

Vidya Muthukumar

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EDUCATION	University of California, Berkeley 2014-2019 (expected) <i>MS/Ph.D, Electrical Engineering and Computer Science</i> Research interests: Game theory, machine learning, information theory, applications in spectrum sharing. Research adviser: Prof. Anant Sahai
	Indian Institute of Technology, Madras, India 2010-2014 <i>Bachelor of Technology (with Honors), Electrical Engineering</i> Research adviser: Prof. Andrew Thangaraj
PROFESSIONAL EXPERIENCE	Graduate Student Researcher Spring 2016-present <i>University of California, Berkeley</i> Supervisor: Prof. Anant Sahai Project: Analysis of spectrum regulatory games
	Graduate Student Researcher Fall 2014-Fall 2015 <i>University of California, Berkeley</i> Supervisor: Prof. Anant Sahai Project: Topics in Spectrum Sharing and Cognitive Radio
	Undergraduate Research Intern Summer 2014 <i>Inst. for Communications Engineering, Technische Universität München, Germany</i> Supervisors: Prof. Gerhard Kramer, Prof. Andrew Thangaraj Project: Stochastic Decoding of LDPC Codes
	Summer Undergraduate Research Fellow Summer 2013 <i>Electrical Engineering, California Institute of Technology</i> Supervisor: Prof. Babak Hassibi Project: Frames From Generalized Group Fourier Transforms and $SL_2(q)$
	Undergraduate Intern Summer 2012 <i>Ittiam Systems Private Limited, Bangalore, India</i> Project: Optimization of H.264 encoder for the x86 platform
	Graduate Student Instructor, EE16A, UC Berkeley Fall 2015 <ul style="list-style-type: none">• Member of content development and discussion teams for first full-scale iteration of course, offered to ~ 500 undergraduate students• Helped develop course content from scratch• Won EECS Department "Outstanding Course Development and Teaching Award"
RESEARCH PROJECTS	Game-theoretic analyses of spectrum regulation 2016-present <i>UC Berkeley with Prof. Anant Sahai</i> <ul style="list-style-type: none">• Built on previous models of primary-secondary games; established crucial implications of the order of play

- Introduced a communication-theoretic notion of partial commitment to Stackelberg strategy, showed convergence of partial commitment equilibria to Stackelberg equilibrium
- Future work: establishing connections between demonstration of Stackelberg commitment and establishment of reputation in repeated games

Ex-post enforcement for cognitive radio

2016-present

UC Berkeley with Prof. Anant Sahai

- Analyzed fundamental limits on protection that can be guaranteed to a primary and secondary user of spectrum through a game-theoretic lens
- Built on novel framework of spectrum jails, established definition of rights for primary and secondary
- Considered fully strategic behavior of primary and secondary, including possible cheating and “crying wolf” behavior
- Additionally explored information-theoretic limits of identity system required to make the spectrum jail work
- Future work: extending model to repeated game with incomplete information, studying implementability through databases and comparing performance with existing spectrum access systems

Data-driven analyses of spectrum auction and TV whitespaces

2014-2015

UC Berkeley with Prof. Anant Sahai, Kate Harrison, Vijay Kamble, Angel Daruna

- Explored effect of the Federal Communications Commission (FCC)’s upcoming incentive auctions to create LTE spectrum on TV whitespaces
- Performed data-driven analysis using existing Python code base; improved performance of core algorithm by $\sim 12X$
- Obtained novel results on whitespace availability in Canada and Australia under different rulesets by contributing to the open-source toolbox “Whitespace Evaluation Software”

Stochastic Decoding of LDPC Codes

2013-2014

IIT Madras, Senior Thesis Project; TUM, Germany

- Implemented iterative stochastic decoder for regular LDPC codes, short LDPC codes over $GF(q)$ and compared performance with existing iterative decoders.

Frames From Generalized Group Fourier Transforms and $SL_2(\mathbb{F}_q)$

2013-2014

Caltech, Summer Undergraduate Research Fellowships

- Constructed deterministic, low-coherence matrices using group theory, representation theory
- Applications: reduces sample complexity in compressed sensing, sphere decoding, quantum measurements

PUBLICATIONS

Vidya Muthukumar and Anant Sahai: “Fundamental limits on *ex-post* enforcement and implications for spectrum rights”, to be presented at IEEE Symposium on Dynamic Spectrum Access Networks, Baltimore, 2017.

Kate Harrison, **Vidya Muthukumar**, Anant Sahai: “Whitespace Evaluation Software (WEST) and its applications to whitespace in Canada and Australia”, IEEE Symposium on Dynamic Spectrum Access Networks, Stockholm, 2015.

Vidya Muthukumar, Angel Daruna, Vijay Kamble, Kate Harrison, Anant Sahai: “Whitespaces after the USA’s TV incentive auction: a spectrum reallocation case study”, IEEE International Conference on Communications, London, 2015.

Matthew Thill, **Vidya Muthukumar**, Babak Hassibi: "Frames from Generalized Group Fourier Transforms and $SL_2(\mathbb{F}_q)$ ", IEEE International Conference on Acoustics, Speech and Signal Processing, Florence, 2014.

TALKS

"Whitespace Evaluation Software and its applications to whitespace in Canada and Australia"
IEEE Dynamic Spectrum Access Networks, Stockholm, 2015.

"Whitespaces after the USA's TV incentive auction: a spectrum reallocation case study"
IEEE International Conference on Communications, London, 2015.

"Stochastic Decoding of LDPC Codes Over $GF(q)$: A Survey and Theoretical Analysis"
Technische Universität München, Germany, June 2014

"Designing Low Coherence Matrices Using Representations of $SL_2(\mathbb{F}_q)$ "
California Institute of Technology, Pasadena, July 2013

COURSE PROJECTS

Inverse Covariance Matrix Estimation With Completely Observed and Missing Data: A Literature Survey

Project for CS281A/Stat241A: Statistical Learning Theory

Surveyed the problem of Gaussian inverse covariance matrix estimation in the sparse high-dimensional regime by neighborhood regression for each node of the Gaussian graphical model. Studied the neighborhood Lasso for completely observed and partially observed case in terms of statistical and algorithmic guarantees.

Selecting secretaries under a time-varying budget

Project for CS270: Graduate Algorithms

Formulated a variant of the classical secretary problem adding a time-varying budget for picking secretaries. Characterized and obtained results for various notions of competitive ratios.

Parameters of BCH codes: Dimension, Bose distance and minimum distance

Project for EE229B: Coding Theory

Reviewed recent results determining dimensions and minimum distances of various classes of the classical Bose-Chaudhuri-Holcequem (BCH) codes. Obtained novel results on dimension for some subclasses.

Intermittent Kalman Filtering: A literature review

Project for EE223: Stochastic Control

Reviewed recent work on the problem of Kalman filtering with intermittent observations, explored through convergence analysis and fundamental properties of eigenvalues of state and observation matrices.

GRADUATE-LEVEL COURSES

Probability and Stochastic Processes
Graduate Algorithms
Introduction to Game Theory
Theoretical Statistics
Information Theory

Statistical Learning Theory
Stochastic Control Systems
Convex Optimization I
Advanced Mathematical Statistics
Coding Theory

SKILLS

Programming Languages & Software: C, C++, Python, Matlab

PROFESSIONAL SERVICE

Reviewing: IEEE International Symposium on Information Theory 2016, IEEE Transactions on Mobile Computing, Proceedings of the IEEE

Women in Computer Science and Engineering, UC Berkeley: Co-president 2016-17, outreach chair 2015-16

HONORS AND AWARDS

EECS Outstanding Course Development and Teaching Award, 2016

EECS SanDisk Fellowship, 2015: awarded to exemplary first-year EECS graduate students

Berkeley Excellence Award, 2014: awarded to incoming graduate students with exemplary academic performance

Institute Blues Certificate of Merit, IIT Madras, 2014 for all-round excellence

Summer Undergraduate Research Fellowships, Caltech, 2013

Todai-IIT Scholarship, University of Tokyo, 2012 and 2013: for **highest cumulative GPA** in the EE department

Aditya Birla Group Scholarship, 2010-14: ~ 25 recipients

Ranked 109 in India (out of 470,000) in the IIT Joint Entrance Examination, 2010

Ranked 10 in the Karnataka Regional Mathematics Olympiad, 2008. (Wrote the Indian National Mathematics Olympiad, 2009.)

Recipient of Kishore Vaigyanik Protsahan Yojana (KVPY) fellowship, 2009

Recipient of National Talent Search Examination (NTSE) scholarship, 2007