

Kulin Shah

Research Fellow, Microsoft Research India

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EDUCATION

International Institute of Information Technology, Hyderabad

B. Tech (Honours) in Computer Science and Engineering

August 2015 - July 2019

GPA: 9.01/10

PUBLICATIONS

1. **DEAN: Deep Explainable Abstain Network**
Bhavya Kalra, **Kulin Shah**, Naresh Manwani
Submitted to Conference on Computer Vision and Pattern Recognition (**CVPR**), 2021.
2. **Rawlsian Fair Adaptation of Deep Learning Classifiers** [\[pdf\]](#)
Chiranjib Bhattacharyya*, Amit Deshpande*, Pooja Gupta*, **Kulin Shah*** (* - alphabetical order)
Submitted to International Conference on Artificial Intelligence and Statistics (**AISTATS**), 2021.
3. **Learning and Generalization in Univariate Overparameterized Normalizing Flows** [\[pdf\]](#)
Kulin Shah, Amit Deshpande, Navin Goyal
Submitted to International Conference on Learning Representations (**ICLR**), 2021.
4. **Online Active Learning for Reject Option Classifier** [\[pdf\]](#)
Kulin Shah, Naresh Manwani
AAAI Conference on Artificial Intelligence (**AAAI**), 2020 (**Oral**).
5. **Sparse Reject Option Classifier using Successive Linear Programming** [\[pdf\]](#)
Kulin Shah, Naresh Manwani
AAAI Conference on Artificial Intelligence (**AAAI**), 2019 (**Oral**) .
6. **PLUME: Polyhedral Learning Using Mixture of Experts** [\[pdf\]](#)
Kulin Shah, PS Sastry, Naresh Manwani
7. **Ingredients for Happiness: Modeling Constructs via Semi-supervised Content Driven Inductive Transfer** [\[pdf\]](#)
Bakhtiyar Syed, V. Indurthi, **Kulin Shah**, Manish Gupta and Vasudeva Varma
AAAI-19 Workshop on Affective Content Analysis, AFFCON-19 (**Runner-up** for CL-Aff shared task).

RESEARCH EXPERIENCE

Research Fellow, Microsoft Research, India

Aug 2019 - Current

- Mentor: [Dr. Navin Goyal](#) and [Dr. Amit Deshpande](#)
- Working on problems in generative models, representation learning, theory of deep learning.

Research Intern, Microsoft Research, India

May 2019 - July 2019

- Mentor: [Dr. Amit Deshpande](#) and [Prof. Chiranjib Bhattacharyya](#)
- Worked on problems related to fairness in machine learning.

Research Intern, Indian Institute of Science (IISc), Bangalore

May 2018 - June 2018

- Mentor: [Prof. PS Sastry](#)
- Worked towards understanding architecture and training dynamics of Capsule Network.

Undergraduate Researcher, Machine Learning Lab, IIIT Hyderabad

May 2017 - May 2019

- Mentor: [Dr. Naresh Manwani](#)
- Worked on research problems related to reject option classification, online learning, multi-armed bandit, polyhedral learning, explainability.

SELECTED RESEARCH PROJECTS

- **Learning and Generalization in Univariate Overparameterized Normalizing Flows**
Advisors: [Dr. Navin Goyal](#) and [Dr. Amit Deshpande](#), Microsoft Research India Sep 2019-Present
 - ◊ Normalizing Flow (NF) is a type of generative model. We provided training and generalization proof for univariate Normalizing Flow, modelled using an overparameterized neural network.
 - ◊ We showed that a class of univariate NFs can learn any reasonable data distributions and provided evidence that overparameterization can hurt training for another class of NFs (Submitted in **ICLR**, 2021).
- **Online Active Learning for Reject Option Classifier**
Advisor: [Dr. Naresh Manwani](#), IIIT Hyderabad June 2018 - July 2019
 - ◊ Reject Option Classifier (ROC) is a classifier with a rejection, i.e., option of not to classify in one of the class, Usecases: High misclassification cost settings. We proposed two active learning algorithms for ROC.
 - ◊ Provided mistake bound for an algorithm and convergence guarantee for another algorithm. Performed extensive experiments to show the effectiveness of the algorithms (**Oral** presentation at **AAAI**, 2020).
- **Sparse Reject Option Classifier using Successive Linear Programming**
Advisor: [Dr. Naresh Manwani](#), IIIT Hyderabad July 2017 - July 2019
 - ◊ Proposed an algorithm for learning ROC. Analyzed properties of loss function (classification calibration and excess risk bound) and proposed approach (generalization error bounds).
 - ◊ Demonstrated benefits of the proposed approach on several datasets. Showed sparseness of the learned classifier and robustness of the approach against label noise (**Oral** presentation at **AAAI**, 2019).
- **Rawlsian Fair Adaptation of Deep Learning Classifiers** May 2019 - Present
Advisors: [Dr. Amit Deshpande](#), Microsoft Research India and [Prof. Chiranjib Bhattacharyya](#), IISc Bangalore
 - ◊ Using philosopher Rawls' principles of justice, we proposed an objective to obtain an optimal fair classifier. To optimize the objective, underlying data distribution is required.
 - ◊ Proposed an efficient fair adaptation method, which optimizes an approximation of the objective. Showed importance of Rawlsian principles and effectiveness of adaptation technique through several experiments (Submitted in **AISTATS**, 2021).

AWARDS AND ACHIEVEMENTS

- Awarded **Google, Microsoft Research** travel grant and **AAAI Student Scholarship** to attend **AAAI** 2019.
- Awarded **Research Award** for exceptional research work at IIIT Hyderabad.
- Received perfect **10 GPA** in Spring 2018 semester.
- Awarded **Dean's List** award for excellent academic performance in Spring 2016, Spring 2017 and Spring 2018 semesters.
- **34 rank** in India in online round of ACM ICPC, 2018 (Total 3000+ teams) and **53 rank** in Amritapuri regional of ACM ICPC, 2017 (Total top 260 teams from India).
- Maximum Codechef rating: **2076 (5 star)**. *Handle:* [kulin](#). Maximum Codeforces rating: **1665 (Expert)**.
Handle: [kulinShah](#)

POSITIONS

- **Subreviewer** of [IJCAI 2019](#), [IJCNN 2019](#), [ACM IKDD CoDS-COMAD 2019](#) conference.
- **Teaching Assistant** for Statistical Methods in AI (Spring'18), Linear Algebra (Spring'19) and Algorithms (Monsoon'17). Designed & graded assignments, evaluated exams, conducted tutorials and mentored projects.

SELECTED RESEARCH/COURSE PROJECTS

- **Consistent Bellman Operator**
Studied inconsistency problem in traditional Bellman operator and new optimality-preserving consistent Bellman operator. Implemented new Bellman operator in Deep Q-Network in PyTorch. Compared its performance with traditional Bellman operator on Atari-2600 games.

- **Multiclass classification in partial feedback setting**

Surveyed various algorithms using Multi-Armed Bandit to learn multiclass classification model in partial feedback setting i.e. the feedback is prediction made by the algorithm was correct or not. Understood properties (e.g. mistake bounds) of the algorithms.

- **Understanding Capsule Network**

Studied some papers in [Capsule Network](#). Implemented the Capsule Network and checked the performance in several dataset. Conducted an experimental study to understand importance of various parts of Capsule Network and compared its performance with traditional CNNs.

- **AI Bot for Ultimate Tic-Tac-Toe**

Developed an agent for ultimate tic-tac-toe game using Monte-Carlo Tree Search (MCTS) and Upper Confidential Bound (UCB) algorithms. Implemented the algorithm in python and compared its performance with other search algorithms.

- **Universal Style Transfer**

Surveyed recent style transfer techniques and implemented universal style transfer in content image from style image via feature transforms using Coloring Transform, Whitening Transform and encoder-decoder. Evaluated the performance of the architecture on real-life content and style images.

- **Learning Relative Attributes of an Image**

Surveyed algorithms to learn visual attributes of an image and implemented a ranking algorithm to learn relative visual attributes of an image. Evaluated performance of the algorithm on PubFig dataset.

RELEVANT COURSES

Artificial Intelligence
Optimization Methods

Probability & Complex numbers

Digital Signal Analysis and Applications

Statistical Methods in AI

Introduction to Game Theory

Functional Analysis

Computer Vision

Topics in Machine Learning

Linear & Abstract Algebra

Discrete Mathematics

Graphics