

# Harsh Maheshwari

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## EDUCATION

**Georgia Institute of Technology, Atlanta, US**

Master of Science (Thesis) in Computer Science (Specialization: **Machine Learning**); GPA: 4.0/4.0

Aug. 2021 – Present.

Advisor: **Prof. Devi Parikh, Prof. Zsolt Kira**; Expected Graduation: May 2023

Thesis topic: Multi-modal Semi-supervised Semantic Segmentation

**Indian Institute of Technology, Delhi, New Delhi, India**

B.Tech in Electrical Engineering; GPA: 8.27/10.0

Jul. 2015 – May. 2019

Advisor: **Prof. Prathosh AP**

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## PUBLICATIONS and PREPRINTS

1. **Recommendation of Compatible Outfits Conditioned on Style**,  
*ECIR'22* (presentation); CODS-COMAD'22 Demo track  
Harsh Maheshwari\*, Lucky Dhakad\*, Debopriyo Banerjee\*, Niloy Ganguly, Arnab Bhattacharya
  2. **CoSIR: Optimal control of SIR epidemic dynamics by mapping to Lotka-Volterra System**,  
presented at *ICLR'21 Workshop MLPCP and CHIL'21 Workshop*  
Harsh Maheshwari, Shreyas Shetty, Nayana Bannur, Srujana Merugu
  3. **Deploying Covid-19 Case Forecasting Models in the Developing World**,  
Book chapter in: *AI for Social Impact*  
Sansiddh Jain, Avtansh Tiwari, Nayana Bannur, Ayush Deva, Siddhant Shingi, Vishwa Shah, Mihir Kulkarni, Namrata Deka, Keshav Ramaswami, Vasudha Khare, Harsh Maheshwari, Soma Dhavala, Jithin Sreedharan, Jerome White, Srujana Merugu, Alpan Raval
  4. **Audience Creation for Consumables - Simple and Scalable Precision Merchandising for a Growing Marketplace**,  
Shreyas S\*, Harsh Maheshwari\*, Avijit Saha\*, Samik Datta\*, Shashank Jain, Disha Makhija, Anuj Nagpal, Sneha Shukla, Suyash
  5. **Adaptive COVID-19 Forecasting via Bayesian Optimization**, presented at *CODS-COMAD'21*  
Nayana Bannur, Harsh Maheshwari, Sansiddh Jain, Shreyas Shetty, Srujana Merugu, Alpan Raval
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## WORK EXPERIENCE

**Applied Scientist (intern) - Amazon, Seattle, WA**

Personalizations team in Amazon Fashion

Aug. 2021 – Present.

- Formulated and proposed the use of **active learning** for exploration in recommendations to drive customer understanding.
- Improved ROCAUC score for predicting the like-rate of the recommendations by **4% points with limited data per customer**.
- Generated meaningful and important insights by extensive analysis and comparisons between active learning and **contextual multi-armed bandits** using thompson sampling - helped formulate future work and priorities
- Devised an offline evaluation framework to measure the goodness and iterate over multiple recommendation policies.

**Return offer:** Extended a full time Applied Scientist role in the Fashion Personalization team

**Data Scientist II - Flipkart, Bengaluru, India**

Largest E-Commerce platform in India with over 200M users

July. 2019 – July. 2021

- **Complete The Look** (Prof. Niloy Ganguly - IIT KGP, Dr. Arnab Bhattacharya - Flipkart):
  - Problem: Generating **fashion-compatible** and **diverse** outfits for a 'hero' product for Indian users and their preferences.
  - Designed an architecture and algorithm to learn outfit compatibility conditioned under a 'style'.
  - Designed a **beam search** variant using **determinantal point process** to introduce diversity **across outfits**.
  - Implemented SOTA **fashion-compatibility, apparel segmentation, category classification** models and a flask tool to get annotations.
- **Candidate Generation and Ranking** (Samik Datta, Dr. Aditya Rachakonda - Flipkart):
  - Customized **Bayesian Personalised Ranking based Matrix Factorisation** framework for Flipkart homepage recommendation
  - Designed multiple **Lamda MART** & LR based rankers for Flipkart home and product page.
  - Designed algorithms to improve diversity & freshness of recommendations and handled the trade off with short-term conversion metrics.
  - **Impact:** Improvement in overall conversion by 2bps (units/visits) and 16bps (units/visitor) - **won an internal project award for this work**

## Covid19 Volunteer - DSIndiaVsCovid19, Wadhvani AI,

A consortium of volunteer technologists to support public authorities in managing COVID-19

March. 2020 – July. 2021

- *Forecasting* (Dr. Srujana Merugu, Dr. Alpan Raval, Dr. Mohit Kumar):
  - Developed an **ML framework** for infectious disease forecasting based on **SEIR epidemiological model variants**
  - Achieved less than 10% MAPE error on the forecasts for COVID-19 by estimating parameters via **Bayesian optimization**.
  - *Impact*: The system is being used for COVID-19 medical preparedness in war rooms of heavily impacted Indian cities.
- *Controlling an Epidemic* (Dr. Srujana Merugu):
  - Proposed a control framework by mapping the SIR model to the **Lotka-Volterra** system and **control-Lyapunov** theory.
  - The framework permits **design of non-pharmaceutical interventions** that limits the disease burden on an isolated region.

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## Projects

### Multi-modal Semi Supervised Semantic Segmentation, Advised by: Prof. Zsolt Kira

Work in progress

Jan. 2022 – Present.

- Leading project on semi-supervised (label-efficient) semantic segmentation using multiple spatial modalities (RGB, Depth).
- Reproduced results on several state-of-the-art well cited baselines in semi supervised semantic segmentation and modality fusion techniques.
- Working on creating a semi supervised framework to effectively use unlabeled data from multiple modalities.

### Misc course projects,

Done for various courses during MS at Georgia Tech

Aug. 2021 – Present.

- Generating *consistent* images using text prompts by incorporating CLIP in VQ-GAN's latent space. (with Prof. Devi Parikh)
- Highlighted the performance degradation of the popular ImageNet trained PyTorch models on image transformations. (arXiv:2207.08079: Performance degradation of ImageNet trained models by simple image transformations)
- Visual Question Answering using CLIP: Using CLIP to solve the VQA task in a zero-shot/few-shot setting (Project Page)
- Unsupervised Domain Adaptation: Used FixMatch consistency to achieve 4% improvement over the state-of-the-art approach for Unsupervised Domain Adaptation from SVHN to MNIST.

### BoardSnapped, Advised by: Prof. Prathosh AP

Video summarisation

Dec. 2017 – July. 2018

- Formulated educational video summarization problem as a keyframe detection problem.
- Used CNNs and **bi-directional convolutional LSTM** models to solve the problem.
- Achieved classification accuracy of **99.3%** and keyframe detection acc. of **97.38%** with precision & recall of **74% & 77%**  
*Received highest grade by the panel.*

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## SCHOLASTIC ACHIEVEMENTS

- Awarded **Best Project Award** at Flipkart for a recommendations ranking project (2020)
- Among 11 finalist teams in 4-stage National level AI/ML Challenge - Flipkart GRiD (2019)
- **Huawei Seeds for the Future**: Among **4 students** from India selected for a 2-week training program in **China**, studied Chinese Language and Culture in BLCU, Beijing and picked up hands-on experience of **5G, IoT and Cloud Computing** in Huawei Headquarters, Shenzhen (2018)
- **All India Rank 834** in IIT-Joint Entrance Exam Advanced among **1.4 million** students. (2015)
- **NSEP top 1%**: Certified for being in **top 1%** out of 37837 in National Standard Examination in Physics (NSEP) organised by Indian Association of Physics Teachers (IAPT) (2015)

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## SKILLS & INTERESTS

**Research Interest**: Computer Vision, Creative AI, Vision + Language, NLP

**Deep Learning Frameworks**: PyTorch, TensorFlow, Keras

**Languages**: Python, C++, Java, Hive, SQL

**Courses**: Deep Learning, Big Data Systems, Mathematical Foundations of ML, Introduction to Machine Learning, Advanced Machine Learning, Computational Learning Theory and Mind, Information bottleneck Theory of Deep Learning, Information Theory, Data Structures and Algorithms, Probability, Linear Algebra

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