

## EDUCATION

### Indian Institute of Technology (IIT), Delhi

*M.Tech in Computer Science and Engineering – GPA: 9.348 / 10.0*

*B.Tech in Computer Science and Engineering*

New Delhi, India

*July 2015 - July 2020*

*July 2015 - July 2020*

## WORK EXPERIENCE AND RESEARCH

### Google Research, Pre-Doctoral Researcher

*Machine Learning and Optimization Team, Host: Dr. Prateek Jain*

Bangalore, India

*July 2021 - July 2023*

- *Efficient Transformers*: Developed *Treeformer*, a new self attention module leveraging decision trees to reduce FLOPs and inference time in the attention layer by 6x while matching performance on benchmarks like GLUE and LRA. Proposed bootstrapping techniques for stable training of the discrete trees in the end-to-end neural pipeline.
- *LLM Inference*: Evaluated the performance of weight-based pruning and post-training quantization techniques on accuracy and inference time of large language models like LaMDA. Investigating neural architecture search (NAS) techniques to reduce the size of feed-forward layers and the communication cost across multiple TPU devices.
- *Scaling with Efficiency*: Probing ways to scale large transformer models for longer sequence lengths using sparse structures for the attention and feed-forward layers.

### Google Research, Research Associate

*AI for Social Good Team, Host: Prof. Milind Tambe*

Bangalore, India

*Dec 2020 - July 2021*

- *Resource-Constrained Planning*: Developed a Restless Multi-Armed Bandits (RMABs) solution for intervention planning problems with resource constraints for real-world deployment. Used demographic information and engagement data to infer the transition probabilities of the MDPs in RMAB.
- *Pilot Study*: Conducted a pilot study on 23,000 beneficiaries in collaboration with a non-profit, showing efficacy of RMABs in improving retention of the beneficiaries by over 32%. Coverage: [Google AI Blog](#)

### Level AI, Applied AI Engineer

*Applied NLP and Engineering Team*

New Delhi, India

*July 2020 - Dec 2020*

- Implemented the question answering module over textual knowledge base and incorporated in the chat-based product. Developed the annotation pipeline in the product to collect data and perform automatic evaluation of existing models. Developed an extract and rank search system over text documents using Elastic Search and semantic similarity models.

### Data Analytics and Intelligence Research Lab

*Advisors: Prof. Parag Singla, Prof. Sayan Ranu*

IIT Delhi

*Jan 2019 - July 2020*

- *Master's Thesis*: Designed semi-supervised models for Machine Translation (MT) leveraging monolingual data and linguistic structure. Built SoTA MT models for low [web] resource languages using transfer learning.
- *Research Project*: Worked with Graph Attention Networks in node classification and link prediction tasks for small and large scale graphs. Explored unsupervised pre-training in Graph Neural Networks for n-ary link prediction.

### Appropriate Computing Technologies for Development Lab

*Research Project, Advisor: Prof. Aaditeshwar Seth*

IIT Delhi

*Jan 2018 - Jan 2019*

- Worked on forecasting and anomaly detection in commodity prices using multivariate time series and neural models.

## PUBLICATIONS

- **Lovish Madaan**, Srinadh Bhojanapalli, Himanshu Jain, Prateek Jain. “Treeformer: Dense Gradient Trees for Efficient Attention Computation”. *International Conference in Learning Representations (ICLR) 2023, Kigali, Rwanda*. [Paper](#)
- 🏆 Aditya Mate\*, **Lovish Madaan\***, Aparna Taneja, Neha Madhiwalla, Shresth Verma, Gargi Singh, Aparna Hegde, Pradeep Varakantham, Milind Tambe. “Field Study in Deploying Restless Multi-Armed Bandits: Assisting Non-Profits in Improving Maternal and Child Health”. *AAAI Conference on Artificial Intelligence (AAAI) 2022, Vancouver, Canada*. [Paper](#). **Best Paper Award** in the Workshop on Machine Learning in Public Health (MLPH), NeurIPS 2021.

- Siddharth Nishtala, **Lovish Madaan**, Aditya Mate, et al. “Selective Intervention Planning using Restless Multi-Armed Bandits to Improve Maternal and Child Health Outcomes”. *Autonomous Agents for Social Good (AASG) Workshop, AAMAS 2021, Remote*. [Paper](#).
  - **Lovish Madaan**, Soumya Sharma, Parag Singla. “Transfer Learning for Related Languages: Submissions to WMT20 Similar Language Translation Task”. *Conference on Machine Translation (WMT), EMNLP 2020, Remote*. [Paper](#)
  - **Lovish Madaan\***, Siddhant Arora\*. “GATCheck: A Detailed Analysis of Graph Attention Networks”. *Workshop on Mining and Learning with Graphs (MLG), KDD 2020, Remote*. [Paper](#)
  - **Lovish Madaan**, Ankur Sharma, Praneet Khandelwal, Shivank Goel, Parag Singla, Aaditeshwar Seth. “Price Forecasting & Anomaly Detection for Agricultural Commodities in India”. *ACM SIGCAS Conference on Computing & Sustainable Societies (COMPASS) 2019, Accra, Ghana*. [Paper](#)
- \* - indicates equal contribution.

## AWARDS & HONORS

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- *Best Paper Award*: Machine Learning for Health (MLPH) Workshop, NeurIPS 2021
- *HPC-IITD Award for Research, 2019-20*: Awarded computational credits worth 10,741 USD for Master’s Thesis Project
- *Microsoft Research Travel Grant, 2019*: Presentation of paper in COMPASS Conference held at Accra, Ghana
- *Impact Challenge, 2018*: Ranked first for positive impact of summer internship project at AXA XL
- *JEE Advanced, 2015*: All India Rank 124 out of 150,000 candidates
- *National Top 1%, 2015*: National Standard Examination in Physics and Chemistry conducted by HBCSE
- *KVPY Scholar, 2013*: Accorded fellowship by Department of Science and Technology, Government of India
- *NTSE Scholar, 2011*: Secured sixth position nationwide in National Talent Search Examination

## TEACHING EXPERIENCE

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- *Teaching Assistant*: COL774, Machine Learning, Spring 2020
- *Teaching Assistant*: COL870, Reinforcement Learning, Fall 2019

## TALKS AND PRESENTATIONS

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### Treeformer: Dense Gradient Trees for Efficient Attention Computation

Presentation at *Google Research Conference* 2022

### Restless Multi-Armed Bandits for Intervention Planning

Poster Session at *AAAI Conference* 2022

Oral Presentation at *NeurIPS Workshop on Machine Learning in Public Health* 2021

Oral Presentation at *AAMAS Workshop on Autonomous Agents for Social Good* 2021

### Machine Translation with Limited Data

Presentation at *DAIR Lab, IIT Delhi* 2020

## EXTRA-CURRICULAR ACTIVITIES

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### Vice Captain, IIT Delhi Aquatics Team

IIT Delhi

*Aquatics & Waterpolo*

*Aug 2016 - Oct 2019*

- Represented IIT Delhi at Inter IIT Aquatics Meet - 2017 & 2018 and Silver Medallist at Aavhan 2018, IIT Bombay.

### Member and Club Representative

IIT Delhi

*Music Club*

*Jan 2016 - May 2017*

- Member of Mridang, the Indian Music Society and performed in the opening ceremony of Rendezvous, 2016.
- Awarded BRCA Recognition for the Best Music Club Representative and significant contribution to music society.