Aditya Makkar

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Education

Columbia University — New York City, NY
MPhil in Electrical Engineering (GPA: 4.02) — *2021 - 2022 (expected)*
MS in Electrical Engineering (GPA: 3.98) — *2019 - 2021*

Indian Institute of Technology Delhi — Delhi, India
Bachelor of Technology in Mechanical Engineering — *2012 – 2016*

Research Interests

Machine learning, nonparametric statistics, probability theory, optimal transport

Experience

Goldman Sachs — June 2016 – June 2019
Machine Learning Engineer — *Bangalore, India*

- Member of statistical modeling team within Surveillance Analytics Group of Compliance division headed by Dr. Howard Karloff. Responsible for researching and developing **machine learning** and statistical tools for surveillance models which must process **terabyte scale data** and flag suspicious activities.
- Example projects: **Word2Vec** – Wrote code in MapReduce to parallelize the computation to be able to run the model on terabytes of text data. Open-source code is available here on Github. **Search engine** – A natural language based search engine developed by our team in house. Responsible for the query expansion task using synonyms and spell correction. **Anomaly detection** – Used variational autoencoder to flag anomalous emails.
- Worked closely with data curation team to design databases for efficient data retrieval for ML applications.

PhD Research Projects at Columbia

Fast Bayesian nonparametric ensemble: This approach augments an existing ensemble model to account for different sources of model uncertainty, using Bayesian nonparametric machinery and random Fourier features. Paper here.
Exploiting low-dimensionality in statistical optimal transport: Proving rates of convergence under the non-asymptotic regime for the estimators of transport maps when source measure has a lower-dimensional structure.
Probabilistic symmetries: Developing useful representation theorems for probabilistic symmetries beyond the two most common assumptions of i.i.d. or exchangeability used in modeling data.
Kernel based nonparametric tests: Proving properties of statistical tests, like goodness-of-fit, homogeneity and independence testing, using the framework of reproducing kernel Hilbert space (RKHS) embedding of probability measures.

Awards

Summer schools: Received full funding to attend: PIMS-IFDS-NSF Summer School on Optimal Transport (2022) & 50^{th} Probability Summer School Saint-Flour, France (2022)
IIT Delhi Semester Merit Award (2 times): batch top 7%. 2012-2013
Indian National Mathematical Olympiad (INMO) finalist (2 times): 3^{rd} rank in the state of Uttar Pradesh (largest state) in Regional Mathematics Olympiad. 2012
KVPY fellowship: 250 students awarded nationally by the Government of India. 2012
NTSE fellowship: 1000 students awarded nationally by the Government of India. 2008

Relevant Courses

Graduate courses: Modern Analysis (A+), Topology (A+), Probability theory (Pass/fail due to COVID), Probability Theory III*, Analysis & Probability (A+), Modern Algebra*, Statistical Inference (Pass/fail due to COVID), Empirical Process Theory (A+), Number theory, Theoretical Statistics III*, Analysis of Algorithms*, Foundations of Graphical Models, Bayesian Models for Machine Learning, Natural Language Processing, Robotics
Undergraduate courses: Linear algebra, Differential equations, Artificial Intelligence, Game theory, Control theory
* := ongoing, A+ for exceptional performance (4.33/4)

Miscellaneous

Teaching Experience: Introduction to Machine Learning – Spring 2021, Fall 2021; Digital Signal Processing – Fall 2022
Programming languages & frameworks: Python, Java, NumPy, SciPy, JAX, TensorFlow, PyTorch, Hadoop, Spark