

Rohan A. Varma

Curriculum Vitae

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Education

- 2014–2019 **Doctor of Philosophy (Ph.D)**, *Department of Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, PA.*
Thesis: Exploiting Structure In Data - Signal Processing on Graphs
- 2014–2016 **Master of Science (M.Sc)**, *Department of Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, PA.*
- 2010–2014 **Bachelor of Science (B.Sc)**, *Department of Electrical Engineering and Computer Science, University of California, Berkeley, CA.*
- 2010–2014 **Bachelor of Arts (B.A)**, *Department of Economics and Department of Statistics, University of California, Berkeley, CA.*

Research

I am broadly interested in signal processing, machine learning and interdisciplinary work drawing from tools in statistics, information theory and optimization. Currently, I work in the general area of signal processing on graphs where I study the sampling and modeling of unstructured data that lie on graphs advised by Prof. Jelena Kovačević.

Publications

Journal

- Varma, R., Chen, S., Singh, A. and Kovačević, J. (2019). **Active Sampling for Non-Smooth Signals on Graphs** IEEE Transactions on Signal Processing. (in preparation).
- Varma, R., Lee, H., Chi, Y. and Kovačević, J. (2019). **Vector-Valued Graph Trend Filtering with Non-Convex Penalties** arXiv:1905.12692. IEEE Transactions of Signal Processing.(submitted)
- Varma, R., Chen, S., Singh, A. and Kovačević, J. (2018). **Signal Representations on Graphs: Tools and Applications.** arXiv:1512.05406.
- Chen, S., Varma, R., Singh, A., and Kovačević, J. (2016). **Signal Recovery on Graphs: Fundamental Limits of Sampling Strategies.** IEEE Transactions on Signal and Information Processing over Networks
- Chen, S., Varma, R., Sandryhaila, A., and Kovačević, J. (2016). **Discrete Signal Processing on Graphs: Sampling Theory.** IEEE Transactions on Signal Processing. (SPS Best Paper Award)

Conference

- Varma, R. and Kovačević, J. (2019). **Passive and Active Sampling for Piecewise Smooth Graph Signals.** 13th International Conference on Sampling Theory and Applications
- Varma, R. and Kovačević, J. (2019). **Random Sampling for Bandlimited Signals on Product Graphs.** 13th International Conference on Sampling Theory and Applications
- Varma, R., Lee, H., Chi, Y. and Kovačević, J. (2019). **Improving Graph Trend Filtering with Non-Convex Penalties** IEEE International Conference on Acoustics, Speech and Signal Processing
- Varma, R., and Kovačević, J. (2019). **Smooth Signal Recovery on Product Graphs** IEEE International Conference on Acoustics, Speech and Signal Processing

- Mangia, M., Pareschi, F., Varma, R., Rovatti, R., Kovačević, J., Setti, G. (2018). *Rakeness-based Compressed Sensing of Multiple-Graph Signals for IoT Applications*. IEEE Transactions on Circuits and Systems II: Express Briefs.
- Varma, R., Chen, S., and Kovačević, J. (2017). *Graph Topology Learning from Signals: Regular vs Irregular structures*. IEEE Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP).
- Varma, R., Chen, S., and Kovačević, J. (2016) *Representations for Localized Signals on Graphs*. IEEE Asilomar Conference on Signals, Systems and Computers.
- Chen, S., Varma, R., Singh, A., and Kovačević, J. (2016). *Representations of Piecewise Smooth Signals on Graphs*. IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP).
- Varma, R., Chen, S., and Kovačević, J. (2015). *Spectrum-Blind Signal Recovery on Graphs*. IEEE Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP).

Experience

Industry

- May 2018 – August 2018 **Research Intern, Microsoft Research**, Worked on incorporating syntactic and semantic information in co-word and graph embeddings.
- May 2013 – August 2013 **Engineering Intern, Apple**.
Worked on the signal integrity team for the next generation of Apple devices.
- May 2012 – August 2012 **Engineering Intern, Samsung Electronics**.
Worked on digital signal processing algorithms to enable accurate timing for GPS receiver on the mobile sensors team.
- May 2011 - August 2011 **Software Engineering Intern, Lawrence Berkeley National Laboratory**.
Designed and helped implement IBECS (Integrated Building Environmental Communications System) an integrated building equipment communications network using embedded device networks to control sensors and actuators

Research Experience

- September 2013 – May 2014 **Research Associate, Wireless Foundations, U.C. Berkeley**.
Extended an existing framework for low-rate sampling and efficient recovery of spectrally sparse signals (FFAST) with Prof. Kannan Ramchandran
- September 2012 – May 2013 **Research Associate, U.C. Berkeley Wireless Research Center**.
Worked on capacitive multi-dimensional imaging for high resolution depth-direction imaging with Prof. Ali Niknejad
- January 2012 – January 2013 **Research Associate, U.C. Berkeley Wireless Research Center**.
Worked on a lossless data compression block for neural signals on a Brain-Machine Interface with Prof. Jan Rabaey
- January 2011 – January 2012 **Research Associate, Lawrence Berkeley National Laboratories**.
Nano-Fabricated Arrays of Superconductor Quantum Interference Devices and Transport Studies of Thin Film Manganite/Multiferroic Field Effect Devices. Designed experiments on array geometries at low temperatures to demonstrate reversible control of exchange bias and gain insight into their use as a low noise amplifier.

Technical Skills

- Programming experience in Java, Python, C, C++, Julia, MATLAB, R, Haskell, JavaScript.
- Experience with the Hadoop, Hive, MapReduce, TensorFlow, and CUDA platforms.

Languages

- Fluent English, French, Hindi and Malayalam
- Working German and Arabic
- Fluency

Awards

- IEEE Signal Processing Society Best Paper Award
- Carnegie Institute of Technology Dean's Tuition Fellowship.
- Ranker in Euclid Canadian International Mathematics Competition 2010

Relevant Coursework

- Machine Learning and Statistical Learning Theory
- Convex Optimization
- Computer Vision
- Probability Theory and Stochastic Processes
- Information Theory
- Deep Learning and Neural Networks
- Probabilistic Graphical Models
- Sparse Optimization and Compressed Sensing
- Game Theory
- Parallel Programming and Computer Architecture

Relevant Projects

- May 2016 **Variational Inference for Gamma-Process Corrosion Models**, *Carnegie Mellon University*.
Developed a variational inference based framework using a hierarchical Bayesian model to determine and predict corrosion defects in oil pipelines
- May 2015 **Using Multi-Task Learning to Predict Signaling and Regulatory Pathways**, *Carnegie Mellon University*.
Developed a machine learning framework using multi-task learning for predicting signaling and regulatory pathways in cancer cells that employs greedy optimization-based algorithms
- October 2013 **Data Compression using Error Correcting Codes**.
Explored lossless data compression using error correcting codes. Specifically implemented and analyzed an approach to universal noiseless variable-length lossless compression based on the concatenation of the Burrows-Wheeler block sorting transform with Fountain Codes that allowed linear encoding and decoding times.
- October 2013 **Network Coding and Multi-Commodity Flow**, *UC Berkeley*.
Studied Network Coding compared with Multicommodity Flow for the k-pairs Communication Problem as part of project for graduate algorithms class. Specifically analyzed maximum achievable rate in the information flow formulation as opposed to the multicommodity flow formulation for both directed acyclic graphs as well as more general undirected graphs.
- December 2013 **Cuckoo Filter**, *UC Berkeley*.
Implemented and optimized a Cuckoo Filter, a practical data structure that replaces both counting and traditional Bloom filters because of its better lookup performance as well as the added capability of dynamic addition and removal of elements.
- October 2013 **High Resolution IF-to-Baseband Σ - Δ ADC for Radio Receiver**, *UC Berkeley*.
Designed a 4th order 1.5 bit double-sampling Σ - Δ modulator with an input-feedforward topology with state of the art 84dB DR for realization in a 180nm process technology
- May 2013 **Touch Screen Sensor Controller**, *UC Berkeley*.
Designed the analog front-end of the controller, including the capacitive sensor using a novel sensing architecture optimized for low-power using a dual-slope switched capacitor integrator based ADC in 45nm technology
- July 2012 **Facebook Search Engine**, *Greylock Hackathon*.
Created a Facebook search engine that indexes one's Facebook data and allows us to intelligently search Facebook data and apply a variety filters. Specifically worked on an image retrieval system using collaborative filtering.
- September 2012 **Face Recognition Platform**, *Yahoo Hackathon*.
Used digital image processing and novel machine learning techniques to create a robust face recognition platform.

March 2012 **Project Eigen.**

Created a custom trading and stock prediction platform using complex financial engineering techniques, discrete stochastic process theory, technical analysis, signal processing and probabilistic graphical models.