

# Kushagra Chandak

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## RESEARCH INTERESTS

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

## EDUCATION

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**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

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- 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 [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

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**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 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

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

Rehovot, Israel

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

Research Assistant

Hyderabad, India

Aug, 2018 - Dec, 2018

- 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.
- Our suggested strategy enhanced the discovery potential of these particles at  $5\sigma$  significance at the LHC, and resulted in a publication.

## IIIT Hyderabad

Teaching Assistant: Conducted tutorials and graded exams

Hyderabad, India

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

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### 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

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- **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)