institute of Technology, Kanpur — **Kanpur, India**
B.Tech - M.Tech Dual Degree in Electrical Engineering — *July 2014 - June 2019*

Technical Skills

- **Programming Languages**: Python, C, C++, MATLAB, SQL.
- **Machine Learning Tools**: Pandas, Numpy, PyTorch, Tensorflow, Scikit-Learn, Matplotlib, CVXPY, Jupyter, Ray.
- **Development Tools**: IntelliJ, VSCode, Google Kubernetes, Docker, SQLWorkbench, Amazon Web Services.

Industry Experience

Amazon — **Bellevue, WA, USA**
Research Scientist Intern, Supply Chain Optimization Technologies — *May 2023 - Aug. 2023*

- Investigated the inventory **dual source problem** where the retailer has two inventory procurement options: a short lead time supply channel, and a long lead time supply channel.
- Developed a markov decision process formulation with appropriately engineered state, action and rewards.
- Built a **time series inventory simulator** from historical datasets of Amazon's products that can facilitate training, backtesting of a variety of single/dual source inventory procurement policies.
- Implemented a **CNN** based Deep Reinforcement Learning (Deep RL) algorithm that is equipped to adaptively place dual sourced orders for each product every week.
- Training and backtesting scaled for approximately **80k Amazon products** over 104 weeks and 52 weeks respectively.
- Compared performance of Deep RL algorithm with competitive Operations Research Inventory control algorithms via comprehensive ablation study experiments.

Amazon — **Bellevue, WA, USA**
Research Scientist Intern, Supply Chain Optimization Technologies — *June 2022 - Aug. 2022*

- Introduced a data-driven predictive modeling approach to infer vendors' **inventory behavior** from product economics data.
- The approach produces estimates of inventory **policy parameters** while leveraging vendor-product lead, lag and coincident features carefully engineered from historical data.
- Conducted thorough experimental evaluations bringing out crucial business insights on **buying strategies** for a collection of key vendor-product combinations.

JP Morgan Chase and Company — **Mumbai, India**
Quantitative Developer, Wholesale Credit Core Analytics — *July 2019 - Dec. 2020*

- Implemented **loss forecasting** and **valuation** models associated with firm's **CECL, CCAR** regulatory submissions for **Wholesale Credit Loans**.
- Developed Probability of Default (**PD**), Loss Given Default (**LGD**) models and **Basel III** Risk calculation methodologies specific to bank's Commercial Real Estate (**CRE**) Loans and Commercial Mortgage-Backed Securities (**CMBS**).
- Built a **MEVAnalytics** engine to investigate the impact of variations in critical macro-economic indices on the expected future default loss pertaining to all the different categories of Wholesale Credit Loans at both individual loan level and portfolio level.

Fuzzy Logix — **Bengaluru, India**
Data Scientist Intern, Software Engineering Team — *May 2017 - July 2017*

- Development and testing of software modules pertaining to end to end **in-database ML** systems.
- Built in-database **cross-validation** modules for a variety of supervised/unsupervised prediction models.
- Deployed python based parallelization libraries leading to end-to-end runtime improvement.

Selected Publications

1. J. Chen, **B. Ganguly**, T. Lan, and V. Aggarwal, "Variational Offline Multi-agent Skill Discovery", (under review).
2. J. Chen, **B. Ganguly**, Y. Xu, Y. Mei, T. Lan, and V. Aggarwal, "Deep Generative Models for Offline Policy Learning: Tutorial, Survey, and Perspectives on Future Directions", (under review).
3. **B. Ganguly**, Y. Xu, and V. Aggarwal, "Quantum Speedups in Regret Analysis of Infinite Horizon Average-Reward Markov Decision Processes", (under review).
4. **B. Ganguly**, and V. Aggarwal, "Online Federated Learning via Non-Stationary Detection and Adaptation amidst Concept Drift", *IEEE/ACM Transactions on Networking*, August 2023.
5. **B. Ganguly**, S. Hosseinalipour, K.T. Kim, C.G. Brinton, V. Aggarwal, D.J. Love, and M. Chiang, "Multi-Edge Server-Assisted Dynamic Federated Learning with an Optimized Floating Aggregation Point", *IEEE/ACM Transactions on Networking*, April 2023.
6. A. Koppel, A.S. Bedi, **B. Ganguly**, and V. Aggarwal, "Convergence Rates of Average-Reward Multi-agent Reinforcement Learning via Randomized Linear Programming", *IEEE Conference on Decision and Control*, Dec. 2022.
7. M. Agarwal, **B. Ganguly**, and V. Aggarwal, "Communication Efficient Parallel Reinforcement Learning", *Conference on Uncertainty in Artificial Intelligence*, July 2021.

Selected Projects

Federated Learning Amidst Dynamic Environments **Purdue University**
Ph.D. thesis, Areas: Federated Learning (FL), Distributed Systems, Online ML *May 2021 - Present*

- Introduced a **floating aggregator** based FL framework, where the aggregator server is carefully selected to achieve a trade-off between model performance, energy consumption, and delay.
- Proposed a new platform for FL, where the end devices offload a portion of their data to the edge servers through base stations.
- Experimentally demonstrated efficacy of the proposed framework through extensive ablation study against baseline models using a real-world **4G/5G** data collection testbed.
- Developed a novel federated learning architecture equipped with real-time detection and adaptation to **time-varying data** distributions at the clients. Performed proof-of-concept experiments comparing with current benchmark methods under different data drift scenarios.

Discovering skills in multi-agent task scenarios with VQ-VAEs [PrePrint] **Purdue University**
Areas: Generative AI, Deep Reinforcement Learning (Deep RL) *Spring 2024*

- Developed a Deep RL based algorithmic framework to extract coordination patterns in multi-agent task scenarios.
- Engineered novel **Vector Quantized Variational Autoencoder** (VQ-VAE) architectures to effectively capture both temporal variations in agents' behavior as well as the diversity of behaviors among different agents.
- Demonstrated efficiency of proposed approach on challenging multi-agent task environments such as **StarCraft** task against existing SOTA online Multi-agent Deep RL algorithms.

Deep Learning Based Sarcasm Detection Using Contexts [Github] **Purdue University**
Areas: Natural Language Processing (NLP), Sequence modeling *Spring 2021*

- Inspected the classification performance of *state-of-the-art* **Bi-LSTM** and **attention** based deep learning models on the task of sarcasm detection in Self-Annotated Reddit Corpus (**SARC**) dataset.
- Demonstrated the effect of incorporating additional **attention layers** against **conditional features**.
- Optimized runtime of **PyTorch** based model implementations by leveraging **CUDA** assisted GPU computation support.

Compressed Online Multi-class Kernel Bandit Learning [Slides] **IIT Kanpur**
Master's thesis, Areas: Online ML, Bandit Algorithms *May 2018-May 2019*

- Proposed a storage efficient kernel algorithm for the online multi-class classification problem in the **bandit** setting.
- The number of classification mistakes incurred is shown to be **sublinear** in number of online rounds.
- For appropriate choices of parameters, it has been shown that the proposed method concedes only **finite memory** asymptotically.

Academic Achievements

- Summer Research Grant 2024 awarded by Purdue University Graduate School.
- Passed CFA Level 1 examination conducted in February 2022 by CFA Institute.
- Awarded Computer Science minor degree with specialization in AI at IIT Kanpur in July 2019.
- Graduate Fellowship Award for academic year 2018 - 19 at IIT Kanpur.
- Academic Excellence Award 2017 at IIT Kanpur.
- KVPY Fellowship Award 2013 by the Department of Science and Technology, Government of India.