

# Varun Babbar

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**Citizenship:** Indian • **Current Location:** Durham, USA

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## Research Interests

Explainable / Interpretable AI, Deep Learning

## Education

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|-------------|---|
| 2023 – 2028 | <b>Duke University</b> – Durham, USA<br>PhD in Computer Science<br>Interpretable Machine Learning Lab<br><b>Advised by:</b> <a href="#">Dr Cynthia Rudin</a>  |
| 2018 – 2022 | <b>University of Cambridge</b> – Cambridge, UK<br>BA + MEng in Information and Computer Engineering<br><b>MEng Supervisors:</b> <a href="#">Dr Adrian Weller</a> , <a href="#">Umang Bhatt</a><br><b>MEng Thesis:</b> <i>Set Valued Predictions for Human-AI Teams</i><br><b>MEng Grade:</b> 78.8% - Honours with Distinction, Rank 14/261<br><b>BA Grade:</b> 79.4% - 1st Class Honours, Rank 18/289 |
| 2016 – 2018 | <b>Singapore International School</b> – Mumbai, India<br>IB Diploma<br><b>Grades:</b> <ul style="list-style-type: none"><li>• 45/45 Points (World Topper)</li><li>• 5/5 in AP Mechanics, Chemistry, Calculus AB</li><li>• 800/800 in SAT Subject Tests in Physics, Chemistry, Maths II</li><li>• 35.25/36 in ACT</li></ul>  |

## Relevant coursework

- *Probability and Statistics:* Probabilistic Ranking, Bayesian Inference, Gaussian Processes, Latent Dirichlet Allocation, High-dimensional MCMC, Information theory, Statistical Signal Processing, Linear Programming
- *Heuristic Optimization Methods:* Bayesian Optimization, Simulated Annealing, Particle Swarm Optimization
- *Algorithms:* Geometric Algorithms, Approximation Algorithms

## Honors and Scholarships

- 2023 Duke Graduate School Fellowship (*Duke University*)
- 2022 IIB Project Prize (*University of Cambridge*)  
*For a top ranked MEng Project in the Department.*
- 2021, 2022 Foundation Scholarship (*Queens' College, University of Cambridge*)  
*Awarded twice for obtaining a first class in my BA and MEng exams respectively*
- 2022 The James & Jean Bennett Prize (*Queens' College, University of Cambridge*)  
*For outstanding distinction in my MEng degree*
- 2022 Ruth Hendry Year Prize (*Queens' College, University of Cambridge*)  
*For outstanding distinction in my MEng degree*
- 2020 Hawks' Trust Prize (*University of Cambridge*)  
*For sporting and academic achievements*
- 2017, 2018 Merit Scholarship in School  
*Topped the school in all subjects.*
- 2018 Full Scholarship from Hong Kong University  
*On the basis of my IB results.*

## Publications and Workshops

- 2024 **Topical: Learning Repository Embeddings from Source Code using Attention**  
**Agathe Lherondelle**, Varun Babbar, Yash Satsangi, Fran Silavong, Shaltiel Eloul, Sean Moran  
*The 1st Workshop on Software Engineering Challenges in Financial Firms, International Conference on Software Engineering (ICSE), 2024..*
- 2022 **On the Utility of Prediction Sets in Human-AI Teams**  
**Varun Babbar**, Umang Bhatt, Adrian Weller.  
*International Joint Conference on Artificial Intelligence (IJCAI) 2022 (Oral)*
- 2022 **Conformal Prediction for Resource Prioritisation in Predicting Rare and Dangerous Outcomes**  
**Varun Babbar**, Umang Bhatt, Miri Zilka, Adrian Weller  
*NeurIPS Workshop on Human in the Loop Learning 2022.*
- 2022 **Style Transfer Preprocessing for Federated Learning**  
**Antonios Georgiadis\***, **Varun Babbar\***, Fran Silavong, Sean Moran  
*SPIE Medical Imaging 2022*

2020     **Training a Task-Specific Image Reconstruction Loss**  
**Aamir Mustafa\***, **Aliaksei Mikhailiuk\***, Dan Andrei Iliescu, Varun Babbar, Rafal Mantiuk  
*2022 IEEE CVF Winter Conference on Applications of Computer Vision (WACV).*

## Papers Under Review

2024     **What is different between these datasets?**  
**Varun Babbar\***, **Zhicheng Guo\***, Cynthia Rudin  
*Arxiv Pre-print. Submitted to the Journal of Machine Learning Research (JMLR).*

## Research experience

September 2022     **Senior Associate at JP Morgan Chase and Co**  
– July 2023     Working on projects in the following areas:

- Code completion
- Network compression
- Automated code quality analytics

  
*Contributor to 2 patents. Also won an internal hackathon*

August 2022 –     **Research Assistant**  
September 2022     **Supervisors:** Dr Adrian Weller, Umang Bhatt  
Applied risk control methods to a problem where we want to identify radicalised individuals and allocate resources for intervention and monitoring. Top 15% of accepted papers at the NeurIPS Human-in-the-Loop Learning Workshop.

September 2021     **MEng Project: Set Valued Predictions for Human-AI Teams**  
– June 2022     **Supervisors:** Dr Adrian Weller, Umang Bhatt  
Link to [thesis](#) (contains abstract).

June 2021 –     **JP Morgan Chase and Co**  
September 2021     **Supervisor:** Antonios Georgiadis  
Proposed a CyclGAN augmented federated learning model for resolving heterogeneity in client datasets. The resulting system showed promising performance on a segmentation task, leading to a **patent** and a paper (see above).

June 2020 –     **Research Assistant: University of Cambridge - Dept of Computer Science**  
September 2020     **Supervisor:** Dr Rafal Mantiuk.  
Experimented with different loss functions for image-to-image translation tasks in order to answer the question - which loss function provides the most perceptually pleasing images? Co-author of a paper accepted at WACV '22.

June 2019 – **Research Assistant: University of Cambridge - Dept of Physics**  
September 2019 **Supervisors:** Dr Sarah Bohndiek, Emma Brown.  
Wrote scripts in Matlab and Python that can perform image processing operations on tumour images. Link to research [report](#)

## Some Projects

January 2022 **Hack Cambridge**  
Built an app that determines your carbon footprint by taking a photo of your receipt and performing a semantic search for identified keywords. Winner of the Huawei Challenge. ([see Devpost](#))

December 2021 **Analysis of Optimization Algorithms**  
Implemented Simulated Annealing and Particle Swarm Optimization for a high dimensional, constrained function as part of a coursework project. Extended this by tweaking algorithm hyperparameters using Bayesian optimization - I scored 90% in this module.

May 2021 **Image Compression**  
My 3rd year Image Processing project. Extended this by developing a decompressor that combines efficient hyperparameter tuning and deep learning based denoising. Obtained a 1st class mark + placed 2nd in the competition. ([see Github](#))

March 2020 **Vanilla CNN**  
Built a modern CNN from scratch, using only matrix multiplications. ([see Github](#))

Jan 2020 – April 2020 **Synthetic Medical Image Generator**  
Trained a GAN for generating synthetic MRI images from their corresponding segmentations.

October 2019 **Hack Brunel**  
Built an app that finds the optimal cycling route based on user risk preferences, crime levels, and traffic. Winner of the McAfee Security Challenge. ([see Devpost](#))

November 2019 **Integrated Design Project**  
Designed and wrote the navigation algorithm for a robot that can detect mines in a minefield, pick them up, and drop them to a safe zone. Came 2<sup>nd</sup> in the final competition out of 14 teams.

November 2018 **Oxford Hack**  
Built an app that makes storytelling an interactive experience by outputting relevant images and playing appropriate background sounds as a story is narrated. Winner of the AWS Challenge. ([see Devpost](#))

## Miscellaneous

Reviewer at ICML 2024, ECAI 2023, TheWebConf2023

## Technical skills

**Python Libraries** - PyTorch, Tensorflow, Sklearn, Numpy, Matplotlib

**Other Languages** - Javascript, HTML, Java, C++ (basic)

**Conceptual** - Machine Learning, Optimization, Statistics

### Misc Libraries

L<sup>A</sup>T<sub>E</sub>X, Git, Shell

### Languages

English, Hindi, French

## Other interests

Racquet Sports, Juggling, Basketball, Climbing, Chess, Rubiks Cubes