

Shishir Sharma

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Education

M.Sc. Computer Science **Sep 2018 – Dec 2020**
McGill University

Supervisor: Doina Precup

Related Coursework:

- Machine Learning
- Probabilistic Graphical Models
- Matrix and Tensor Factorizations in Machine Learning
- Reinforcement Learning
- Graph Representation Learning

B.E. Instrumentation and Control Engineering **Jun 2011 – Jun 2015**
Netaji Subhas Institute of Technology, Delhi University

Related Coursework:

- Control Systems I
- Artificial Intelligence
- Control Systems II
- Digital Signal Processing

Experience

○ Graduate Research Assistant **Sep 2019 – Dec 2020**
Mila

Thesis: Investigated model based RL strategies to efficiently perform planning in stochastic environments. These included modeling 2-step state transitions as well as employing a Gaussian distribution model with a 2nd order polynomial value function

○ Graduate Teaching Assistant **Sep 2019 – Apr 2020**
McGill

- Worked as a Teaching Assistant for the courses COMP 251: Data Structures and Algorithms and COMP 321: Programming Challenges
- Prepared quizzes, held weekly office hours and organized competitive programming contests

○ Graduate Teaching Assistant **Jan 2019 – Apr 2019**
McGill

- Worked as a Teaching Assistant for the course COMP 250: Introduction to Computer Science
- Prepared quizzes, mid-terms and held weekly office hours

○ Research Associate **May 2016 – Jun 2018**
IIT Delhi

- Worked as a Research Associate under the guidance of Dr. A. V. Subramanyam, with the field of research spanning across multimedia forensics and computer vision
- Devised a novel algorithm for tackling various forensic detectors and presented findings in the paper titled *Anti-forensic technique for median filtering using L1-L2 TV model* in IEEE International Workshop on Information Forensics and Security (WIFS), 2016 and an extension titled *Anti-forensics of median filtering and contrast enhancement* in Elsevier Journal of Visual Communication and Image Representation

○ Business Analyst **Aug 2015 – May 2016**
EXL Services

- Analyzed validity of different financial models as part of the credit card portfolio for one of the top 5 UK based banks
- Computed key risk indicators including Gini coefficient and Population Stability Index (PSI) for monitoring the employability of underwriting and impairment models and refitted the models in cases of subpar performance caused by the shift in the target population

Projects

Thesis: Planning Using Variance In Model Based RL (Ongoing)

For stochastic environments, planning performed using expectation models ignores the variance, while it is only incorporated using Monte Carlo approximation for sample models. A more robust modeling is performed using distribution models which explicitly model variance, but planning using them requires calculating the integral for expected next state value, which is often intractable. To perform efficient planning, we propose a Gaussian distribution model along with a polynomial value function, allowing for a Bellman update that is linear in the moments of the model. We also propose a 2-step Bellman update, exploring the direct effect of variance on the value of the states.

Relational Model Based Reinforcement Learning (Ongoing)

In this project, we build upon the work of Zambaldi et al. (2018) and investigate marrying relational reinforcement learning and model-based reinforcement learning. Specifically, we propose learning a model which employs Relational Networks to learn the relations between visual entities as well as predicts the change in these relations over time. Having access to the knowledge about the environment in a relational language enhances the generalization capacity of traditional RL algorithms, while performing model-based planning leads to a high sample efficiency.

Bayesian Uncertainty Driven Exploration

The project involved investigating posterior sampling using Bayesian Networks for driving exploration in complex environments. Posterior sampling allows the agent to perform deep exploration of the environment by sampling different Q-value function for each episode. The requirement for such a strategy is to maintain a distribution over Q-value functions. The exploration in this strategy is driven by the variance of the posterior distribution that is sampled from each episode. The Bayes-By-Backprop algorithm (Blundell et al. (2015)) is employed to maintain a Bayesian Network that acts as the distribution over Q-value functions and is efficiently updated using Backpropagation algorithm. Code available [here](#).

Reproducibility Challenge: Goal Oriented Reinforcement Learning

As part of the ICLR 2019 Reproducibility challenge, implemented the code for paper submission [Q-map: a Convolutional Approach for Goal-Oriented Reinforcement Learning](#) in Pytorch framework. The authors proposed a goal-oriented agent called Q-map that utilized an Autoencoder-like Neural Network to predict the minimum number of steps towards each goal (spatial coordinates) in a single forward pass, allowing the agent to discover correlations between visual patterns and navigation. While reproducing the agents Neural Network models was straightforward, the paper also proposed a novel exploration mechanism relying on goal selection strategies which was especially challenging to reproduce. Code available [here](#)

Publications

- [Anti-forensic technique for median filtering using L1-L2 TV model](#), IEEE International Workshop on Information Forensics and Security (WIFS), 2016 conference.
- [Anti-forensics of median filtering and contrast enhancement](#), Elsevier Journal of Visual Communication and Image Representation.

Technical and Personal Skills

- **Programming Languages:** Proficient in: C, C++, Python, Java
- **Framework/Software:** Pytorch, MATLAB
- **Certifications/Professional Memberships/Exams:**
 - Awarded the first prize for poster presentation titled *Anti-forensic technique for median filtering using L1-L2 TV model* in Research Showcase 2017, IIITD
 - Secured All India Rank of 7,080 in IIT JEE out of over 400,000 candidates
 - Oracle Certified Professional Java SE programmer
- Avid Chess player (Online Blitz Rating: 2000)