

# Abhay Singh

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## Education

### Cornell University

Aug 2018 - May 2021

Bachelor of Science, Computer Science  
Overall GPA: 4.14/4.30, Dean's List – All Semesters

#### *Selected Coursework*

Computer Vision (Graduate), Machine Learning, Probability (Graduate), Numerical Methods (Graduate), Statistical Distances (Graduate), Algorithms, Compilers, Analysis (Honors), Linear Algebra

## Publications

### *Preprint*

Q. Huang, H. He, **A. Singh**, SN. Lim, and A. Benson. "Combining Label Propagation and Simple Models Outperforms Graph Neural Networks" arXiv:2010.13993 (2020).

### *Conference*

Q. Huang, H. He, **A. Singh**, Y. Zhang, SN. Lim, and A. Benson. "Better Set Representations For Relational Reasoning" *Conference on Neural Information Processing Systems (NeurIPS)* 2020.

## Research Experience

### *Undergraduate Researcher, Cornell University*

Oct 2019 – Present

- Researching with Professor Austin Benson on developing methods to efficiently and effectively handle structured representations of data, such as sets and graphs.
- Proposed a simple and general network module that generates set embeddings in a way that respects permutational invariance, obtaining substantial gains in prediction performance and robustness on a wide variety of relational reasoning tasks.
- Proposed a simple framework that outperforms state-of-the-art graph neural networks using a shallow MLP prediction followed by two label propagation variants, with orders of magnitude less parameters and runtime.
- Published paper in NeurIPS 2020. Have one paper currently under review.

## Work Experience

Incoming Intern, Citadel  
New York, NY

May 2021 - Aug 2021

Intern, Yext  
New York, NY

May 2020 - Aug 2020

- Worked on vulnerable code detection at the compilation phase through static code analysis.
- Wrote performant multi-threaded data pipeline in Golang to fetch API log data via AWS S3.

Intern, Morgan Stanley  
New York, NY

May 2019 - August 2019

- Architected parallelizable data pipeline to process over 800,000,000 entries of financial data daily with NumPy and Pandas.
- Reduced mainframe consumption by 90%, saving tens of millions of dollars in annual costs.

## Teaching Experience

**CS 4780: Introduction to Machine Learning**  
Head Teaching Assistant, Cornell University

Aug 2020 - Present

**CS 4820: Introduction to Analysis of Algorithms**  
Teaching Assistant, Cornell University

Aug 2019 - Dec 2019

## Honors and Awards

Valedictorian, Pathways School Gurgaon

2018

Academic Merit Scholarship, Pathways School Gurgaon

2017, 2018

## Projects

*Few-Shot Clustering Instance Segmentation Network*

Aug 2019 - Dec 2019

Designed novel neural network architecture to perform proposal-free few-shot instance segmentation, showcasing results in graduate-level course, CS 6670: Computer Vision. Validated approach on PASCAL-5i dataset, showing comparable performance to few-shot Mask R-CNN inspired methods with significant speedups at inference time.

*Continual Learning with Lottery Tickets*

Aug 2019 - Dec 2019

Proposed and demonstrated effectiveness of novel training scheme to resist catastrophic forgetting, a phenomena in which a model overfits to the most recently seen data in a multi-task learning setting.

*Xi Compiler*

Jan 2020 - May 2020

Wrote optimized compiler in Scala for language Xi, in team of 4; approximately 10,000 lines of code. Includes lexing, parsing, type-checking, intermediate code generation, various optimizations including dataflow analysis, and emitting assembly instructions with non-trivial register allocation.

## Activities

*Cornell Unmanned Air Systems (CUAir) | Computer Vision Lead* *Sept 2018 – Present*

Designed and implemented custom object detection and classification model (Mask R-CNN variant with multi-head output) in multi-task learning setting on collected aerial imagery dataset, in PyTorch. Lead all computer vision tasks on team, with individual efforts directly increasing classification task accuracy by 32% and object detection mAP IoU by over 80%.

Last updated: December 30, 2020