Dheeraj Baby

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Career Goals

To do ML research and use the insights to build products that are useful to people/business.

Research Focus

A Machine Learning (ML) model is usually trained on a training data set. When we deploy this model in the wild, the data distribution it sees can be different from what was encountered during the training time. This training-test distribution mismatch is a significant problem that lead to performance drop of ML systems. My research has focused on developing algorithms that can robustly improve the performance of ML models under distribution shifts.

Research Expertise

Online Learning, Optimization, Statistics, Handling distribution shifts

Knowledgeable In

NLP, LLM, Meta-Learning

Education

University of California, Santa Barbara
PhD student, Department of Computer Science *October 2018 - present*
Advisor: *Yu-Xiang Wang*

- CGPA : 4.0/4.0

Indian Institute of Technology Madras, Chennai, India *July 2011 - June 2016*
Dual Degree, Department of Electrical Engineering
Bachelor of Technology, Electrical Engineering
Master of Technology, Microelectronics & VLSI

- CGPA : 8.87/10

Awards

Best student paper award at 34th Annual Conference On Learning Theory (COLT) 2021

Outstanding publication award 2021, from department of Computer Science, University of California Santa Barbara

Top 33% reviewer award at 37th International Conference on Machine Learning (ICML) 2020

Best paper honorable mention at Time Series workshop in ICML 2019

Industry Experience

- Applied Scientist Intern, **AWS**, Artificial Intelligence and Research Education, Aug 2023 - Present
  - Developed algorithms for improving the performance of deep learning models under training to test distribution mismatch.
- Student Researcher, **Google Research** India, Machine Learning and Optimization group, Jun 2022 - Sept 2022
  - Developed algorithms for online recommendation of user preferences via low rank matrix completion.
- Applied Scientist Intern, **AWS** AI Labs Palo Alto, Time Series forecasting group, Jun 2020 - Sept 2020
  - Developed algorithms for online trend estimation in Time Series.
- Software Developer, **IBM** India, 2016-2018
  - Developed C++ based software tools for automatic synthesis of integrated circuits.

PROGRAMMING

C++, Python, PyTorch

PUBLICATIONS

Dheeraj Baby*, Saurabh Garg*, Tzu-Ching Yen*, Sivaraman Balakrishnan, Zachary Chase Lipton, Yu-Xiang Wang. "*Online Label Shift: Optimal Dynamic Regret meets Practical Algorithms*", Proceedings of 37th Conference on Neural Information Processing Systems (**NeurIPS**) 2023. (*Equal contribution, **Spotlight presentation**, top 3% of accepted papers)

Dheeraj Baby and Yu-Xiang Wang, "*Optimal Dynamic Regret in Exp-Concave Online Learning*", in Proceedings of 34th Annual Conference On Learning Theory (**COLT**) 2021. (**Best student paper award**)

Dheeraj Baby, Aniket Das, Dheeraj Nagaraj, Praneeth Netrapalli. "*Near Optimal Heteroscedastic Regression via Symbiotic Learning*", in Proceedings of 36th Annual Conference On Learning Theory (**COLT**) 2023.

Dheeraj Baby and Yu-Xiang Wang, "*Second Order Path Variationals in Non-Stationary Online Learning*", in Proceedings of 26th International Conference on Artificial Intelligence and Statistics (**AISTATS**) 2023.

Dheeraj Baby*, Jianyu Xu* and Yu-Xiang Wang, "*Non-stationary Contextual Pricing with Safety Constraints*", in Journal of Transactions of Machine Learning Research (**TMLR**) 2023 (*Equal contribution).

Dheeraj Baby and Yu-Xiang Wang, "*Optimal Dynamic Regret in LQR Control*", in Proceedings of 36th Conference on Neural Information Processing Systems (**NeurIPS**) 2022.

Dheeraj Baby and Yu-Xiang Wang, "*Optimal Dynamic Regret in Proper Online Learning with Strongly Convex Losses and Beyond*", in Proceedings of 25th International Conference on Artificial Intelligence and Statistics (**AISTATS**) 2022.

Dheeraj Baby, Xuandong Zhao and Yu-Xiang Wang, "*An Optimal Reduction of TV-Denoising to Adaptive Online Learning*", in Proceedings of 24th International Conference on Artificial Intelligence and Statistics (**AISTATS**) 2021.

Dheeraj Baby and Yu-Xiang Wang, "*Adaptive Online Estimation of Piecewise Polynomial Trends*", in Proceedings of 34th Conference on Neural Information Processing Systems (**NeurIPS**) 2020.

Dheeraj Baby and Yu-Xiang Wang, "*Online Forecasting of Total-Variation-bounded Sequences*", in Proceedings of 33rd Conference on Neural Information Processing Systems (**NeurIPS**) 2019.

PREPRINTS

Dheeraj Baby, Soumyabrata Pal. "*Online Matrix Completion: A Collaborative Approach with Hott Items*", 2023, Under review

Ruihan Wu, Siddhartha Datta, Yi Su, **Dheeraj Baby**, Yu-Xiang Wang, Kilian Q Weinberger "*Online Feature Updates Improve Online (Generalized) Label Shift Adaptation*", 2023, Under review

PATENTS

Jason R. Baumgartner, Robert L. Kanzelman, Pradeep Kumar Nalla, Raj Kumar Gajavelly, **Dheeraj Baby**, "*Initial-state and next-state value folding*", US Patent# US10621297B1

TALKS

34th Annual Conference On Learning Theory (COLT), Colorado, 2021

36th International Conference on Machine Learning (ICML), Time Series workshop, Long Beach, 2019

Learning And Mining from DatA (LAMDA) research group, Nanjing University, 2022

Summit.CS, UCSB, 2019

Statistical Machine Learning reading group, UCSB, 2019-23

Theory Colloquium, UCSB, 2022

Boson AI Inc, California, 2022

Google Research, India, 2022

Academic Experience

- TA for CS24, 2019-2020, UCSB
  - C++ course targeted for undergraduates.
  - Helped with crafting assignments and exam questions.
  - Helped with grading.
- TA for EE5332: Mapping of DSP Algorithms to Architectures, IIT Madras, 2015
  - Course targeted at graduate students.
  - Delivered lectures on High Level Logic Synthesis.
  - Helped with grading.

Academic Service

Reviewer for ICML19,20,21, AISTATS22,23, JMLR21,22,23, ICLR24

Miscellaneous

In my free time, I enjoy running, swimming and playing tennis.