Charupriya Sharma

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About Me

I am a PhD student in Machine Learning with a masters in optimization and top-tier publications (AAAI). I combine expertise in

1) **ML and Statistics**: Bayesian Methods, Causal Inference, Deep Learning,

2) **Optimization**: Linear, Integer, Combinatorial Optimization, Algorithm Design

3) **Implementation**: Python, R, Bash, C/C++, Java, . . . to solve problems.

I am looking for opportunities to learn, challenge myself and have real-world impact.

Education

PhD in Computer Science 2021
Artificial Intelligence
University of Waterloo, Canada

Masters of Mathematics 2017
Combinatorics and Optimization
University of Waterloo, Canada

Bachelor of Technology 2015
Computer Science and Engineering
IIIT-Delhi, India

Skills

Languages: Python, R, Bash, C/C++, Java, OpenGL, MATLAB

Machine Learning: Tensorflow, PyTorch, Keras, XGBoost, Scikit-Learn

Optimization: CPLEX, Coin-OR, Boost

Databases: Gremlin, Terrier, Neo4j

Other: CUDA, Unix, D3.js, Verilog

Course Work

Machine Learning: Deep Learning, Statistical Computing, Information Retrieval, Artificial Intelligence, Information Theory

Optimization: Combinatorial Optimization, Randomized Algorithms, Graph Theory

Databases: Information Retrival

Graphics: GPU Computing, Splines

Selected Research Projects

09.18–now **Structured Representations of Conditional Probability Distributions**
Developed an algorithm (Python, Java) for learning Bayesian networks with Noisy-OR and logistic regression with performance guarantees for model averaging (90%+) and Bayesian inference (∼ 99%). We learn latent variables and can handle Gaussian and discrete data.

05.20–now **Simplex Optimization with Deep Reinforcement Learning**
Developed a deep reinforcement learning algorithm (Python) for learning custom pivots for the simplex algorithm to speed up linear programming solvers.

01.20–now **Bayesian Model Averaging Toolkit**
Developed a tool for querying, analysis and inference on an ensemble of Bayesian network with close to optimal score, learned with BIC, BDeu, Noisy-OR and logistic and spline regression for non-specialist use.

10.18–12.18 **Theorem Proving with Deep Reinforcement Learning**
Developed a deep reinforcement learning algorithm (Python) for automatic theorem using Monte Carlo tree search and LSTM.

09.17–08.18 **Finding All Bayesian Network Structures within a Factor of Optimal**
Designed an algorithm (C++) to find all high scoring Bayesian networks to address uncertainty in data using model averaging. Solved benchmarks 2X larger than state of the art.

03.18–04.18 **Multi-Dimensional Truncated Hierarchical B-Splines**
Rendered surfaces using truncated-hierarchical B-splines (C++,R) to handle local refinement in B-spline multi-dimensional surfaces

09.15–08.17 **Technology Diffusion on Weighted Graphs**
Designed polynomial time algorithms and polyhedral characterizations (CPLEX) for weighted cycles and spider graphs in the non-submodular seed minimization and influence maximization case.

03.15-04.15 **Voronoi Diagrams on the GPU**
Adapted jump flooding algorithm (CUDA) for streaming to improve computation of generalized 3D Voronoi Diagrams on GPU. Achieved ∼8X speedup for kernel time and memory transer.

Open Source

05.20–now **CyLP**
Provided documentation for functions and error codes to interact with simplex solver methods in Coin-OR using Python.

10.19–12.19 **JavaBayes 8**
Modified JavaBayes from Java 1.1 to Java 8. Provided scripts for fast Bayesian inference batch queries.

04.18–09.19 **GOBNILP**
Relaxed pruning rules and provided methods to enumerate all high scoring Bayesian networks. Available in both Python and C++.

Publications

A Score-and-Search Approach to Learning Bayesian Networks with Noisy-OR
with Z. A. Liao, J. Cussens and P. van Beek.
(Proceedings of Probabilistic Graphical Models, 2020)

Learning All Credible Bayesian Network Structures for Model Averaging.
with Z. A. Liao, J. Cussens and P. van Beek. *(Under Review)*

Learning Bayesian Networks using Spline Regression
with J. Cussens and P. van Beek. *(Under Review)*

Finding All Bayesian Network Structures within a Factor of Optimal.
with Z. A. Liao, J. Cussens and P. van Beek.
(Proceedings of the AAAI Conference on Artificial Intelligence. Vol. 33. 2019.)

Learning to search more efficiently from experience: A multi-heuristic approach.
with S. Aine and M. Likhachev. *(Symposium on Combinatorial Search*, 2015.)