EECS 
Rising Stars 
2013
“Welcome to MIT! The Rising Stars Workshop has again brought together some of the most talented women in computer science and electrical engineering in the country. You will help lead research, education, and the professional community in these fields, and others, in the years to come. We hope this program will provide guidance and inspiration as you launch your careers, and help foster a strong collegial network that will persist long into the future.”

— Ian A. Waitz
Dean of Engineering
Jerome C. Hunsaker Professor of Aeronautics and Astronautics
MacVicar Faculty Fellow
From the 2013 Rising Stars Workshop Chairs

Welcome to the 2013 Rising Stars in EECS Workshop at MIT. The first such event in EECS was held in November 2012 and was valued by the participants as being stimulating and informative. Several of the attendees went on to secure faculty positions at top universities or research positions in industry labs.

The Rising Stars workshop is open to outstanding female PhD students in electrical engineering and computer science who are near graduation, and to postdoctoral associates. We also welcome recent female graduates working in industry. The overall goal of the workshop is to help build and strengthen the academic pipeline and network for these women. We are very grateful to the nominators of workshop participants. We would also like to thank MIT’s School of Engineering, the Office of the Dean for Graduate Education, and the EECS-affiliated research labs – CSAIL, LIDS, MTL, and RLE – for their support.

This year, the workshop brings together 40 of the world’s top young female electrical engineers and computer scientists for two days of scientific discussions and informal sessions aimed at addressing how to navigate the early stages of a faculty career. By presenting their work to each other, Rising Stars participants are also exposed to the wide range of EECS research.

The workshop will feature 14 oral presentations and 26 poster presentations by the participants, covering a wide range of specialties representative of the breadth of EECS research. The presentations span the spectrum from materials, devices and circuits to signal processing, communications, computer science theory, artificial intelligence and systems. The attendees will have an opportunity to interact with MIT faculty and other invited participants. A highlight of the workshop will be a dinner presentation by Professor Shafi Goldwasser, co-recipient of the 2013 ACM A.M. Turing Award for pioneering work in the fields of cryptography and complexity theory.

The workshop will include invited presentations targeting the academic search process, how to give an effective job talk presentation, and developing and refining one’s research and teaching statement. There will also be panels focused on early years of an academic career, covering topics such as forming and ramping up a research group, work-life balance, fund raising, and the promotions process.

The Rising Stars workshop will provide plenty of opportunity for networking, and is expected to open up opportunities for ongoing collaboration and professional support following the workshop. We are pleased to highlight and feature workshop participants by circulating this brochure to the leadership of EE/CS departments at top universities. We look forward to meeting and interacting with you all.

Anantha P. Chandrakasan, Workshop Chair
Joseph F. and Nancy P. Keithley Professor of Electrical Engineering
Department Head, MIT Electrical Engineering and Computer Science

Judy Hoyt, Technical Program Co-Chair
Professor of Electrical Engineering and Computer Science

Dina Katabi, Technical Program Co-Chair
Professor of Electrical Engineering and Computer Science
“The Rising Stars in EECS workshop presents innovative, cross-disciplinary research alongside panels emphasizing essential professional skills and the unique challenges women face as they pursue a career in academia. These vital discussions serve to both inform and inspire – giving attendees invaluable practical insight while fueling their imaginations.”

— Christine Ortiz
Dean for Graduate Education
Professor of Materials Science and Engineering
2013 EECS Rising Stars

Shiri Azenkot University of Washington
Sarah Bird NYU and Microsoft Research
Yemaya C. Bordain University of Illinois at Urbana-Champaign
Michelle Borkin Harvard University
Tamara Broderick University of California — Berkeley
Erin Carson University of California — Berkeley
Jiasi Chen Princeton University
Christina Delimitrou Stanford University
Audrey Fan Massachusetts Institute of Technology
Maria Gorlatova Columbia University
Sara E. Harrison Stanford University
Frances Hill Massachusetts Institute of Technology
Sha Huang Massachusetts Institute of Technology
S.J. Claire Hur Harvard University
Katherine Kim University of Illinois at Urbana-Champaign
Gillat Kol Institute for Advanced Study
Victoria Kostina Princeton University
Caroline P. Lai Tyndall National Institute, Ireland
I-Ting Angelina Lee Massachusetts Institute of Technology
Jiye Lee Lawrence Berkeley National Laboratory
Yanjing Li Stanford University
Po-Ling Loh University of California — Berkeley
Sarah Loos Carnegie Mellon University
Ruta Mehta Georgia Institute of Technology
Aditi Muralidharan University of California — Berkeley
Cristina Pop Stanford University
Raluca Ada Popa Massachusetts Institute of Technology
Shaloo Rakheja Massachusetts Institute of Technology
Franziska Roesner University of Washington
Nan Rong Cornell University
Cindy Rubio-González University of California — Berkeley
Olga Russakovsky Stanford University
Shang Shang Princeton University
Hyojin Sung University of Illinois at Urbana-Champaign
Yafang Tan University of Illinois at Urbana-Champaign
Jessica J. Tran University of Washington
Beth Trushkowsky University of California — Berkeley
Catherine Wah University of California — San Diego
Jue Wang Massachusetts Institute of Technology
Jean Yang Massachusetts Institute of Technology
**Optimizing Resource Allocations for Dynamic Interactive Applications in a Manycore OS**

Modern computing systems are under intense pressure to provide guaranteed responsiveness to their workloads. Ideally, applications with strict performance requirements should be given just enough resources to meet these requirements consistently, without unnecessarily siphoning resources from other applications. However, executing multiple parallel, real-time applications while satisfying response time requirements is a complex optimization problem and traditionally operating systems have provided little support to provide QoS to applications. As a result, client, cloud, and embedded systems have all resorted to over-provisioning and isolating applications to guarantee responsiveness.

In this talk, I present PACORA, a resource allocation framework designed to provide responsiveness guarantees to a simultaneous mix of high-throughput parallel, interactive, and real-time applications in an efficient, scalable manner. By measuring application behavior directly and using convex optimization techniques, PACORA is able to understand the resource requirements of applications and perform near-optimal resource allocation while only requiring a few hundred bytes of storage per application.

PACORA is implemented in the Tessellation OS, a new experimental OS designed to distribute resources to QoS domains called cells, which are explicitly parallel lightweight containers with guaranteed, user-level access to resources. The resource allocations are dynamically adjusted whenever applications change state or the mix of applications changes.

**Bio**

Sarah Bird is a Postdoctoral Associate jointly with NYU’s Center for Urban Science and Progress (CUSP) and Microsoft Research NYC. Her current research is in designing systems for big data, particularly for applications in urban informatics. Her research interests more generally include mobile and cloud computing, energy efficiency, parallel computer architecture, operating systems, machine learning, and dynamic optimization.

Sarah completed her PhD in Computer Science with the Parallel Computing Laboratory (ParLab) at University of California, Berkeley in Fall 2013. During her graduate career, she created a resource allocation framework using convex optimization, PACORA, and helped design and implement a new manycore operating system, Tessellation OS.

Her graduate work was advised by Krste Asanovic and David Patterson at Berkeley and Burton Smith at Microsoft Research. She has a B.S. in Electrical Engineering from UT Austin and has interned with Microsoft Research, Google, and IBM.

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**DigiTaps: Eyes-Free Number Entry on Touchscreens with Minimal Audio Feedback**

Eyes-free interaction on touchscreens enables people with varying visual abilities and circumstances to use mainstream mobile devices. However, current eyes-free interaction techniques rely on audio feedback, which can be difficult to hear in noisy environments or inappropriate in quiet settings. We present the eyes-free number entry method DigiTaps, which requires little auditory attention. To enter a digit, users tap or swipe anywhere on the screen with one, two, or three fingers. The 10 digits are encoded by combinations of these gestures that relate to the digits’ semantics. For example, the digit 2 is input with a 2-finger tap.

We conducted a longitudinal evaluation with 16 people (10 sighted and 6 blind) and found that DigiTaps with no audio feedback was faster but less accurate than with audio feedback after every input. Throughout the study, participants entered numbers with no audio feedback at an average rate of 0.87 characters per second, with an uncorrected error rate of 5.63%.

**Bio**

Shiri Azenkot is a fifth-year Ph.D. student in Computer Science at the University of Washington. She is advised by Richard Ladner and Jacob Wobbrock and is broadly interested in human-computer interaction and accessibility. Her dissertation explores eyes-free input on mobile devices using gestures and speech. Shiri received a Best Paper award from ACM’s ASSETS conference, a National Science Foundation Graduate Research Fellowship, and an AT&T Labs Graduate Fellowship. She holds a B.A. in computer science from Pomona College and an M.S. in computer science from the University of Washington. You can find out more at http://shiriazenkot.com.
Innovative Techniques in Atomic Force Microscopy for Nanoscale Electrical Characterization

It is difficult to imagine a more flexible platform for nanoscale instrumentation design than the modern atomic force microscope (AFM). The basic AFM instrument allows studies of localizing phenomena at the nanoscale using an atomically sharp tip with precise positioning control, an exquisitely sensitive scheme for measuring tiny forces using a flexible cantilever with laser deflection sensing, and a system to record and display measurements during a raster or line scan. Forces of electrical, magnetic, or chemical origin can be detected. Moreover, the tip can be used to transfer forces, fields, or matter to a sample at precise locations. An alphabet soup of acronyms such as CAFM, CFM, MFM, SCM, SCPM, SGM, SKPM, SSRM, and TUNA are some of the many techniques that AFM supports. This presentation will describe the development of innovative variations on AFM to extend its capabilities for nanoscale electrical characterization beyond tunneling ITUNA, gate (SGM), and capacitance (SCM) microscopy. The design of advanced electronics and shielded probes will be discussed.

Bio
Yemaya Bordain is a doctoral student in Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign. She received the B.S. in Electrical Engineering and the M.S. in Computer Science from Clark Atlanta University (CAU). Yemaya conducted research at the NASA High Performance Polymer and Composites Center at CAU where she developed instrumentation for characterizing thermoplastics. She also served as a graduate student mentor of high school teachers under the auspices of the National Science Foundation (NSF) Engineering Research Center for Advanced Engineering Fibers and Films, led by Clemson University. While at CAU, Yemaya also worked as a research engineer for a small technology company, where she developed advanced polymer composites for space flight applications for the NASA Goddard Space Flight Center, the U.S. Air Force, and Lockheed-Martin Aeronautics Company. She studied magnetic nanostructures at the National University of Singapore during an NSF East Asia and Pacific Summer Institutes fellowship. Yemaya is currently a research assistant under the direction of Professor Logan Liu, developing high-efficiency hybrid photovoltaic devices and innovative techniques in atomic force microscopy for nanoscale characterization of integrated circuits. She is an NSF Graduate Research Fellow and a Ford Foundation Pre-Doctoral Fellow.

What makes a visualization memorable?

An ongoing debate in the Visualization community concerns the role that visualization types play in data understanding. In human cognition, understanding and memorability are intertwined. As a first step towards being able to ask questions about the impact and effectiveness of visualizations, I set out to ask: “What makes a visualization memorable?” In collaboration with the Computational Visual Cognition Laboratory at MIT, we ran the largest scale visualization study to date using 2,070 single-panel visualizations, categorized with visualization type (e.g., bar chart, line graph, etc.), collected from news media sites, government reports, scientific journals, and infographic sources. Each visualization was annotated with additional attributes, including ratings for data-ink ratios and visual densities. Using Amazon’s Mechanical Turk, we collected memorability scores for hundreds of these visualizations, and discovered that observers are consistent in which visualizations they find memorable and forgettable. We find intuitive results (e.g., attributes like color and the inclusion of a human recognizable object enhance memorability) and less intuitive results (e.g., common graphs are less memorable than unique visualization types). Altogether our findings suggest that quantifying memorability is a general metric of the utility of information, an essential step towards determining how to design effective visualizations.

Bio
Michelle Borkin works on creating new approaches to interdisciplinary scientific visualization and data exploration. She co-founded the “Astronomical Medicine” project at Harvard which brings together astronomers, doctors, and computer scientists to collaborate on new analysis and visualization techniques, and cross-fertilize techniques across scientific disciplines. In her visualization research, Michelle also investigates the perceptual and cognitive properties of visualizations and works to apply these principles to improve visualizations in a variety of domains. Michelle graduated from Harvard College with a B.A. in Astronomy & Astrophysics and Physics in 2006, and is now an Applied Physics Ph.D. candidate at Harvard’s School of Engineering and Applied Sciences (SEAS) where she also received a M.S. in Applied Physics in 2011. She was a National Defense Science and Engineering Graduate (NDSEG) Fellow, and is currently a National Science Foundation (NSF) Graduate Research Fellow.
MAD-Bayes: Beyond K-means and beyond clustering

K-means is fast and conceptually straightforward. But it is designed to find a known number of equally-sized spherical clusters (mutually exclusive and exhaustive groups of data points that reflect latent structure). Bayesian methods have proven effective at discovering clusters as well as more general latent structure; using Bayesian methods, we can relax the assumptions that we know the number of clusters, that latent groups of data points are mutually exclusive or exhaustive, etc. But Bayesian methods are often slower and require more background knowledge than K-means. We have designed a method to transform Bayesian methods for latent structure problems into optimization problems with objective functions similar to K-means. From these optimization problems, we derive algorithms that are faster and simpler than Bayesian inference but retain much of the flexibility of the original Bayesian models. As an example, we show how our method produces an objective function and algorithm for learning groups of data points called features that need not be exclusive or exhaustive [in contrast to clusters]. The number of features learned is unbounded. We demonstrate novel and fast performance in computer vision experiments.

Bio
Tamara Broderick is a Ph.D. candidate in the Department of Statistics at the University of California, Berkeley. Her research in machine learning focuses on the design and study of Bayesian nonparametric models, with particular emphasis on feature allocation as a generalization of clustering that relaxes the mutual exclusivity and exhaustivity assumptions of clustering. While at Berkeley, she has been a National Science Foundation Graduate Student Fellow and a Berkeley Fellowship recipient. She graduated with an A.B. in Mathematics from Princeton University in 2007—with the Phi Beta Kappa prize for highest average GPA in her graduating class and with Highest Honors in Mathematics. She spent the next two years on a Marshall Scholarship at the University of Cambridge, where she received a Masters of Advanced Study in Mathematics for completion of Part III of the Mathematical Tripos (with Distinction) in 2008 and an M.Phil. by Research in Physics in 2009. She received a Masters in Computer Science from UC Berkeley in 2013.

High Performance Iterative Solvers for Scientific Computing

The runtime of an algorithm can be modeled as a function of computation cost, the number of arithmetic operations, and communication cost, the amount of data moved. Traditionally, to increase algorithm performance, one sought to minimize arithmetic complexity. On today’s computer systems, however, the time to move one word of data is much greater than the time to complete one floating point operation. Many algorithms are thus communication-bound on modern machines. This has resulted in a paradigm shift in the design of high-performance algorithms: to achieve efficiency, one must focus on strategies which minimize data movement, rather than minimize arithmetic operations. We call this a communication-avoiding approach to algorithmic design.

Linear systems and eigenvalue problems constitute the core computational kernels in a wide variety of scientific applications. Iterative methods, which repeatedly refine a candidate solution until some stopping criteria is met, are commonly used when the matrix is very large and sparse. The most general and flexible class of iterative methods are Krylov subspace methods. These methods are based on vector projection onto expanding subspaces, where, in iteration k, the solution is updated using the Krylov subspace

\[ \mathbf{K}_k (A,v) = \text{span} \{ v, A v, A^2 v, \ldots, A^{k-1} v \} \]

This process requires one or more sparse matrix-vector multiplications and one or more inner product operations in each iteration, both communication-bound operations on modern computer architectures.

In this talk, we present communication-avoiding Krylov subspace methods, which asymptotically reduce the communication cost versus classical implementations. By performing a change of basis operation, we can exploit temporal locality by computing blocks of iterations at a time. We discuss the derivation and mathematical basis for communication-avoiding Krylov methods, as well as issues with performance, implementation, and numerical stability in practice.

Bio
Erin Carson is a current Ph.D. student and NDSEG Fellow in the EECS Department at the University of California, Berkeley. Advised by James Demmel and Armando Fox, her research lies at the intersection of high performance computing, numerical analysis, and computational science. As a student in the Designated Emphasis in Computational Science and Engineering program, she is passionate about helping computational scientists in various domains leverage available computing power by designing efficient and reliable algorithms for modern platforms.

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Are High Performance and High Utilization Mutually Exclusive in Modern Datacenters?

Cloud computing promises flexibility, high performance, and low operating costs. However, cloud computing facilities today operate at very low utilization, wasting tens of megawatts and preventing performance scalability. Current cluster managers require users to express their resource needs in the form of reservations. This is suboptimal, as users do not necessarily understand the load variations and resource requirements of complex codebases. Additionally, these clusters are highly heterogeneous and experience varying amounts of interference from concurrently-running workloads, causing the users to be conservative, often reserving orders of magnitude more resources than needed, to sidestep performance unpredictability. We study a 3000-server cluster at Twitter managed by Mesos and show that despite utilization being higher compared to clusters dedicated to a specific service, most applications either overprovision their allocations, reducing efficiency or underprovision allocations, hurting performance.

In this work we present Quasar, a cluster management system that increases utilization while providing high application performance. Quasar employs three techniques. First, it does not rely on reservations. Instead, users express performance constraints for each workload, letting Quasar determine the appropriate resources to meet these constraints. Second, Quasar avoids the high profiling overheads of previous approaches by leveraging the large amount of data the system already has about previously-scheduled applications. It mines this data using classification techniques to quickly determine the impact that the amount and type of resources have on workload performance. Third, it uses the classification results to explore the large space of options for an efficient way to pack workloads on available resources without violating QoS constraints. Quasar also monitors application performance and adjusts its decisions when needed. We evaluate Quasar over a range of workload scenarios, including combinations of distributed frameworks and low-latency, stateful services, both on a local cluster and a 200-server EC2 cluster.

Bio
Christina Delimitrou is a Ph.D. student in the Electrical Engineering Department at Stanford University, where she works with Professor Christos Kozyrakis. Her main interest is in computer architecture and computer systems. Specifically she works on QoS-aware techniques for scheduling and resource management in large-scale datacenters. In the past she has also worked on datacenter application and system modeling. Christina has earned an MS from Stanford University in December 2011. Prior to Stanford, she graduated with a diploma in Electrical and Computer Engineering from the National Technical University of Athens. She is the recipient of the Arvanitidis Stanford Graduate Fellowship. http://www.stanford.edu/~cdel/

Quota-Aware Video Adaptation

Two emerging trends of Internet applications, video traffic becoming dominant and usage-based pricing becoming prevalent, are at odds with each other. Given this conflict, is there a way for users to stay within their monthly data plans [data quotas] without suffering a noticeable degradation in video quality? We develop an online video adaptation system, called Quota Aware Video Adaptation (QAVA), that manages this tradeoff by leveraging the compressibility of videos and by predicting consumer usage behavior throughout a billing cycle. We propose the QAVA architecture and develop its main modules, including Stream Selection, User Profiling, and Video Profiling. Online algorithms are designed through dynamic programming and evaluated using real video request traces. Empirical results suggest that QAVA can provide an effective solution to the dilemma of usage-based pricing of heavy video traffic.

Bio
Jiasi Chen is a fourth-year Ph.D. candidate in electrical engineering at Princeton University, working with Mung Chiang. She received a B.S. in electrical engineering from Columbia University in 2010 and a M.A. from Princeton University in 2012. Her research interests include video streaming, wireless networks, network economics, and mathematical optimization.
Quantitative Magnetic Resonance Imaging of Oxygen Metabolism in the Human Brain

Continuous oxygen delivery to neural tissue is necessary to maintain normal brain function, and the healthy brain consumes 20% of total body energy through aerobic metabolism. Reliable measurements of brain oxygenation can provide critical information to manage diseases in which this oxygen supply is disturbed, including stroke, tumor, and multiple sclerosis (MS). In acute stroke, for instance, metabolic indicators such as local oxygen extraction have been shown to identify tissue at risk of infarction. This knowledge can then be used to identify patients who are candidates for reperfusion therapies or to avoid thrombolytic therapy in futile situations.

However, clinically feasible assessment of brain oxygenation is not currently available. Such measurements are technically challenging and traditionally have relied on positron emission tomography (PET) imaging with short-lifetime 150 radiotracers. Because 150 PET imaging requires complex setup and equipment that is not widely accessible to hospitals, radiologists are unable to evaluate oxygenation in medical routines. Our work aims to address this need through development of a clinically viable tool to examine brain oxygenation levels with magnetic resonance imaging (MRI).

We have designed a novel oxygenation imaging method, termed Phase-based Regional Oxygen Metabolism (PROM), to quantify oxygenation in cerebral veins. MRI phase images are sensitive to local, oxygenation-dependent magnetic field variations in brain vessels, due the presence of paramagnetic deoxyhemoglobin molecules in venous blood. In an initial study of 12 healthy subjects, we demonstrated that PROM is feasible on a 3 Tesla MRI scanner. The PROM oxygenation measurements in volunteers at rest were within the expected physiological range from PET studies. We additionally detected normal regional variations between brain lobes that were consistent with the PET literature. This study was recently published in a journal edited by the International Society of Magnetic Resonance in Medicine.

Bio
Audrey is a Ph.D. student working with Elfar Adalsteinsson in the Research Laboratory of Electronics at MIT and Bruce Rosen at the Athinoula A. Martinos Imaging Center. Her dissertation project focuses on development of new MRI acquisition and image reconstruction methods for physiological imaging in the human brain. In the future, Audrey sees herself as a faculty member who can work closely with engineers and clinicians to develop diagnostic tools to address unmet clinical needs. Audrey is originally from Los Angeles, California and received a B.Sc. in electrical engineering and in biological sciences from Stanford University.

Energy Harvesting Active Networked Tags (EnHANTS) for Ubiquitous Object Networking

In the Columbia University Energy Harvesting Active Networked Tags (EnHANTS) project we design and develop the EnHANTS that will be small, flexible, and energetically self-reliant tags. EnHANTS will be attached to objects that are traditionally not networked (books, furniture, walls, doors, toys, keys, clothing, and produce), thereby providing the infrastructure for novel tracking applications, such as locating misplaced objects and continuous peer-based object monitoring. More information about the EnHANTS project is available at enhants.ee.columbia.edu.

Recent advances in ultra-low-power circuit design, ultra-wideband impulse-radio wireless communications, and in organic energy harvesting technologies will enable the realization of the EnHANTS in the near future. In this presentation, I will describe the important paradigm shifts associated with the underlying technologies enabling the EnHANTS, and will talk about our efforts in designing and developing the EnHANTS prototypes and the prototype testbed. I will also present the results of the indoor light energy and human and object motion energy measurement studies we have conducted to characterize the EnHANTS energy availability. I will also describe the energy-harvesting-adaptive communication and networking algorithms we have been designing and developing for the EnHANTS. This presentation is based on the publications that appeared in the ACM MobiCom ’09, IEEE WiOpt’ 11, IEEE INFOCOM’ 11, ACM ITiCSE’ 13, and IEEE INFOCOM’ 13. EnHANTS project recognitions include the 1st place in the Vodafone Americas Foundation Wireless Innovation Competition, the 2011 IEEE Communications Society Award for Advances in Communications, and the 2011 ACM SenSys Best Student Demonstration Award.

Bio
Maria Gorlatova is a postdoctoral researcher at the Columbia University Department of Electrical Engineering. Her current research is in the area of wireless and mobile networks, with a particular focus on the emerging Internet of Things devices and applications. She recently received the Ph.D. in Electrical Engineering from Columbia University. Her Ph.D. dissertation, focused on networking ultra low power energy harvesting devices, was recognized with the highest departmental distinction (the Jury Award for Outstanding Achievement in Communications). Previously, Maria received the B.Sc. (Summa Cum Laude) and the M.Sc. degrees in Electrical Engineering from University of Ottawa, Canada. She also previously worked as a research scientist, specializing in security of wireless networks, at Defense R&D Canada and at Telcordia Technologies Advanced Research.

Maria is a recipient of the Columbia University Presidential Fellowship, Canadian Graduate Scholar CGS NSERC Fellowships, and the 2012 Google Anita Borg USA Fellowship. She is a co-recipient of the 2011 ACM SenSys Best Student Demo Award and the 2011 IEEE Communications Society Award for Advances in Communications.
Molecular Beam Epitaxial Growth of Topological Insulator Thin Films

In recent years, three-dimensional topological insulators in the bismuth telluride (Bi2Te3) family have attracted significant interest from the condensed matter community as potential candidates for next generation interconnects, room temperature spintronics, quantum computation, and surface state enhanced thermoelectric devices. However, since the experimental discovery of this new electronic phase of matter, the growth of high quality, large area topological insulator thin films has been a major obstacle to exploring new physics and proposed device applications.

We present our efforts to synthesize high quality Bi2Te3 topological insulator thin films using a two-temperature step molecular beam epitaxy (MBE) growth process. The use of MBE has also enabled us to incorporate large concentrations (up to 40%) of gadolinium (Gd) into bismuth telluride, which ordinarily has a Gd solubility of less than 5%. The stoichiometric magnetic topological insulator GdBiTe3 has been proposed as a candidate material for realizing the quantum anomalous Hall effect. We will discuss the growth and characterization of our Bi2Te3 and magnetically doped (GdxBi1-x)2Te3 thin films.

Bio
Sara E. Harrison is a Ph.D. candidate in electrical engineering at Stanford University. Her Ph.D. thesis work is focused on the molecular beam epitaxial growth and characterization of topological insulator thin films. Prior to joining the Harris MBE group at Stanford in 2010, Sara received her M.S. in electrical and computer engineering from Purdue University while studying the growth of epitaxial graphene on 4H-silicon carbide and characterization by scanning tunneling microscopy. Sara completed her undergraduate studies in 2008 at the University of South Florida. She is a recipient of a National Defense Science and Engineering Graduate (NDSEG) Fellowship and a Diversifying Academia, Recruiting Excellence (DARE) Doctoral Fellowship. Sara’s research interests include novel materials growth, solid state radiation detectors, betavoltaics, and biomedical devices. In her spare time, Sara enjoys spending time with her husband Gabriel, running, kickboxing, reading, and baking.

High-Throughput Microfabricated Electrospray Source for Ionic Liquids with an Integrated Extractor Grid and Carbon Nanotube Flow Control Structures

Efficient high-throughput generation of ions using electrospray ionization is of great interest for a number of emerging applications including mass-efficient nanosatellite electric propulsion, multiplexed focused ion beam imaging, and high-throughput nanomanufacturing. We report the design, fabrication and experimental characterization of batch-microfabricated MEMS multiplexed externally-fed electrospray arrays with an integrated extractor grid and carbon nanotube flow control structures for high-throughput generation of ions from ionic liquids in vacuum. The electrospray source is composed of two microfabricated silicon electrodes: an emitter die and an extractor grid die. The emitter die contains an array of sharp emitter tips and the extractor grid die contains a matching array of circular apertures. When the two dies are assembled, each emitter tip sits centered underneath a grid aperture. Arrays with as many as 1900 emitter tips in 1 cm² have been fabricated: these emitters are 450 μm tall and have a sidewall taper angle of 80° from the horizontal. A conformal carbon nanotube film is grown on the surface of the emitters to provide a highly effective wicking structure to transport liquid up the emitter surface to the emission site at the tips where the electric field is highest. Experimental characterization of the electrical performance of the emitter devices shows symmetric emission in both polarities with as much as 5 μA of emitted current per tip, startup voltages as low as 550 V and greater than 80% transmission, on par with the best reported results in the literature. The emitter density, output current and output current density are all five times higher than the best reported values in the literature. Imprints on a collector electrode demonstrate uniform operation across the emitter arrays and mass spectrometry has established that the electrospray arrays operate in the pure ionic regime.

Bio
Dr. Frances Hill is a Postdoctoral Associate who received her Ph.D. in Mechanical Engineering from the Massachusetts Institute of Technology in 2011. She earned a Master of Science degree from MIT in Mechanical Engineering in 2008 and a Bachelor of Applied Science degree from the University of Waterloo in Systems Design Engineering on the Dean’s Honour List in 2006. She is the recipient of Natural Sciences and Engineering Research Council of Canada (NSERC) Postgraduate Scholarships at the Master’s and doctoral levels. Her Ph.D. research focused on studying the mechanical properties and energy storage capabilities of carbon nanotubes. Dr. Hill is currently a Postdoctoral Associate in the Microsystems Technology Lab at MIT, where she is developing MEMS-based electrospray emitters and NEMS cathodes for X-Ray generation.
Sha Huang
Ph.D. Candidate
Research Laboratory of Electronics
Massachusetts Institute of Technology

Differential Inertial Microfluidics: Label-free cell manipulation and functionalization for biomedical research

Alteration in single-cell physical properties (e.g., size, deformability, and shape) has been identified to be a useful indicator of changes in cellular phenotype for important biological research and clinical applications. Our lab has focused on developing techniques that can (i) continuously but differentially position bio-particles to geometrically-determined equilibrium positions in flow, and/or (ii) isolate and maintain identical populations of cells in the designated region of the channel without additional external forces. Recent research findings showed that dynamic equilibrium positions are strongly influenced by flow characteristics and physical properties of cells. Therefore, novel techniques, allowing high-throughput single-cell deformability measurement and target cell enrichment based on deformability, would expand the research use and clinical adoption of this biomarker.

Bio
Sha Huang is a fifth-year graduate student from the EECS department at MIT. For the past several years, she has been working in Prof. Jongyoon Han’s lab on the general topic of the biomechanics of red blood cells (RBCs). Her research focuses on using a microfluidic device to measure RBC deformability and apply cell deformability as an important biomarker to several blood related problems including malaria and blood storage lesion. The ultimate goal of her Ph.D. project is to be able to quantify assess population-wide single RBC deformability and aid in the decision-making of various clinical scenarios, such as drug screening and blood transfusion.

S.J. Claire Hur
Junior Fellow
Rowland Institute
Harvard University

The Mechanical Clearance of Red Blood Cells in the Spleen

Red blood cells (RBCs) circulate for approximately 500,000 times and undergo repeated deformations in small blood capillaries and splenic cords. During RBC microcirculation, the spleen plays a critical role in removing old and abnormal RBCs, and some of the clearance mechanisms are believed to be mechanical rather rather than biochemical. The special structure of spleen, which is composed of dense meshwork with pore sizes between 1-3 um, enables it to function as a “mechanical sieve”: RBCs have to deform extensively to remain in circulation. Being able to establish the important correlation of RBC deformability and splenic RBC retention can advance our understanding of multiple blood related problems such as malaria disease and blood storage lesion. Our goal here is to quantitatively assess population-wide single RBC deformability and aid in the decision-making of various clinical scenarios including drug screening and blood transfusion.

Malaria Pathology
In the case of malaria, infected RBCs exhibit impaired deformability. Mechanical splenic filtration thus plays a major part in the host’s defense against malaria parasites. Several important questions relating malaria pathology can be addressed through the understanding of RBC filtration in spleen. The effects of malaria infection and/or antimalarial drug treatment on RBC deformability and on splenic RBC retention are explored. A statistical model is developed to estimate the deformability threshold for in vivo RBC clearance.

Blood Storage Lesion
The age of stored blood plays a critical risk factor in blood transfusion. Rapid clearance of transfused RBC is believed to account for the added risk. Over storage time, RBC deformability decreases, accompanied with a rise in the intracellular calcium level. In this project, we demonstrate that through a deformability-based mechanical sorting, we are able to remove “bad” RBC subpopulation. Potentially, it could be used to extend RBC shelf-life and reduce blood age related transfusion risks.

Bio
S.J. Claire Hur is currently a junior fellow at Rowland Institute at Harvard. She received her B.S., M.S. and Ph.D. in Mechanical Engineering from UCLA in 2005, 2007 and 2011, respectively. During her study at UCLA, she has received numerous awards and scholarships, including Edward K. Rice Outstanding Doctoral Student award, HSSEAS academic scholarship, MAE department’s Chevron scholarship and UCLA Dean’s special fellowship. She has conducted her doctoral work under supervision of professor Di Carlo in Bioengineering department and her PhD thesis focused on development of label-free rare cell purifying inertial microfluidic devices. She co-authored 12 peer-reviewed journals, including three articles featured as journal covers, 29 conference proceedings, 2 US patents, and 1 international patent. She has been selected as one of two junior fellows at Rowland Institute at Harvard in September 2011 with 5 years of research funding for conducting her independent postdoctoral research.
Detection Methods for Hot Spot Faults in Photovoltaic Systems

As the power grid becomes more intelligent, renewable energy sources will require higher levels of monitoring and control. In photovoltaic (PV) systems, the ability to detect fault conditions allows the control to react quickly and protect the system. Hot spots in PV strings are a type of fault that can lead to reduced power output and permanent damage in PV systems. Bypass diodes are typically employed to mitigate this problem, but field studies have shown that hot spots still develop in PV string with bypass diodes.

When a PV string goes into a hot spot condition, a distinct change can be detected in the string’s parallel resistance and capacitance. The objective is to detect this change in characteristics without interrupting normal operation. Observer-based and least-squares parameter estimation techniques are explored to measure the string’s characteristics in real-time to detect hot spot formation. These methods can be incorporated into the power converter that is used to control PV string operation. Many of the components needed to implement hot spot detection are already employed in PV converters, but sensors and processors may need to be upgraded. Once implemented, PV systems will be able to monitor for hot spots and, potentially, other faults in PV string with bypass diodes.

Interactive Channel Capacity

In a profoundly influential 1948 paper, Claude Shannon defined the entropy function H, and showed that the capacity of a symmetric binary channel with noise rate (bit flip rate) $\epsilon$ is $1-H(\epsilon)$. This means that one can reliably communicate $n$ bits by sending roughly $n / (1-H(\epsilon))$ bits over this channel.

An interactive communication protocol is a protocol between several players that allows them to compute a function of their private inputs. The extensive study of such protocols in the last decades gives rise to the related question of finding the capacity of a noisy channel when it is used interactively.

We define interactive channel capacity as the minimal ratio between the communication required to compute a function (over a non-noisy channel), and the communication required to compute the same function over the $\epsilon$-noisy channel. We show that the interactive channel capacity is roughly $1-c\sqrt{H(\epsilon)}$ for a constant $c$. Our result gives the first separation between interactive and non-interactive channel capacity.

Joint work with Ran Raz.

Bio

Katherine Kim received her B.S. degree in electrical and computer engineering from Franklin W. Olin College of Engineering, Needham, MA, in 2007. She received her M.S. degree in electrical and computer engineering from the University of Illinois, Urbana-Champaign, in 2011, where she is currently working toward a Ph.D. degree. She received the National Science Foundation’s East Asian and Pacific Studies Institute Fellowship in 2010 and Graduate Research Fellowship in 2011. She is the Student Membership Chair for the IEEE Power Electronics Society and is an active member and organizer in her local IEEE student chapter at the University of Illinois. Her current research interests are power electronics, modeling, control, and protection for photovoltaic systems.

Gillat Kol

Postdoctoral Researcher

Institute for Advanced Study

School of Mathematics

Princeton University

Interactive Channel Capacity

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Joint work with Ran Raz.

Bio

I am postdoctoral researcher at the school of Mathematics at the Institute for Advanced Study (IAS), Princeton. I received my Ph.D. in Computer Science from the Weizmann Institute, Israel. My research interest is in Complexity Theory (theoretical computer science), with a focus on Information Theory, Interactive Communication, and Boolean function analysis.
Lossy data compression: nonasymptotic fundamental limits

The basic tradeoff in lossy compression is that between the compression ratio (rate) and the fidelity of reproduction of the object that is compressed. Traditional (asymptotic) information theory seeks to describe the optimum tradeoff between rate and fidelity achievable in the limit of infinite length of the source block to be compressed. A perennial question in information theory is how relevant the asymptotic fundamental limits are when the communication system is forced to operate at a given fixed blocklength. The finite blocklength (delay) constraint is inherent to all communication scenarios. In fact, in many systems of current interest, such as real-time multimedia communication, delays are strictly constrained, while in packetized data communication, packets are frequently on the order of 1000 bits.

Motivated by critical practical interest in non-asymptotic information-theoretic limits, we study the optimum rate-fidelity tradeoffs in lossy source coding and joint source-channel coding at a given fixed blocklength.

While computable formulas for the asymptotic fundamental limits are available for a wide class of channels and sources, the luxury of being able to compute exactly (in polynomial time) non-asymptotic fundamental limits is affordable. One can at most hope to obtain bounds and approximations to information-theoretic non-asymptotic fundamental limits. Our main findings include tight bounds on the non-asymptotic fundamental limits in lossy data compression and transmission, valid for general sources without any assumptions on ergodicity or memorylessness. Moreover, in the stationary memoryless case we show a simple formula approximating the nonasymptotic optimal coding rate that involves only two parameters of the source.

Bio
Victoria Kostina received the Bachelors degree with honors in applied mathematics and physics from the Moscow Institute of Physics and Technology, Russia, in 2004, where she was affiliated with the Institute for Information Transmission Problems of the Russian Academy of Sciences, and the Masters degree in electrical engineering from the University of Ottawa, Canada, in 2006. In September 2013, she completed her Ph.D. in electrical engineering at Princeton University, and is currently a postdoctoral researcher working with Prof. Sergio Verdú. Her research interests lie in information theory, theory of random processes, coding, and wireless communications.

Energy-Efficient Colorless Photonic Technologies for Next-Generation Wavelength-Division-Multiplexed Metro and Access Networks

Realizing energy-efficient, high-bandwidth network architectures and photonic components is imperative to ensure the future scaling of metro and access network infrastructures. In current state-of-the-art networks, dense wavelength-division-multiplexing (DWDM) offers terabit-scale fiber capacities; however, exponentially-increasing traffic demands are emphasizing the need for innovative next-generation DWDM technologies with reduced energy consumption and cost-per-bit.

Within the scope of our EU project C3PO, we are developing novel, energy-efficient, colorless photonic technologies for low-cost DWDM metro transport and access networks. The colorless transmitters use reflective arrayed photonic integrated circuits, particularly hybrid reflective electroabsorption modulators, and multi-wavelength laser sources, with custom power-efficient driver circuitry. A low-loss piezoelectric beam-steering optical matrix switch allows for dynamic wavelength reconfigurability. Simplifying the required optical and electronic hardware, as well as avoiding the need for expensive, thermally-stabilized tunable lasers, will yield cost and energy savings for data switching applications in future metro, access, and datacenter interconnection networks.

I will review the recent advancement toward these low-power optical networks, providing the latest systems results achieved with key enabling hybrid photonic integrated devices and electronic driver/receiver arrays for our targeted applications. Specifically, the first demonstration of error-free 25-Gb/s duobinary transmission using a colorless hybrid reflective integrated modulator is highlighted. This work paves the way to realizing a four-channel arrayed photonic integrated circuit for 100-Gb/s aggregate data rates, with sufficient dispersion tolerance and error performance to provide 100 Gigabit Ethernet services in future metro network applications.

Bio
Caroline P. Lai received the B.A.Sc. degree (with honors) from the University of Toronto, Toronto, ON, Canada in 2006, and the M.S. and Ph.D. degrees from Columbia University, New York, NY, USA, in 2008 and 2011, respectively, all in electrical engineering. At Columbia, she was a member of the Lightwave Research Laboratory, and her Ph.D. work was performed under the guidance of Professor Keren Bergman. From May 2010 to August 2010, she was a research intern in the Optical Link and Systems Design group at IBM T. J. Watson Research Center, Yorktown Heights, NY, working under Dr. Jeffrey A. Kash. She is currently a postdoctoral researcher in the Photonic Systems Group at the Tyndall National Institute, Cork, Ireland. Her research interests lie in colorless energy-efficient photonic technologies for next-generation access and metro networks, and cross-layer optimized architectures for future optical networks. She was a recipient of the IEEE Photonics Society 2010 Graduate Student Fellowship. She is a member of the IEEE Photonics Society and the OSA.
Memory Abstractions for Parallel Programming

A memory abstraction is an abstraction layer between the program execution and the memory that provides a different “view” of a memory location depending on the execution context in which the memory access is made. Properly designed memory abstractions help ease the task of parallel programming by mitigating the complexity of synchronization and/or admitting more efficient use of resources.

The first memory abstraction is the cactus stack memory abstraction in Cilk-M, a Cilk-based work stealing runtime system. Many multithreaded concurrency platforms that use a work-stealing runtime system incorporate a “cactus stack” to support multiple stack views for all the active children simultaneously. The use of cactus stacks, albeit essential, forces concurrency platforms to trade off between performance, memory consumption, and interoperability with serial code due to its incompatibility with linear stacks. We propose a new strategy to build a cactus stack using “thread-local memory mapping,” which allows worker threads to have their respective linear views of the cactus stack. This cactus stack memory abstraction enables a concurrency platform that employs a work stealing runtime system to satisfy all three criteria simultaneously.

The second memory abstraction is reducer hyperobjects (or reducers for short), a linguistic mechanism that helps avoid determinacy races in dynamic multithreaded programs. The Cilk-M runtime system supports reducers using the memory-mapping approach, which utilizes thread-local memory mapping and leverages the virtual-address translation provided by the underlying hardware to implement this memory abstraction. This memory mapping approach yields a close to 4x faster access time compared to the existing approach of implementing reducers.

Bio

I-Ting Angelina Lee is a postdoctoral associate in Computer Science and Artificial Intelligence Laboratory (CSAIL) at MIT, working with Prof. Charles E. Leiserson. Her primary research interest is in the design and implementation of programming models, languages, and runtime systems to support multithreaded software. She received her Ph.D. from MIT, under the supervision of Prof. Charles E. Leiserson. In her Ph.D. thesis, she investigated several memory abstractions, which help ease the task of parallel programming. Her prior work includes the “ownership-aware” transactional-memory methodology, the first transactional memory design that provides a structured programming style with provable safety guarantees for “open-nested” transactions, and JCilk, a variant of Java with multithreading provided by Cilk’s fork-join primitives, that has exception-handling semantics which integrate synergistically with those primitives. She received her Bachelor of Science in Computer Science from UC San Diego, where she worked on the Simultaneous Multithreading Simulator for DEC Alpha under the supervision of Prof. Dean Tullsen.

Excitonic Devices for Photovoltaics and Nanophotonics

Excitons are an energy packet that mediates the conversion between photons and electrons in various nanomaterials, such as organic molecules, quantum dots, and 2D semiconductors. By controlling excitons, I demonstrate two optoelectronic devices that enable functions that conventional semiconductors could not achieve.

The first device is a solar cell that doubles the electricity generated from the blue part of the sunlight. Conventional solar cells generate one electron for each absorbed photon. Exciton fission in organic molecules splits a high-energy excitons into a pair of low-energy ones. In solar cells, it promises to increase the photocurrent twofold for the blue solar spectrum. In this talk, I will present fission-based photovoltaic cells that produce more than one electron per photon in the visible spectrum. Also, I will discuss the fundamental mechanism governing exciton fission, which is crucial to the development of fission-enhanced photovoltaics.

The second device is an electrically-controllable nanoscale light source. Such devices may find applications ranging from integrated photonic circuits to optical control of biological systems. I will demonstrate electrical switching of light emission from semiconductor nanocrystals by controlling excitonic interaction between nanocrystals and graphene.

Bio

Jiye Lee is currently a postdoctoral fellow in the Molecular Foundry at Lawrence Berkeley National Laboratory. She received her Ph.D. in electrical engineering from MIT under the supervision of Prof. Marc Baldo. Her Ph.D. thesis won the Microsystems Technology Laboratories Doctoral Dissertation Seminar at MIT. She obtained her B.S. in electrical engineering from KAIST in South Korea.
Online Self-Test, Diagnostics, and Self-Repair for Robust System Design

Electronic system malfunctions resulting from hardware failures are a growing concern. For future generations of silicon integrated circuits (ICs) with remarkably small geometries, several hardware failure mechanisms that were largely benign in the past are now becoming visible. Therefore, a large class of future systems will require tolerance of hardware failures during their operation. Hardware failures can be broadly classified as permanent or temporary. This work focuses on tolerating permanent failures.

Online self-test and diagnostics enable a system to test itself during normal operation for detecting and localizing permanent failures. We present three new online self-test ideas:

1. A technique called CASP (Concurrent Autonomous chip self-test using Stored test Patterns) which achieves thorough online self-test at 1% chip-level power, speed, and area costs.

2. Software orchestration techniques that minimize visible system performance impact during online self-test of processor cores.

3. New design principles that minimize system-level performance impact during online self-test of uncore components (e.g., cache / memory / I/O controllers). Although uncore components occupy significant portions of multi-core ICs, little existing research targets online self-test of these components.

We demonstrate the effectiveness of these techniques using the OpenSPARC T2 design supporting 8 processor cores and 64 hardware threads. Upon failure localization, self-repair techniques are required to keep the system functioning correctly. Unlike memories and processor cores, little attention has been paid to self-repair of uncore components. Naive uncore redundancy imposes significant (e.g., 20%) chip-level area costs. We present new techniques that enable cost-effective self-repair of uncore components. For OpenSPARC T2, the chip-level area, power and performance impacts are 7%, 3%, and 5%, respectively, for self-repair of any single faulty component. Our techniques are capable of self-repairing multiple faulty components with graceful degradation of system performance. However, if no failure occurs, our techniques do not introduce any performance impact.

Bio
Yanjing Li is a research scientist at Intel Labs and a visiting scholar at Stanford University. She received her Ph.D. in Electrical Engineering from Stanford University in 2013, a M.S. in Mathematical Sciences and a B.S. in Electrical and Computer Engineering from Carnegie Mellon University in 2006. Yanjing has authored and presented award-winning papers at IEEE International Test Conference and IEEE VLSI Test Symposium. She has also been awarded an Intel Divisional Recognition Award. Her research interests include robust system design, validation and test, and computer architecture and system software for emerging technologies and applications.

Learning with systematically corrupted data

We present a line of recent work on methods for statistical inference in settings where the number of parameters is much larger than the number of samples. As in many real-world problems, observations are not collected cleanly and may be subject to systematic corruptions such as missing data and/or additive noise.

Our first result involves theoretical and empirical results concerning the “corrected Lasso,” which may be used to perform sparse linear regression with corrupted data. We discuss applications of the corrected Lasso in the context of magnetic resonance imaging (MRI) with corrupted k-space acquisitions. On the theoretical side, we describe issues of nonconvexity that arise from our inference procedures, and propose optimization algorithms that are nonetheless guaranteed to produce statistically consistent solutions. Time permitting, we discuss links between our results on corrected Lasso and new procedures for structural estimation in undirected graphical models with corrupted data.

This is joint work with Martin Wainwright.

Bio
Po-Ling will be entering her 5th (and final) year as a Ph.D. student in the statistics department at UC Berkeley. She earned a masters degree in computer science from Berkeley in May 2013. Prior to arriving at Berkeley, Po-Ling grew up in Madison, Wisconsin, and graduated from Caltech with a B.S. in math and a minor in English in 2009.

Po-Ling’s research comprises a range of topics in theoretical statistics, with applications to high-dimensional problems in science and engineering. Her research on high-dimensional linear regression has potential applications in compressed sensing MRI with corrupted measurements, and her work on inference in Gaussian and discrete graphical models, which earned her a best paper award at the Neural Information Processing Systems (NIPS) conference in 2012, is relevant for statistical problems arising from social networks and epidemiology. More recently, Po-Ling has been working on developing new theoretical results concerning local optima of certain types of nonconvex functions.

Po-Ling is a recipient of the Hertz Fellowship and has also been supported by the NSF and NDSEG Fellowships during her graduate career.
Formal Verification of Distributed Aircraft Controllers

As airspace becomes ever more crowded, air traffic management must reduce both space and time between aircraft to increase throughput, making on-board collision avoidance systems ever more important. These safety-critical systems must be extremely reliable and work properly under every circumstance. In tough scenarios where a large number of aircraft must execute a collision avoidance maneuver, a human pilot under stress is not necessarily able to understand the complexity of the distributed system and may not take the right course, especially if actions must be taken quickly. We consider a class of distributed collision avoidance controllers designed to work even in environments with arbitrarily many aircraft. We prove the controllers never allow aircraft to get too close to one another, even when new planes approach an in-progress avoidance maneuver. Because these safety guarantees always hold, the aircraft are protected against unexpected emergent behavior that simulation and testing may miss.

Bio
Sarah Loos earned B.S. degrees in Computer Science and Mathematics from Indiana University in 2009. She is currently working toward her Ph.D. in Computer Science at Carnegie Mellon University, where she is working with her advisor, André Platzer, on formal verification techniques for cyber-physical systems. In particular, she is working to minimize the mismatch between the combinations of dynamics that occur in complex physical systems and the limited kinds of dynamics currently supported in analysis.

Sarah is pleased to serve on the board of trustees for the Anita Borg Institute, and as co-editor of the ACM-W Newsletter. Her research is supported in part by a Computational Science Graduate Fellowship from the Department of Energy.

For more information, visit www.cs.cmu.edu/~sloos.

A Polynomial Time Algorithm for Rank-1 Two-Player Games (Despite Disconnected Solutions)

A non-cooperating, two-player finite game can be represented by two payoff matrices (A, B), one for each player. The rank of such a game (A, B) is defined as the rank of (A+B). For zero-sum games, i.e., rank-0, von Neumann (1928) showed that Nash equilibria are min-max strategies, which is equivalent to the linear programming duality. We solve the open question of Kannan and Theobald (2005) of designing an efficient algorithm for rank-1 games. The main difficulty is that the set of equilibria can be disconnected. We circumvent this by moving to a space of rank-1 games which contains our game (A, B), and defining a quadratic program whose optimal solutions are Nash equilibria of all games in this space. We then isolate the Nash equilibrium of (A, B) as the fixed point of a single variable function which can be found in polynomial time via an easy binary search.

Based on a joint work with Bharat Adsul, Jugal Garg and Milind Sohoni.

Bio
Ruta Mehta is a Postdoctoral Fellow in the College of Computing at Georgia Institute of Technology (host: Prof. Vijay Vazirani). She received her Ph.D. degree from Indian Institute of Technology, Bombay, in 2012. Her research lies at the intersection of theoretical computer science and mathematical economics, and aims at understanding computational and strategic aspects of games and markets. She has developed a number of novel linear complementarity problem (LCP) formulation based techniques, to design efficient and simple algorithms for equilibrium computation, in finite two-player games and Walrasian markets. Equilibrium computation is an important problem due to its applicability in market predictions, and policy and decision making. Apart from this she has analyzed strategic behavior in markets, and demonstrated reasons for some of their inefficiencies.

She is the recipient of 2012 ACM India Doctoral Dissertation Award, 2012 IIT-Bombay Excellence in Ph.D. Thesis Award, a 2012 Anita Borg Memorial Scholarship, and a 2010 IBM Ph.D. Award. She was one of the invitees of China Theory Week 2012, an annual invitation only workshop for the graduate students working in TCS.
Analysis of the Regulatory Features Guiding Translation of RNA into Protein

The translation of RNA into protein is an essential cellular process that must be carefully controlled to ensure the organism’s survival. Evidence of regulation at this stage of gene expression has prompted analysis of features associated with efficient translation – how much protein is produced per each RNA molecule. In our work, we develop a queuing-theory-based machine learning model that takes as input data from a recent high-throughput strategy tracking the number of ribosomes (translating molecules) paused at each codon (set of 3 positions) on each RNA-encoded gene. Ribosomes assemble at a gene’s start codon during initiation and then proceed elongation: they move along each gene, translating, with differential rates, each codon into the associated amino acid that becomes part of the growing protein chain. Accounting for these steps allows us to extract codon translation rates, protein synthesis rates for each gene, and translational efficiency (TE) for each gene. With our estimates, we can explore which step is rate limiting and which biological features are causal for translational efficiency.

Using our TE estimates, we develop a regression model that predicts TE based on several biological features, including three major correlates: RNA structure at the beginning of a gene, the quality of the motif around the gene start, and codon usage (which codons are preferred among a redundant set coding for the same amino acid). Applying our computational analysis to two mutants with modified levels of codon usage show that neither translation rates nor TE are significantly changed. This suggests that codon usage does not causally affect TE in physiological conditions, as previously thought. Instead we propose a mechanism whereby initiation signals like structure around the start codon and a favorable sequence motif regulate ribosome flow, and TE dictates codon usage.

Bio
Cristina Pop is a Ph.D. student at Stanford University. Her area of interest is probabilistic modeling for biological datasets. She has worked on developing models for understanding how RNA is translated into protein and algorithms for how RNA strands fold on themselves. The former helps us understand causal mechanisms for efficient gene expression and the latter helps inform function of RNA in the cell. In her spare time, Cristina enjoys baking, tennis, being outdoors, and the occasional hands-on crafty project. She hopes to extend her research in machine learning toward other exciting directions in biology and other fields.
CryptDB: Protecting Confidentiality with Encrypted Query Processing

Online applications are vulnerable to theft of confidential information because adversaries can exploit software bugs in these applications, and curious or malicious administrators may capture and leak data. I will talk about CryptDB, a system that provides practical and provable confidentiality in the face of these attacks for applications backed by SQL databases. CryptDB works by executing SQL queries over encrypted data using a set of efficient SQL-aware encryption schemes, some of which we designed from scratch. CryptDB also uses a novel technique, called onions of encryptions, to adjust dynamically the encryption of values in the database depending on the queries users want to run on the database.

An analysis of a trace of 126 million SQL queries from a production MySQL server shows that CryptDB can support operations over encrypted data for 99.5% of the 128,840 columns seen in the trace. Our evaluation shows that CryptDB has low overhead, reducing throughput by only 26% for queries from the industry benchmark TPC-C, compared to unmodified MySQL.

I will briefly mention Mylar, a system for securing web applications by computing on encrypted data in the spirit of CryptDB, as well as our new results in cryptography allowing far more general functions to be computed over encrypted data.

Bio
Raluca Ada Popa is a fourth year Ph.D. student at MIT working in systems security and applied cryptography. She is the recipient of the 2011 Google Ph.D. Fellowship, the 2010 Johnson award for best MIT CS Masters of Engineering thesis, and the 2009 CRA Outstanding Undergraduate award for research, nationwide.

Alternate State Variables for Post-CMOS Logic: Physical Limits and Device Implications

To overcome the “thermal limit” of current field-effect transistors that use electronic charge as the state variable, revolutionary device concepts based on utilizing alternate physical means of storing and manipulating information are being researched. Some noteworthy examples of alternate state variables (ASV) are electron spin, pseudospin in graphene, phonons, domain walls, spin waves, photons, and plasmons.

To quantify the advantages, opportunities, and limits of any logic technology, it is imperative to consider their interconnection aspects since communication of information is at the heart of any technology. To this end, my presentation will consist of following three components. 1) Briefly, I will discuss the notion of state variables as physical means of representing information in devices. Examples of novel state variables and their corresponding devices being researched and developed will be discussed. 2) A generic platform that maps the state variables against physical transport modes suitable for communicating information at the local signal level is established. This platform serves as a model structure to compare and benchmark many diverse post-CMOS devices without invoking the device dynamics per se. 3) Concept of area scaling in ASV devices to meet the performance requirements compared to CMOS logic system at the end of silicon technology roadmap (minimum feature size of 7.5 nm) will be discussed.

I will wrap the presentation with a brief discussion on how multi-disciplinary research between basic science and various engineering disciplines can help address challenges facing giga- and tera-scale integration in future semiconductor technology.

Bio
Shaloo Rakheja received the B.Tech. degree in electrical engineering from Indian Institute of Technology, Kanpur, India, in 2005, and the M.S. and Ph.D. degrees in electrical and computer engineering from the Georgia Institute of Technology (Georgia Tech), Atlanta, in 2009 and 2012, respectively. She worked as a Component Engineer at Intel, Bangalore in 2005 and later as an Analog Engineer at Freescale Semiconductor, Noida from 2006 to 2007. She is currently a Postdoctoral Associate with Microsystems Technology Laboratories, Massachusetts Institute of Technology, Cambridge.

Over the last five years, she has co-authored twenty-three international conference and refereed journal publications. She has also co-authored four book chapters and contributed to the chapter on Emerging Interconnect in ITRS 2011. She received the Intel PhD Fellowship for the academic year 2011-2012. She also received the ECE Graduate Research Assistant Excellence Award for the academic year 2011-2012. Her current research interests are in modeling and optimization of post-CMOS interconnects and developing solutions to the challenges facing giga- and tera-scale integrator.
Learning in the Presence of Unawareness

Markov decision processes (MDPs) are widely used for modeling decision-making problems in robotics, automated control, and economics. Traditional MDPs assume that the decision maker (DM) knows all states and actions. However, this may not be true in many situations of interest. For example, someone buying insurance may not be aware of all possible contingencies; a robot flying a helicopter may not be aware of all flying techniques. We define a new framework, MDPs with unawareness (MDPUs) to deal with the possibilities that a DM may not be aware of all possible actions. We provide a complete characterization of when a DM can learn to play near-optimally in an MDPU, and give an algorithm that learns to play near-optimally when it is possible to do so, as efficiently as possible. In particular, we characterize when a near-optimal solution can be found in polynomial time.

Moreover, we apply the MDPU framework on robotic problems. As we show, this framework can give insight into the difficulty of learning various robotic tasks. We apply these ideas to the problem of learning to drift a robotic car in tight turns.

Bio
Nan Rong is a Ph.D. candidate in computer science at Cornell University. She completed her MS in computer science at Singapore-MIT Alliance in 2007. Her research interests include algorithms, intelligent decision making, game theory, and robotics. Her current research focuses on learning in the presence of unawareness, which includes algorithm design, complexity analysis, and robotic experiments. Devising a new equilibrium that explains/predicts cooperative behavior is another research topic that she enjoys. Her previous research include POMDP problem optimization and x-ray image analysis.
Automatically detecting objects in still images: what have we done, and where are we going?

In this work (to appear in ICCV2013) we strive to answer two key questions about the field of automatic object detection. First, where are we currently as a field: what have we done right, what still needs to be improved? Second, where should we be going in designing the next generation of object detectors?

We perform a large scale study on the ImageNet Large Scale Visual Recognition Challenge (ILSVRC) data, which is the largest object localization dataset to date. Due to its scale of 1000 object categories, ILSVRC provides an excellent testbed for understanding the performance of detectors as a function of several key properties of the object classes. We conduct a series of analyses looking at how different detection methods perform on a number of image-level and object-class-level properties such as texture, color, deformation, and clutter. We learn important lessons of the current object detection methods and propose a number of insights for designing the next generation object detectors.

Bio
Olga Russakovsky is a Ph.D. student at Stanford working on computer vision, advised by Professor Fei-Fei Li. Her main interest is in large-scale object detection and recognition. This year she is organizing the international ImageNet Large Scale Visual Recognition Challenge (ILSVRC) data, which is the largest object localization dataset to date. Due to its scale of 1000 object categories, ILSVRC provides an excellent testbed for understanding the performance of detectors as a function of several key properties of the object classes. We conduct a series of analyses looking at how different detection methods perform on a number of image-level and object-class-level properties such as texture, color, deformation, and clutter. We learn important lessons of the current object detection methods and propose a number of insights for designing the next generation object detectors.

Precimonious: Tuning Assistant for Floating-Point Precision

The use of floating-point applications has been growing rapidly over the past few years. Unfortunately, testing and debugging floating-point programs is a difficult task given the large variety of numerical errors that can occur in these programs, including extreme sensitivity to roundoff, incorrectly handled exceptions, and nonreproducibility across machines or even across runs on the same machine. One common practice employed by developers without an advanced background in numerical analysis is using the highest available precision. While more robust, this can affect program performance significantly.

In this talk, I will present Precimonious, our dynamic program analysis tool to assist developers in tuning the precision of their floating-point programs. Precimonious performs a search on the types of the floating-point program variables trying to lower their precision subject to accuracy constraints and performance goals. Our tool recommends a type instantiation that uses lower precision while producing an accurate enough answer without causing exceptions. We have evaluated Precimonious on the NAS Parallel Benchmarks, a few widely used functions from the GNU Scientific Library, and three other numerical programs. For most of the programs tested, Precimonious successfully reduces precision, which results in performance improvements as high as 41%.

Bio
Cindy is currently a Postdoctoral Researcher in the EECS Department at the University of California, Berkeley, where she works with Koushik Sen, James Demmel, William Kahan, and Costin Iancu. She recently received her Ph.D. in Computer Sciences from the University of Wisconsin-Madison, advised by Prof. Ben Liblit. Her research area of interest is Programming Languages, with a specific focus on Program Analysis. For her doctoral dissertation, she worked on applying static program analysis techniques to find error-propagation bugs in large software systems, including the Linux kernel.

She is an AAUW International Doctoral Fellow, and currently serves as a Latina in Computing ambassador for the Anita Borg Institute. Cindy earned her M.S. in Computer Science from the University of Wisconsin-Milwaukee and her B.S. in Computer Systems Engineering from Saltillo Institute of Technology (Mexico). She also received a B.M. in Piano Performance from the Autonomous University of Coahuila (Mexico). Cindy is originally from Saltillo, Coahuila, México.
An Upper Bound on the Convergence Time for Quantized Consensus

We analyze a class of distributed quantized consensus algorithms for arbitrary networks. In the initial setting, each node in the network has an integer value. Nodes exchange their current estimate of the mean value in the network, and then update their estimation by communicating with their neighbors in a limited capacity channel in an asynchronous clock setting. Eventually, all nodes reach consensus with quantized precision. We start the analysis with a special case of a distributed binary voting algorithm, and then proceed to the expected convergence time for the general quantized consensus algorithm proposed by Kashyap et al. We use the theory of electric networks, random walks, and couplings of Markov chains to derive an $O(N^3 \log N)$ upper bound for the expected convergence time on an arbitrary graph of size $N$, improving on the state of the art bound of $O(N^4 \log N)$ for binary consensus and $O(N^5)$ for quantized consensus algorithms. Our result is not dependent on graph topology. Simulations are performed to validate the analysis.

Bio
Shang is a fifth-year graduate student from the Department of Electrical Engineering, Princeton University. She is co-advised by Prof. Sanjeev Kulkarni and Prof. Paul Cuff. She received her M.A. degree in 2011 from the Department of Electrical Engineering, Princeton University, and B.E. degree in 2009 from the School of Electronic Information and Electrical Engineering, Shanghai Jiao Tong University. Her research interests include recommendation systems, social networks and information aggregation.

Rethinking Multicores for Disciplined Parallelism

As multicore and mobile systems become increasingly dominant in everyday computing, both software and hardware face a major challenge to provide more parallelism-aware solutions for such systems. The continued use of ‘wild shared memory’ programming models, however, undermines the efficiencies that can be achieved through parallelism. Unstructured parallel programming practice not only makes it difficult to debug and maintain software, but also complicates hardware preventing it from scaling in a power-efficient manner. We turn this challenge into an opportunity for rethinking multicore memory hierarchy driven by “disciplined” software models.

DeNovo is the software-hardware co-design project that asks the question: if software becomes more disciplined, can we build more power- and complexity-scalable hardware? Disciplined languages guide programmers to express parallelism only through structured interfaces and explicitly reason about their side effects, which eventually makes it easier to maintain parallel software. The key insight is that such disciplined software can in turn enable much simpler and more scalable shared-memory hardware than the state-of-the-art. As a result, DeNovo essentially eliminates unscalable factors (invalidation traffic, directory storage overhead, etc.) in conventional cache coherence protocols. It also significantly reduces network traffic, which can be translated into considerable energy saving, while providing comparable performance to conventional protocols. More recent work shows a promising vision for DeNovo as a power- and complexity-efficient multicore system for a broader range of shared-memory software including less disciplined, legacy codes.

Bio
Hyojin Sung is a Ph.D. student in Computer Science at University of Illinois, Urbana-Champaign. Her research interests are in parallel computer architecture, compilers and programming, especially SW/HW co-design based on parallel programming patterns. She earned her undergraduate degrees in Literature and Computer Science at Seoul National University and worked for Samsung Electronics as a research engineer for two years, before she obtained her M.S. in Computer Science at UC San Diego in 2008 with her thesis on parallelizing compilers.
Photonic Crystal Enhancement of a Homogeneous Fluorescent Assay using Submicron Fluid Channels Fabricated by E-jet Patterning

We demonstrate the enhancement of a liquid-based homogenous fluorescence assay using the resonant electric fields from a photonic crystal (PC) surface. Because evanescent fields are confined to the liquid volume nearest to the photonic crystal, we developed a simple approach for integrating a PC fabricated on a silicon substrate within a fluid channel with submicron height, using electrohydrodynamic jet (e-jet) printing of a light-curable epoxy adhesive to define the fluid channel pattern. The PC is excited by a custom-designed compact instrument that illuminates the PC with collimated light that precisely matches the resonant coupling condition when the PC is covered with aqueous media. Using a molecular beacon nucleic acid fluorescence resonant energy transfer (FRET) probe for a specific miRNA sequence, we demonstrate an 8x enhancement of the fluorescence emission signal, compared to performing the same assay without exciting resonance in the PC detecting a miRNA sequence at a concentration of 62nM from a liquid volume of only ~20 nl. The approach may be utilized for any liquid-based fluorescence assay for applications in point-of-care diagnostics, environmental monitoring, or pathogen detection.

Bio
Yafang Tan received the B.S. degree in electrical and computer engineering from Tsinghua University, Beijing, in 2008, and the M.S. degree in electrical and computer engineering from University of Illinois at Urbana–Champaign, Urbana, in 2011. She is currently working toward the Ph.D. degree under the direction of Dr. Brian Cunningham at the University of Illinois.

Her research focuses on the study of sub-wavelength optical phenomena and its application in optical sensing. Particularly, her current project is on the design, characterization and optimization of novel fluorescence biosensors, supporting instrumentation and the electrohydrodynamic jet fabrication method.

Human-Centered Approach Optimizing the Lower Limits of Intelligible Mobile Sign Language Video Communication

Mainstream use of mobile video communication is increasing due to the growth of both mobile device computing power and the cellular network infrastructures. However, total network bandwidth capacity is still limited, which can lead to degradation of mobile video quality such as packet loss, delay, and blurred video quality. Deaf and hard-of-hearing people benefit the most from advancements in mobile video communication because it facilitates sign language communication. Sign language is a visual language with unique grammar and syntax that is different from spoken languages. In my research, I am applying both video compression and human–computer interaction to make mobile sign language video communication more accessible and affordable to deaf and hard-of-hearing people. I am discovering how much video transmission rates can be reduced before intelligibility is negatively impacted for the purposes of reducing bandwidth consumption and extending cell phone battery life. In web studies, I have focused evaluation on the lower limits of frame rates (1, 5, 10, 15 fps) and bitrates (15, 30, 60, 120 kbps) when sign language video is transmitted. In my most recent study, I discovered an intelligibility ceiling effect where increasing the frame rate above 10 fps and bitrate above 60 kbps produces diminishing returns on sign language intelligibility. I have also created the Human Signal Intelligibility Model (HSIM), a conceptual model informing evaluations of video intelligibility. The HSIM addresses the lack of uniformity signal intelligibility and signal comprehension have been operationalized. Understanding the lower limits of intelligible sign language video allows for better user experience while making tradeoffs between bandwidth consumption and battery life.

Bio
Jessica J. Tran is a Ph.D. Candidate in Electrical Engineering [EE] at the University of Washington [UW], Seattle. She is advised by Professor Eve A. Riskin [EE], Professor Richard E. Ladner [CSE], and Associate Professor Jacob O. Wobbrock [Information School]. She earned her MSEE in 2010 and BSEE in 2008 from UW. Her research interests are in digital signal processing-video compression- and Human-Computer Interaction. Her research contributes to the Mobile American Sign Language project that aims to make mobile video communication more accessible and affordable to deaf and hard-of-hearing people. She focuses on the lower limits of video transmission rates. Particularly investigating how much sign language video quality can be reduced before intelligibility is sacrificed while considering end users, video quality, and resource consumption like bandwidth and batter life. She has developed the Human Signal Intelligibility Model addressing the lack of a universal model to base video intelligibility evaluations. Her anticipated graduation date is June 2014.

Attribute-Based Detection of Unfamiliar Classes with Humans in the Loop

A recent trend in the computer vision community is the use of high-level visual features or attributes as semantic cues in addressing various problems. Attributes can be used to describe and differentiate classes, and information about attributes and their values can be exploited in order to perform unseen class detection, where the goal is to categorize objects into classes for which we have no training examples (i.e. the train and test sets are disjoint).

For example, a visual recognition system for North American bird species that has not been trained on images of Indigo Buntings can still maintain a database listing the species’ distinguishing attributes, such as having blue bellies and black legs. Should the system then detect the presence of these attributes in a test example, it can predict with high confidence that the bird in question is an Indigo Bunting without ever having seen examples of that species.

In this work, we study the related and more challenging problem of detecting unfamiliar classes, which are not observed at train time, and we do not possess any knowledge regarding their relationships to attributes. In the North American bird recognition system example, this would be akin to submitting an image of a Kiwi (a bird species native to New Zealand) and asking the system to recognize it. The system has no prior knowledge about what attributes describe a Kiwi and has never seen an image of one before.

We propose a novel approach to the unfamiliar class detection task that builds on attribute-based classification methods. We also present a method for incorporating human users to overcome deficiencies in attribute detection, and we demonstrate results superior to existing methods on a challenging data-set of fine-grained visual categories.

Bio
Catherine Wah is currently a Ph.D. candidate in Computer Science at the University of California, San Diego, advised by Serge Belongie. Her research focus is in computer vision, and she is primarily interested in the visual recognition of fine-grained categories with humans in the loop, in which we leverage human abilities to help solve this challenging recognition task. Catherine grew up in the cornfields of Champaign, IL and earned her B.S. in Electrical Engineering at the University of Illinois at Urbana-Champaign, double minor in Mathematics and Computer Science. As a graduate student, she mentors undergraduate engineering students and volunteers with organizations such as Girl Develop It, which help empower women of all backgrounds to learn how to code. In her free time, she enjoys reading, music, running half marathons, yoga, surfing, and good food.

Crowdsourced Enumeration Queries

Hybrid human/computer database systems promise to greatly expand the usefulness of query processing by incorporating the crowd for data gathering and other tasks. Such systems raise many implementation questions. Perhaps the most fundamental question is that the closed world assumption underlying relational query semantics does not hold in such systems. As a consequence the meaning of even simple queries can be called into question. Furthermore, query progress monitoring becomes difficult due to non-uniformities in the arrival of crowdsourced data and peculiarities of how people work in crowdsourcing systems. To address these issues, we develop statistical tools that enable users and systems developers to reason about query completeness. These tools can also help drive query execution and crowdsourcing strategies. We evaluate our techniques using experiments on a popular crowdsourcing platform.

Bio
Beth Trushkowsky is a Ph.D. candidate in computer science at the University of California, Berkeley. Her research interests include scalable database systems and cloud computing, as well as crowdsourcing and its integration with database systems. Trushkowsky has a B.S. and an M.S. in computer science from Duke University and the University of California, Berkeley, respectively.
Centimeter-scale Indoor Positioning with RFIDs

RFIDs are emerging as a vital component of the Internet of Things and M2M communications. In 2012, billions of RFIDs have been deployed to locate equipment, track drugs, tag retail goods etc. However, today’s RFID systems can only identify whether a tagged object is within radio range (several meters) while lacking the capability to pinpoint its exact location. For example, pilot programs of the RFID-automated checkout application revealed that “a shopper could end up paying for the groceries of the person behind her”, because the system confuses which basket the RFID-tagged goods belong to. Existing proposals for addressing this limitation rely on a line-of-sight communication model and hence perform poorly when faced with multipath effects or non-line-of-sight in wireless systems, which are typical in real-world deployments.

This work introduces the first fine-grained RFID positioning system that is robust to multipath and non-line-of-sight. The key technical idea is to capture, extract, and match the profiles of RFID signals by using a synthetic aperture (SAR) created via antenna motion and applying dynamic time warping (DTW) techniques. We have leveraged this design to enable two different RFID applications: locating misplaced objects (PinIt) and robot object manipulation (RF-Compass). In our PinIt system, we deploy 200 RFIDs in the Barker Engineering library to locate misplaced books and achieve a median accuracy of 11.2cm. The second application is to use RFIDs to aid modern robots in interacting with the environment and manipulating objects. Given an RFID-tagged object, our RF-Compass system accurately navigates a robot toward the object. Further, it locates the center of the object to within a few centimeters and identifies its orientation so that the robot may pick it up. Finally, we will also discuss several future applications of this technology, such as automated checkout and gesture-based communication, which we are currently working on.

Bio

Jue Wang is a Ph.D. student in the Computer Science and Artificial Intelligence Laboratory at MIT. She works on wireless communication and mobile computing in the NETMIT group under the guidance of Professor Dina Katabi. Her research is focused on low-power wireless communications. She is particularly interested in developing new techniques and designing systems that can 1) improve the efficiency and reliability of low-power wireless networks, 2) deliver fine-grained positioning information of low-power devices (e.g., RFIDs), and 3) enhance security and privacy of low-power communication. Before coming to MIT, Jue earned her B.S. degree in Electrical Engineering from Tsinghua University in Beijing, China.

A Framework for Automatically Enforcing Security

It is becoming increasingly important for applications to protect sensitive data. Unfortunately, security policies are difficult to manage because their global nature requires coordinated reasoning and enforcement. To mitigate this, we propose a policy-agnostic programming model in which the programmer implements information flow policies separately from the other functionality. The programmer may rely on the runtime to automatically produce outputs adhering to these policies. For my Ph.D. thesis, I have developed the Jeeves programming language to explore this model. Jeeves allows programmers to define multiple views of sensitive values along with policies for disclosing these views. The Jeeves semantics describe the dynamic enforcement of these policies. We have proven security guarantees about our semantics and implemented Jeeves as an embedded domain-specific language in Scala. We have used our implementation to build a small conference management system. My goal is to demonstrate the feasibility of policy-agnostic programming in a web framework.

Bio

Jean Yang is a Ph.D. candidate at MIT. She is interested in designing programming languages that automate the tedious, error-prone aspects of programming so programmers can focus on more interesting functionality. Jean received her B.A. in Computer Science from Harvard University in 2008. She is a recipient of the National Science Foundation Graduate Research Fellowship and the Facebook Fellowship. In 2009, she co-founded Graduate Women at MIT, which now has 1,200 members, two annual conferences, and a mentoring program.
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Floraine Berthouzoz University of California — Berkeley
Cristina Boero École Polytechnique Fédérale de Lausanne
Katharine Brigham Carnegie-Mellon University
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Aakanksha Chowdhery Stanford University
Dana Dachman-Soled Microsoft Research — New England
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Finale Doshi-Velez Harvard Medical School
Alina Ene University of Illinois at Urbana-Champaign
Michelle Goodstein Carnegie Mellon University
Te-Yuan Huang Stanford University
Ružica Jevtić University of California - Berkeley
Miray Kas Carnegie Mellon University
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Ivana Kovacevic Swiss Federal Institute of Technology
Allison Bishop Lewko Microsoft Research — New England
Lin Li University of California — Davis
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Michelle Mazurek Carnegie Mellon University
Natasa Miskov-Zivanov School of Medicine, University of Pittsburgh, Electrical and Computer Engineering, Carnegie Mellon University
Rikky Muller University of California — Berkeley
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Rotem Oshman Massachusetts Institute of Technology
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Professor of Electrical Engineering
Department of Electrical Engineering and Computer Science and Associate Director of the Microsystems Technology Laboratories, MIT

Dina Katabi
Professor of Electrical Engineering
Department of Electrical Engineering and Computer Science and Computer Science and Artificial Intelligence Laboratory, MIT

PROGRAM COORDINATION
Orit Shamir, Ph.D.
Technical program coordinator, Research Laboratory of Electronics, MIT
617.324.2877 / orit@mit.edu

WORKSHOP ADMINISTRATION
Debroah Hodges-Pabon
Workshop administrative manager
Microsystems Technology Laboratories, MIT
617.253.5264 / debb@mtl.mit.edu

Lori McCormick
Administrative Assistant II, Microsystems Technology Laboratories, MIT
617.253.0574 / lmcc@mit.edu

MEDIA AND COMMUNICATIONS
Patricia A. Sampson
EECS Communications Coordinator
617.253.4642 / patsys@mit.edu

Krista Van Guilder
Manager of Media and Design, Research Laboratory of Electronics, MIT
617.452.4650 / kvg@mit.edu
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NOTES
“Attending the Rising Stars EECS workshop answered many questions I had as to what is expected of faculty and provided insight into what exactly the role involves. It was also very encouraging to learn that there’s a large support system focused on helping junior faculty succeed (not just sink or swim). So although the ramp up is steep, there are a lot of people and resources to help you get there. It was also really wonderful to meet so many impressive women across the breadth of EECS who are also just starting off in their careers.”

— Vivienne Sze
Emanuel E. Landsman (1958) Career Development Professor
Principal Investigator in the Microsystems Technology Laboratory and
the Research Laboratory of Electronics
Contact:

Anantha P. Chandrakasan, Department Head, EECS
Joseph F. and Nancy P. Keithley Professor of Electrical Engineering
Massachusetts Institute of Technology, 38-403, 50 Vassar Street
Cambridge, MA 02139-4307

Phone: 617.253.4601  Fax: 617.253.0572
617.258.7619  Email: anantha@mtl.mit.edu