

## Sahil Loomba

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CONTACT INFORMATION	84 Line Street #3 Somerville MA 02143	(857) 218-2159 <a href="mailto:sahil.loomba@wyss.harvard.edu">sahil.loomba@wyss.harvard.edu</a> <a href="https://sloomba.github.io">https://sloomba.github.io</a>
EDUCATION	<b>Indian Institute of Technology Delhi, India</b> B.Tech in Computer Science & Engineering, 2012 – 2016 Overall GPA: 8.969/10 Thesis title: Causal Computational Models for Gene Regulatory Networks	
RESEARCH INTERESTS	Bayesian nonparametrics, deep probabilistic programming, computational and systems biology, computational cognitive science	
PROFESSIONAL RESEARCH EXPERIENCE	<b>Wyss Institute for Biologically Inspired Engineering at Harvard University</b> <i>Research Fellow in Computational and Systems Biology</i> August 2016 – present Advised by Prof. James J. Collins, MIT <ul style="list-style-type: none"><li>• <i>Multimodal data analytics</i>: Extended the “t-SNE” algorithm for visualization of high-dimensional datasets that have multiple feature spaces and associated graph structure(s) called “X-t-SNE”; developed a multimodal clustering algorithm by stacking a Dirichlet process prior over a multi-output Gaussian process mapping</li><li>• <i>Project ConDDR</i>: Characterized the drug repurposing problem as an information retrieval problem, by treating the drug-gene interaction matrix as a document-word matrix and the target genes as a query vector; algorithm successfully “re-discovers” commercially available drugs for diseases like TB and lung cancer</li><li>• <i>Project MALDI for Infection Diagnosis</i>: Developed a probabilistic model for detection of an infectious pathogen in a given urine sample, using mass-spectrometry data of ionized samples as the “signature” of a pathogen; manuscript in prep</li><li>• <i>Project Abbie</i>: In collaboration with Boston’s Children Hospital, characterized the problem of preemptive diagnosis of asthma attacks from patients’ breathing waveform data; hypothesized and validated the onset of anaphylaxis as a shift from mono to multifractality of the breathing signal; applied machine learning methods to achieve a high accuracy of 95% on the 2-class prediction problem</li><li>• <i>protein2vec</i>: In collaboration with the George Church group, defined the unsupervised problem of embedding protein sequences into a vector space to solve supervised proteomics problems like abundance estimation of mutated proteins, function classification, structure prediction and binding characterization; building a seq2seq model based on the RNN encoder-decoder &amp; Google’s Transformer</li><li>• <i>Project THoR (Technologies for Host Resilience)</i>: Formulating a model of host tolerance to pathogens that principally integrates multiomics data from a variety of pathogen infections on different host species, by exploiting causal biomolecular interactions as a set of conditional independences in a Bayesian network structure</li><li>• <i>Project SD2</i>: Co-authored a successful grant proposal worth \$2mil for the DARPA challenge of Synergistic Discovery and Design of biological circuits; proposed an iterative algorithmic pipeline going from large-scale experimental data to network structures (via network inference) to functional network motifs (via graph embeddings) to operable biological circuits (via Bayesian model selection over biokinetic models), which can generate testable scientific hypotheses &amp; thus more data</li></ul>	

## **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
- Characterized the video sequencing problem for generating shortest learning path in a video lecture based curriculum, using TextRank and Bayesian topic modeling
- Contributed to generation of two patents for novel work (pending before USPTO); demo presented at International Conference on Intelligent User Interfaces, 2016
- Received an offer to work at Xerox Research Center India as a Budding Scientist

ACADEMIC  
RESEARCH  
EXPERIENCE

## **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 conditions 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

## **A Topological Perspective on Form Learning**

Advised by Dr. Sumeet Agarwal, IIT Delhi

October – November 2015

- Studied and extended Kemp and Tenenbaum's (2008) cognitive model of finding forms of structure in data by introducing a preprocessing step of manifold learning
- Experimented with an animal-features dataset to explain the use of availability and representativeness heuristics in human cognition during inductive learning

## **Classifying Ocean Plankton using Machine Learning techniques**

Advised by Dr. Parag Singla, IIT Delhi

January – May 2015

- Created apt image representation (Hu moments, Gabor filter banks) & ML model (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

## **Analysis of EEG signals for thought-controlled prosthetics**

Advised by Dr. Saif K. Mohammed, IIT Delhi

March – July 2014

- Conducted EEG experiments with subjects for collecting data on motor activities; developed a motion classifier using information theory approaches and neural nets

ACADEMIC AND  
COMPETITIVE  
HONORS

Finalist of the prestigious 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, MATLAB, R, C, C++  
Machine learning toolkits: TensorFlow, Edward, scikit-learn, PyTorch