Sahil Loomba

Contact Information

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https://sloomba.github.io

Education

Imperial College London, United Kingdom

PhD in Applied Mathematics, 2018 – present

Indian Institute of Technology Delhi, India

BTech in Computer Science & Engineering, 2012 – 2016
GPA: 8.969/10
Thesis: Causal Computational Models for Gene Regulatory Networks

Research Interests

Network science, computational social science, computational cognitive science, computational and systems biology, Bayesian statistics, probabilistic deep learning

Graduate Teaching Experience

Methods for Data Science (Years 3 & 4, MSc)	October 2019 – Present
Mathematical Computation in Python (Year 1)	January – March 2019
Probability and Statistics II (Year 2)	October – December 2018

Academic Research Projects

A Unified Random Walk approach to Network Centralities and Spectra
Advised by Prof. Nick S. Jones, Imperial College London October 2018 – Present

- Developed a probabilistic theory of graph-coarsening using Stochastic Block Models to analytically derive centralities and spectral distribution of graph operators
- Extended matrix function theory of network centralities to compute novel closed-form versions of node-level metrics such as betweenness and closeness centralities

Learning Social Connectivity Kernels from Egocentric Surveys
Advised by Prof. Nick S. Jones, Imperial College London October 2018 – Present

- Created a method to cheaply learn social connectivity models from easily available egocentric surveys such as the census, for multiple socio-demographic dimensions
- Demonstrated how different network statistics, that capture varied dimensions of inequality in social capital, relate to people's subjective and objective well-being

Causal Computational Models for Gene Regulatory Networks
Advised by Dr. Sumeet Agarwal, IIT Delhi August 2015 – May 2016

- Built local pairwise models of gene interactions using causality estimation techniques under assumptions of linear, nonlinear and generalized dynamical systems
- Extended the local model into a global structure learning model, by employing random walk based weight propagation for graph estimation and GRN inference

Lateralization of Exemplar & Prototype Models in Category Learning
Advised by Dr. Varsha Singh, IIT Delhi January – May 2016

- Tested the lateralization of exemplar and prototype approaches of human category learning, by conducting DVF experiments and Bayesian model selection
- Given the lateralization hypothesis holds, resolved the learning epoch when transfer of cognitive control takes place between the exemplar and prototype models

Classifying Ocean Plankton using Machine Learning techniques
Advised by Dr. Parag Singla, IIT Delhi January – May 2015

- Created image representation (Hu moments, Gabor filter banks) & ML models (kernel machines, neural networks) for a 120-class plankton classification problem
- Exploited the phylogeny tree structure of plankton classes to improve prediction accuracies, by developing an ensemble model of hierarchically stacked classifiers

Professional Research Experience

Wyss Institute for Biologically Inspired Engineering at Harvard University
Research Fellow in Computational and Systems Biology August 2016 – July 2018
Advised by Prof. James J. Collins, MIT

- Created NeMoCAD—Network Model for Causally Aware Discovery—a Bayesian model that learns from gene-regulation and drug-gene interaction data to query for desirable therapeutic states; discovered a new therapeutic for Rett Syndrome
- Developed a probabilistic model for universal identification of infectious pathogens, using mass-spectrometry data as a "signature"; ongoing clinical testing at BIDMC
- Co-authored a research grant worth $2mil for DARPA challenge of Synergistic Discovery and Design of biological circuits; developed sequence and circuit embedding models of *E. coli* and yeast using StarSpace, for iterative circuit discovery
- Formulated drug repurposing as an information retrieval problem; successfully rediscovered commercially available drugs for diseases like TB and lung cancer
- Studied the onset of anaphylaxis as a shift in fracticality of breathing waveform signals; developed an ML model for preemptive diagnosis of asthma attacks
- Extended t-SNE to visualize high-dimensional data with multiple feature spaces

Xerox Research Center India
Research Intern in Multimedia Analytics May – July 2015
Advised by Dr. Om Deshmukh, Senior Research Scientist, XRCI

- Developed an end-to-end C++ pipeline for automatic generation of table of contents for video lectures, using video (visual) and subtitles (textual) information
- Received an offer to work at Xerox Research Center India as a Budding Scientist

Publications and Presentations

- Loomba, S., Hoffmann, T., Jones, N. S. (2019, July). Social Access Statistic: Linking Social Connectivity to Health Outcomes. Poster presentation at *5th International Conference on Computational Social Science.*
- Loomba, S., Garrod, M. (2019, July). How Far Would You Go? Comparing Urban Access in 10 Global Cities. Poster presentation at *NetMob 2019.*
- De Figueiredo, A., Loomba, S., Jones N. S. (2018, November). National and sub-national vaccine coverage and confidence analytics. Poster presentation at *Launch of Imperial Network for Vaccine Research (INVaR).*
- Duffy, S., Loomba, S., Cartwright, M., Dimitrakakis, N., Scott, J., McCarty, A., Shapiro, N. I., Super, M., Ingber, D. (In prep). Application of MALDI-TOF mass spectrometry for the rapid identification of PAMPs in blood culture negative septic patients using FcMBL-coated magnetic beads.
- Gandhi, A., Biswas, A., Shrivastava, K., Kumar, R., Loomba, S., Deshmukh, O. (2016, March). Easy Navigation through Instructional Videos using Automatically Generated Table of Content. In *Companion Publication of the 21st International Conference on Intelligent User Interfaces* (pp. 92-96). ACM.

Patents

- Barhate, S. S., Loomba, S., Gandhi, A., Biswas, A., Negi, S., Deshmukh, O. D. (2018). Method and system for generation of a table of content by processing multimedia content. *U.S. Patent Application No. 15/203,868.*
- Gandhi, A., Biswas, A., Deshmukh, O. D., Loomba, S. (2018). Method and system for content processing to determine pre-requisite subject matters in multimedia content. *U.S. Patent Application No. 15/250,958.*

Reviewing

Physical Review E	2019
Nature Scientific Reports	2019

Academic and Competitive Honors

Imperial-TUM Global Fellows Programme	2019
Finalist for Rhodes Scholarship from India	2016
Summer Undergraduate Research Award, IIT Delhi	2014
Cargill Global Scholar Award for academic excellence & leadership	2014
IIT Delhi Institute Medal for obtaining highest overall GPA	2013
IIT Delhi Merit Semester Scholarship	2012, 2013

Technical Strengths

Programming: Python, R, MATLAB, C, C++
Machine learning toolkits: TensorFlow, PyTorch, scikit-learn