Ankit Bhardwaj

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Education

- **PhD in Computer Science** — **New York University**
  Advised by Prof. Lakshminarayanan Subramanian — *September, 2021 – Present*
  Grade Point Average (GPA): 3.93/4.0
  Expected Graduation Date: May, 2026

- **B.Tech. in Computer Science and Engineering** — **Indian Institute of Technology, Kanpur**
  Advised by Prof. Surender Baswana and Prof. Medha Atre — *August, 2015 – April, 2019*
  Cumulative Performance Index (CPI): 9.2/10.0

Publications

- Understanding Sudden Traffic Jams: From Emergence to Impact.
  Ankit Bhardwaj*, Shiva Iyer*, Sriram Ramesh, Jerome White, Lakshminarayanan Subramanian.
  Development Engineering: Journal of Engineering in Economic Development, December 2022.
- Predicting Treatment Adherence of Tuberculosis Patients at Scale.
  Mihir Kulkarni*, Satvik Golechha*, Rishi Raj Grandhe*, Jithin K. Sreedharan*, Ankit Bhardwaj, Santanu Rathod, Bhavin Vadera, Jayakrishna Kurada, Kirankumar Rade, Sanjay Mattoo, Rajendra Joshi, Alpan Raval
  ML for Health Symposium, 2022. Outstanding Paper Award.
- Learning Pollution Maps from Mobile Phone Images.
  Ankit Bhardwaj, Shiva Iyer, Yash Jalan, Lakshminarayanan Subramanian.
  IJCAI, 2022. Oral Presentation.
- High Precision Mammography Lesion Identification from Imprecise Medical Annotations.
  Ulzee An, Ankit Bhardwaj, Shameer Khader, Lakshminarayanan Subramanian.
  Frontiers in Big Data, December 2021.
- Robust Lock-Down Optimization for COVID-19 Policy Guidance.
  Ankit Bhardwaj*, Han-Ching Ou*, Haipeng Chen, Shahin Jabbari, Rahul Panicker, Milind Tambe, Alpan Raval.
  AAAI Fall Symposium on AI for Social Good, 2020.

Unpublished Manuscripts

- Backpressure Traffic Signaling for Free-flow Road Networks.
  Ankit Bhardwaj, Shiva R. Iyer, Ashlesh Sharma, Sajan Ravindran, Lakshminarayanan Subramanian.
  Under Review at ICASSP, 2023.
- HoMi: In-Silico Estimation of Host-Microbe Interaction in Context of Dysbiosis.
  Ankit Bhardwaj, Christina Runkel, Ben Sparklin, Vancheswaran Gopoalakrishnan, Bret Sellman, Lakshminarayanan Subramanian, and Shameer Khader.
  Working Manuscript.
- Localized Pollution Hotspots: Inferences from a Three-year Fine-grained Air Quality Monitoring Study in Delhi.
  Shiva Iyer*, Ankit Bhardwaj*, Ananth Balashankar, Nita Soans, Anant Sudarshan, Rohini Pande, Lakshminarayanan Subramanian.
  Working Manuscript.

Work Experience

- **Research Intern** — **Machine Learning Research, AstraZeneca**
  Mentor - Dr. Shameer Khader — *May, 2022 – Aug, 2022*
  - **Quantifying Host-Microbe Interactions in Context of Dysbiosis**

- Implemented and scaled protein **domain-based** species level canonical score for humans and microbes.
- Designed and implemented **evaluation methodology using Dysbiosis data** on humans, using **MBodyMap**, **Disbiome** and **MicrophenoDB** datasets.
- Implemented **SVM**, **Random Forest** and **Neural Network** based models for **binary classification scoring** of host-microbe interactions in the context of dysbiosis.
- Obtained **0.754** AUC-ROC using Random Forest model compared to the canonical baseline of **0.649**.

Research Fellow **Wadhwani Institute for Artificial Intelligence, Mumbai**
Mentor - Dr. Alpan Raval *June, 2019 – July, 2021*

- **Tuberculosis Medicine Regimen Adherence - LFU Prediction**
  - Developed prototype models for predicting risk of loss to follow-up (LFU) (non-adherent behaviour which increases the risk of death (**9%**), recurrence (**25%**) and drug resistance (**37%**)) on a **42k patient dataset**.
  - Obtained **3x lift in precision@0.5recall** over baseline. Presented a plan to scale the corresponding solution to the **20 million patient central dataset** to the **National TB Elimination Program (NTEP)**.
  - Used **xgboost** base model tuned for different geographies using social indicators to encode locations.
  - Developed **first ever** models for predicting ground-truth adherence (urine test) on a **600 patient dataset**. Plan to extend the work through a **10k patient survey** to develop a data-correction model for the central dataset.
  - Scheduled passive evaluation and **deployment in 2021**.
  - In collaboration with **Central TB Division, Govt. of India** and **National Institute of Research in TB (NIRT)** and funded by **United States Agency for International Development (USAID)**.
- **TB Screening via Ultrasound**
  - Worked on algorithms to power **portable and affordable ultrasound screening devices**. As high as **30%** TB suspects drop off the screening process in some areas due to medical infrastructure problems.
  - Verified presence of TB correlated features in ultrasound imaging, and built models to identify abnormal frames and localize the features. Extended the work to classify patients as TB positive or negative on a **prototype dataset of 50 patients**.
  - **Beat radiologists' performance by 60% on AUC-ROC** proving the feasibility of the method. Designed the ongoing data-collection **study on 800 patients**. Funded by the **Bill and Melinda Gates Foundation**.
- **Covid19 Lockdown Optimization**
  - Developed a model for COVID-19 lock-down interventions based on **SEIR-class epidiomiological models**.
  - Optimized the resource allocation for balancing health and economy using reinforcement learning while taking robustness to uncertainty and multiple objectives into account. Research paper **accepted in AAAI Fall Symposium on AI for Social Good, 2020**.
  - In collaboration with **Prof. Milind Tambe, Harvard University** and funded by **USAID**.

Research Intern **Video Analytics Lab, Indian Institute of Science, Bangalore**
Mentor - Prof. Venkatesh Babu *Dec,18 - Jan,19*

- **Source-Free Domain Adaptation**
  - Developed and implemented a **unique training loss for probabilistic clustering of features** and used this for source-model compression. Extended this to a **novel source-free approach** for domain adaptation on images, which is highly relevant for adapting models trained on private data.
  - Developed a **novel algorithm to solve the incremental domain adaptation** problem by using few-shot training examples. Achieved reasonable accuracy on Office-31(**78.8%**), visDA-17(**48.1%**) and MNIST-USPS-SVHN(**58.8%**) datasets.
  - A white paper of the work is available at https://tinyurl.com/y3f4tal6.

Research Intern **IBM Research Labs, Bangalore**
Mentor - Dr. Sumanta Mukherjee *May,18 - July,18*

- **Explainable Image Search**
  - Designed a **custom grad-cam based attention metric** to evaluate image similarity models. Proposed a **new loss function** to optimize the attention metric and to improve the explainability of these models.
  - Used image embeddings from attention-trained models to improve the accuracy of visual search compared to general triplet-loss trained methods and create a **new system of visual search** based on explanations while including human in the loop. Poster for the work is available at https://tinyurl.com/yadflxrt

Research Intern **Monet Networks, AshmarIP, Gurugram**
Mentor - Mr. Saurav Kumar *May,17 - July,17*

- **Face Analysis**
  - Developed a custom face detection and similarity comparison module using Procrustus Analysis, Homography and Geometric and Eigen face models with Australian Immigration Department's template for face verification.

Achievements, Awards and Honours

- Awarded the **Henry M. MacCracken fellowship** for doctoral students from NYU for 2021-2026.
- Received the **Academic Excellence Award** from IIT Kanpur for excellent academic performance in the year 2015-16 and 2016-17 and **Merit-cum-Means Scholarship** from 2015-19.
- Rank **145** in **JEE Adv.** among **150,000 candidates** and rank **602** in **JEE Main** among **1.5 million candidates**.
- Attended **Orientation and Selection Camp** for **Indian National Astronomy Olympiad** held at **HBCSE, Mumbai** attended by **top 30 out of 20,000 candidates** and received the award for **best theoretical solution to a challenging problem**.
- **All India Rank 9** in **KVPY** out of **estimated 90,000 candidates** and successfully passed **National Standard Examination** in **Physics**, **Chemistry** and **Astronomy** with passing rate of **top 1%**.
- Awarded the **National Talent Search Scholarship** in 2013 awarded to **1000 out of around 200,000 candidates**.
- Secured **State Rank-1** in **5th Sofworld International Mathematics Olympiad** in Bihar.

Technical Skills

- **Programming Languages:** Python (proficient), R, C/C++
- **Tools and Libraries:** Pytorch, Scikit-Learn, Pandas, Scipy, Numpy, Git, Bash, VS Code, Latex

Teaching Experience

- **Internship Mentor - TB Solution Project, Wadhwani AI, Mumbai**
  - Mentored a group of 6 interns over two 3 month long summer internships.
  - Worked closely with and guided the interns in their research for a successful internship experience.
- **Academic Mentor - Introduction to Computing, IIT Kanpur**
  - Provided one-on-one mentoring to a group of 10 academically-weak students who had failed to pass the course, for a full year. Provided extensive guidance for labs and exams leading to all of them passing the course.

Extra-Curricular Experience

- **Secretary - Astronomy Club, IIT Kanpur**
  - Managed end-to-end logistics (contacting speakers, booking lecture halls etc.) for astronomy lecture series. Gave several theoretical lectures and conducted observational sessions for the student body.
- **Secretary - Programming Club, IIT Kanpur**
  - Organised and conducted coding bootcamps and tutorials for incoming juniors. Organised regular events and competitions for the student body.
- **Senior Diploma in Music - Prayag Sangeet Samiti, Allahabad**
  - Trained as a musician in Indian classical music and tabla playing. Participated in multiple musical events organised at the district level.