Kushagra Chandak

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Research Interests

• Reinforcement Learning, Sequential Decision Making, Computational Cognitive Science/Neuroscience, Probabilistic Graphical Models, Machine Learning.

EDUCATION

International Institute of Information Technology (IIIT-H)

Hyderabad, India

Bachelors in Computer Science & MS in Computational Natural Sciences (Integrated) Aug, 2014 - Jul, 2020

- Thesis: Prospects of searches for leptoquarks decaying into top quarks and muons at the LHC. (<u>Link</u>) Advisor: Dr. Subhadip Mitra.
- Awards: Deans and Merit List awards for Spring-15, Fall-15, Spring-16, Fall-16 and Fall-17 semesters.

Preprints and Publications

- Combining Propositional Logic Based Decision Diagrams with Decision Making in Urban Systems. *Jiajing Ling**, *Kushagra Chandak**, *Akshat Kumar* (*equal contribution), Preprint: Under Review, <u>Link</u>
- Hunting for scalar leptoquarks with boosted tops in pair and single production channels. *Kushagra Chandak*, *Tanumoy Mandal*, *Subhadip Mitra*, Phys. Rev. D 100, 075019, <u>Link</u>

WORK EXPERIENCE

School of Information Systems, Singapore Management University

Singapore

Research Engineer. Supervisor: Prof. Akshat Kumar

June, 2019 - Current

- Working on Reinforcement Learning (RL) and multi-agent sequential decision making.
- Combined ideas from propositional logic and probabilistic graphical models with RL to develop a generalized framework that can handle domain/human constraints for routing, path finding etc.
- Tested the above framework and found that it improves sample complexity and solution quality on multi-agent RL and pathfinding domains.
- Developed and tested a simulator for maritime traffic data for resource-constrained scheduling.

Okinawa Institute of Science and Technology

Okinawa, Japan

Research Intern. Supervisor: Prof. Kenji Doya

Jul, 2018 - Aug, 2018

- Studied and implemented the existing state of the art deep reinforcement algorithms like soft actor-critic (SAC) and deep deterministic policy gradients (DDPG). Evaluated and compared them against conservative value iteration (CVI), a new deep RL algorithm, on continuous control tasks and found that CVI performs better in terms of sample efficiency.
- Investigated the parameters of DDPG and found out that they have no significant impact on the performance or the solution quality on simple continuous control tasks.
- Studied the connection between CVI and other deep RL algorithms and the underlying mathematics. Learned how they all fit into the generalized maximum entropy framework.
- Explored how reinforcement learning can be applied to study brain functions and how brain computation can be viewed as a hierarchical abstraction.

Weizmann Institute Of Science

Rehovot, Israel

Summer Intern. Supervisors: Prof. Alexander Milov and Dr. Petr Balek

Jun, 2017 - Jul, 2017

• Performed first statistical data analysis and evaluated charged particle spectra for proton-lead collision data recorded with the ATLAS detector at the Large Hadron Collider, CERN. The data is used to study the hottest state of matter called quark-gluon plasma. Combined all the collisions recorded (10 orders of magnitude measurement) to produce a smooth unbiased spectrum.

Center for Computational Natural Sciences and Bioinformatics, IIIT-H Hyderabad, India Research Assistant Aug, 2018 - Apr., 2019

- Worked on computational search strategies for discovering new kind of sub-atomic particles called *leptoquarks* at the Large Hadron Collider (LHC).
- Applied clustering algorithms on data generated using Monte Carlo simulations to detect leptoquarks at a very high energy and collision rate. Discovered that a process, which was neglected in earlier studies, is actually important in the production of these new particles.
- Our suggested strategy enhanced the discovery potential of these particles at 5σ significance at the LHC, and resulted in a publication.

IIIT Hyderabad, India

Teaching Assistant: Conducted tutorials and graded exams

Aug, 2016 - Apr, 2019

- Linear Algebra and Group Theory (Jan, 2017 Apr, 2017 & Jan, 2018 Apr, 2018): Course name: Math II. Led a team of 8 TAs in a class of about 200 students.
- Probability, Statistics and Analysis (Aug, 2016 Nov, 2016): Course name: Math III.
- Quantum Physics (Aug, 2017 Nov, 2017): Course name: Quantum Mechanics, Symmetry and Spectroscopy.

SELECT ACADEMIC PROJECTS

Multi-Objective Bandits: Optimizing the Generalized Gini Index (Link) Aug. 2017 - Nov. 2017

- Studied multi-objective optimization in the multi-armed banded setting using the Generalized Gini Index function.
- Applied online gradient descent and linear programming methods for optimization. Modeled a practical problem of job finding under the multi-objective bandit setting. Code: <u>Link</u>

The Automated Travel Agent: Hotel Recommendations Using ML (Link) Aug, 2016 - Nov, 2016

• Applied and compared supervised algorithms like Bayes' classification, support vector machines and softmax regression to recommend hotels to users, after applying principal component analysis on a large dataset of 37 million instances and 23 features.

Relevant Courses

• Statistical Methods in AI (ML), Topics in ML (Theoretical ML and RL), Math II (Linear Algebra and Group Theory), Math III (Probability, Statistics and Analysis), Math I (Discrete Math).

SKILLS

- Programming languages: Python, C, C++, MATLAB
- ML and Data Analysis: PyTorch, TensorFlow, Keras
- Miscellaneous: Git, SQL
- Languages: English (Proficient), Hindi (Native), Hebrew (Basic), Spanish (Basic), Rajasthani (Basic)