Kushagra Chandak

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RESEARCH INTERESTS

- Sequential Decision Making, Reinforcement Learning, Knowledge Representation, Probabilistic Graphical Models, Computational Neuroscience/Cognitive Science, Machine Learning, Deep Learning.

EDUCATION

International Institute of Information Technology (IIIT-H)   Hyderabad, India
Bachelors in Computer Science & MS in Computational Natural Sciences (Integrated) Aug, 2014 - May, 2019

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

PUBLICATIONS

- Integrating Knowledge Compilation with Reinforcement Learning for Routes.
  Jiajing Ling*, **Kushagra Chandak*,** *Akshat Kumar* (* equal contribution), 31st International Conference on Automated Planning and Scheduling (ICAPS 2021)

- Combining Propositional Logic Based Decision Diagrams with Decision Making in Urban Systems.
  Jiajing Ling*, **Kushagra Chandak*,** *Akshat Kumar* (*equal contribution), AI for Urban Mobility Workshop, AAAI Conference on Artificial Intelligence, 2021 Arxiv Link

- Hunting for scalar leptoquarks with boosted tops in pair and single production channels.
  Kushagra Chandak, *Tanumoy Mandal, Subhadip Mitra,* Phys. Rev. D 100, 075019, Link

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, knowledge representation and probabilistic graphical models with RL to develop a framework that can handle domain/human constraints for RL.
- Tested the above framework and found that it improves sample complexity and solution quality on multi-agent RL problems.
- 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.
- Evaluated how CVI fits into the maximum entropy RL framework and generalizes other entropy-based RL algorithms.

- 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.
- 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 - Dec, 2018*

- Worked on computational search strategies to discover new kinds 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.
- Our suggested strategy enhanced the discovery potential of these particles at 5σ significance at the LHC, and resulted in a publication.

IIIT Hyderabad — Hyderabad, India
Teaching Assistant: Conducted tutorials and graded exams — *Aug, 2016 - May, 2019*

- Linear Algebra and Group Theory (Spring-17, Spring-18, Spring-19):
  Course name: Math II/Linear Algebra. Led a team of 8 TAs in a class of about 200 students.
- Probability, Statistics and Analysis (Fall-16): Course name: Math III.
- Quantum Physics (Fall-17): 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 which guarantees both efficiency and fairness. Modeled a practical problem of job finding which optimizes multiple objectives like salary, other benefits, job location, workplace culture etc.
- Applied online gradient descent and linear programming methods for optimization. Code: Link

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 with 23 features.

SKILLS

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