Arun Verma

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RESEARCH INTERESTS

My research interest lies in designing and analyzing the practical data-driven algorithms for sequential decision-making under uncertainty, which can learn efficiently and effectively by exploiting the underlying problem structure. My research has recently focused on sequential decision making problems in multi-armed bandits, Bayesian optimization, and reinforcement learning.

EDUCATION

Indian Institute of Technology Bombay, India 2016 – 2020

Doctor of Philosophy (Ph.D.)

- Supervisors: Prof. Manjesh K Hanawal and Prof. Nandyala Hemachandra.
- Thesis: Sequential Decision Problems with Weak Feedback.
- Received Naik and Rastogi Excellence in Ph. D. Thesis Award (Best Thesis Award of IIT Bombay) and COMSNETS Best Ph.D. Thesis Award.

Shobhit University, India 2010 – 2014

Bachelor of Technology (B.Tech.) in Computer Science and Engineering

- Cumulative GPA: 9.5/10.
- Received Academic Excellence Award (Gold Medal) for having the highest CGPA.

EXPERIENCE

National University of Singapore (NUS), Singapore May 2021 – Present

Research Fellow, Department of Computer Science

- Studying sequential decision-making problems under uncertainty -in multi-armed bandits, Bayesian optimization, and reinforcement learning with applications in precision agriculture and tactic discovery in games. I am also mentoring the Ph.D. students with their research.

Indian Institute of Technology Bombay, India Jan 2021 – Apr 2021

Research Associate, Industrial Engineering and Operations Research (IEOR)

- Studied the role of auxiliary information associated with reward to get a tighter variance estimate of the mean reward estimator and exploited it to design a better algorithm for the multi-armed bandits problem.

Indian Institute of Technology Bombay, India Jan 2016 – Dec 2020

Teaching Assistant (TA)

- IE 605: Engineering Statistics: TA for Fall 2020 offering
- IE 613: Online Machine Learning: Head TA for Spring 2018, 2019, and 2020 offerings
- IE 611: Introduction to Stochastic Models: TA for Fall 2017 offering
- IE 616: Decision Analysis and Game Theory: TA for Spring 2017 offering

Non-Academic Assistance: Department System Administrator for IEOR

INRIA, Lille, France Jun 2019 – Nov 2019

Raman-Charpak Fellow, SequeL Team (now SCOOL)

- Worked on the sequential decision-making problem with time-series data. The problem is motivated by a health-related decision-making problem where a patient has to decide whether he needs to visit the physician based on his health history.

Conduent Labs India, Bengaluru, India Aug 2018 – Nov 2018

PhD Intern, Machine Learning & Statistics Group

- Designed and analyzed online algorithms for efficient resource allocation with censored data (true data is only available when certain conditions are satisfied).

Indian Institute of Science, Bengaluru, India Jul 2015 –Dec 2015

Research Assistant, Department of Computational and Data Sciences

- Worked on the Smart Campus Project. Developed a Big Data analytics platform for smart resources (water, energy) management using IoT technologies, open-source Big Data processing platforms (Spark, Storm, HBase, HDFS, Apollo), and data visualization tools (Node.js, D3).

Indian Institute of Technology Bombay, India Jul 2014 – Jun 2015

Project Research Assistant, Department of Computer Science & Engineering

- Worked on BodhiTree, an online classroom learning platform. Collaborated with students who were doing projects on BodhiTree for adding new features and enhancing the existing features.

Indian Institute of Technology Bombay, India Jan 2014 – Jun 2014

Project Research Intern, Department of Civil Engineering

- Developed an Android App for IIT Bombay campus for real-time tracking of campus buses. Proposed an algorithm to search and render the shortest path on Google Maps using stored geographical data.

PUBLICATIONS

CONFERENCE PAPERS (⋆ denotes equal contributions)

1. Arun Verma⋆, Dai Zhongxiang⋆, Bryan Kian Hsiang Low, 'Bayesian Optimization under Stochastic Delayed Feedback,' ICML 2022.
2. Arun Verma and Manjesh K Hanawal, 'Stochastic Multi-Armed Bandits with Control Variates,' NeurIPS 2021.
3. Arun Verma, Manjesh K Hanawal, Csaba Szepesvári, and Venkatesh Saligrama, 'Online Algorithm for Unsupervised Sequential Selection with Contextual Information,' NeurIPS 2020.
4. Arun Verma, Manjesh K Hanawal, and N. Hemachandra, 'Thompson Sampling for Unsupervised Sequential Selection,' ACML 2020.
5. Debamita Ghosh, Arun Verma, and Manjesh K Hanawal, 'Learning and Fairness in Energy Harvesting: A Maximin Multi-Armed Bandits Approach,' IEEE SPCOM 2020.
6. Arun Verma and Manjesh K Hanawal, 'Stochastic Network Utility Maximization with Unknown Utility: Multi-Armed Bandits Approach,' IEEE INFOCOM 2020.
7. Arun Verma, Manjesh K Hanawal, and N. Hemachandra, 'Unsupervised Online Feature Selection for Cost-Sensitive Medical Diagnosis,' NetHealth, COMSNETS 2020.
8. Arun Verma, Manjesh K Hanawal, Arun Rajkumar, and Raman Sankaran, 'Censored Semi-Bandits: A Framework for Resource Allocation with Censored Feedback,' NeurIPS 2019.
9. Arun Verma, Manjesh K Hanawal, and Rahul Vaze 'Distributed Algorithms for Efficient Learning and Coordination in Ad Hoc Networks,' WiOPT 2019.
10. Arun Verma, Manjesh K Hanawal, Csaba Szepesvári, and Venkatesh Saligrama, 'Online Algorithm for Unsupervised Sensor Selection,' AISTATS 2019.
11. Arun Verma and Manjesh K Hanawal, 'Unsupervised Cost Sensitive Predictions with Side Information,' CoDS-COMAD 2018.
12. Yogesh Simmhan, Anshu Shukla and Arun Verma, 'Benchmarking Fast Data Platforms for the Aadhaar Biometric Database,' WBDB 2015.

WORKSHOPS

1. Arun Verma, Manjesh K Hanawal, Arun Rajkumar, and Raman Sankaran, 'Censored Semi-Bandits: A Framework for Resource Allocation with Censored Feedback,' Multi Armed Bandit Workshop, Imperial College London, United Kingdom, September 25-26, 2019.
2. Arun Verma, 'Online Cost Sensitive Feature Selection in Cascaded Features Problem,' in *Asian Universities Alliance Postgraduate Academic Forum (AUAPAF), Tsinghua University, Beijing, China*, October 20-22, 2018. **Best Poster Award.**
3. Arun Verma, Yogesh Simmhan, and N. Hemachandra,'Scalable Online Analytics for IoT Applications using Big Data Platforms,' in Graduate Research Workshop, CoDS 2017.

SUBMITTED PAPERS

1. Arun Verma, Zhongxiang Dai, Shu Yao, and Kian Hsiang Low, 'Exploiting Auxiliary Feedback in Contextual Bandits.' (Under review in NeurIPS 2022)
2. Arun Verma, Vishnu Veerathu, Manjesh K Hanawal, and Arun Rajkumar, 'Stochastic Multi-Armed Bandits with Limited Auxiliary Feedback.' (Under review in NeurIPS 2022)
3. Thanh Lam, Arun Verma, Bryan Kian Hsiang Low, Patrick Jaillet, 'Risk-Sensitive Reinforcement Learning with CVaR Criterion and Function Approximation.' (Under review in NeurIPS 2022)
4. Zhongxiang Dai, Shu Yao, Arun Verma, and Kian Hsiang Low, 'Federated Neural Bandit.' (Under review in NeurIPS 2022)
5. Srijith Balakrishnan, Beatrice Cassottana, and Arun Verma, 'Application of Clustering Algorithms for Dimensionality Reduction in Infrastructure Resilience Prediction Models.' (Under review in Reliability Engineering and System Safety)
6. Srijith Balakrishnan, Beatrice Cassottana, and Arun Verma, 'A Network Clustering Approach for Dimensionality Reduction in Machine Learning Models for Infrastructure Resilience Analysis.' (Under review in ESREL 2022)
7. Arun Verma, Manjesh K Hanawal, Arun Rajkumar, and Raman Sankaran, 'Censored Semi-Bandits for Resource Allocation.' (Under review in Mathematics of Operation Research).

TALKS

- Invited talk on 'Sequential Decision Problems with Weak Feedback,' as part of the Multi-Armed Bandits (CS6046) course at IIT Madras on May 4, 2021.
- RIKEN seminar on 'Sequential Decision Problems with Weak Feedback,' at RIKEN AIP, Japan on November 27, 2020.
- Sequel seminar on 'Censored Semi- Bandits' at INRIA Lille, France on November 24, 2019.
- Talk on 'Online Algorithm for Cost-Sensitive Unsupervised Learning,' at RIKEN AIP, Japan during my visit to Approximate Bayesian Inference (ABI) Team from April 9-16, 2019.
- Lighting talk on 'Unsupervised Cost Sensitive Predictions with Contextual Information' at IEOR Day 2018, IIT Bombay on March 17, 2018.

ACADEMIC SERVICES

- Reviewer: NeurIPS 2020-2022, ICLR 2021-2022, ICML 2021-2022, AAAI 2021-2022, IJCAI 2021-2022, TMLR 2022.
- Volunteer: NeurIPS 2020, AISTATS 2021, ICLR 2021, ICML 2021, NeurIPS 2021.

AWARDS

- Awarded Microsoft Travel Grant and COMSNETS Association and LRN Foundation Travel Award for attending IEEE INFOCOM 2020.
- Travel Award from LinkedIn for attending FATE-ML workshop 2020 at IISc, Bengaluru, India.
- Awarded Google Travel Grant and NeurIPS Student Travel Award for attending NeurIPS 2019.
- Awarded Raman-Charpak Fellowship 2018 for visiting SequeL Team, INRIA Lille, France.
- Awarded ACM-India/IARCS and Microsoft Travel Grant for attending AISTATS 2019.
- Awarded Technical Color of Hostel-14, IIT Bombay for year 2017-18 and 2018-19.
- Awarded Sports Color (Cricket) of Hostel-14, IIT Bombay for year 2017-18.
- Conference Travel Awards from HiPC 2016, CoDS 2017, CoDS-COMAD 2018, AUAPAF 2018.
- IITB Research Internship Award 2013-14 from Indian Institute of Technology Bombay.

EXTRA-CURRICULAR ACTIVITIES

- Captain of winning team of *Cricmania, The Institute Cricket League* 2018 and 2020 at IIT Bombay.
- Election Officer in Hostel 14 Election 2018-19 Phase 1 and Phase 2 at IIT Bombay.
- Represented India in *The Asian Youth Roundtable Conference*, October 22, 2018, where students from more than 40 countries participated to exchange their view on the future development of AI.
- Member of Hostel 14 Council 2016-17 and 2017-18 as System Administrator at IIT Bombay.
- Represented of IIT Bombay Cricket team in 52nd Inter-IIT sport meet 2017 (Overall Champions) and Aavahan-2018 (Gold Medal).
- Lead Coordinator of Microsoft AppFest–2013 held at Shobhit University.