

SPONSORED ACTIVITIES

The Ming Hsieh Institute supports ground-breaking proposals from our faculty members to launch research and other academic endeavors to significantly enhance the Electrical Engineering Department. Through venture funding, forward-looking activities will initiate strikingly innovative programs under the below well-defined themes to initiate research and academic programs that are strikingly innovative.

Sponsorship is aimed to support programmatic activities that broadly benefit electrical engineering faculty and students, build an energetic academic environment, and increase the department's impact and visibility. Proposals are evaluated by the MHI Faculty Advisory Council and/or the MHI leadership. The Ming Hsieh Institute supported the following activities in 2011/2012 categorized by research themes. Some of these including a research testbed, innovative seminar series, workshops and conferences, visitor programs and mini-grants.



NETWORKS

Design & analysis of communication networks, including next-generation Internet, cooperative wireless networks, optical networks, cognitive radio systems, sensor networks and mobile-based sensing, vehicular, underwater networks & social networks.

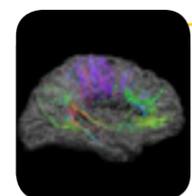
- Electrical Engineering Communication, Networks and Systems Research Seminar (Alex Dimakis & Rahul Jain)
- Large-Scale Software-Radio Testbed (Kostas Psounis, Giuseppe Caire, Andy Molisch & Mike Chen)**
- Visitor Program: Dr. Zijian Tang, Research scientist of TNO, the Hague, the Netherlands (Urbashi Mitra)
- Visitor Program: Dr. Lin Zhang, Tsinghua University, China (Bhaskar Krishnamachari)
- NEGT Symposium (Rahul Jain)



COMPUTATION & DEVICES

Materials, devices, technologies, architectures, and computer tools towards realization of energy-efficient, fast, and reliable computation systems beyond Moore's Law in 2020 (eg. quantum engineering/information processing).

- Integrated Systems Seminar Series (Hossein Hashemi)
- USC Quantum Information Seminar Series (Daniel Lidar & Todd Brun)
- 2nd International Conference on Quantum Error Correction (Daniel Lidar & Todd Brun)



HEALTHCARE

Research and development in devices, signals and systems targeting critical problems in biology and biomedicine with scientific and translational impact on human health and well being.

- Center for Human Behavioral Informatics (Shri Narayanan, Richard Leahy, Krishna Nayak, Urbashi Mitra, Andy Molisch, Antonio Ortega, Jay Kuo, Justin Halder, Panayiotis Georgiou)
- Medical Imaging Seminar Series (Krishna Nayak, Richard Leahy, Justin Halder, Houchun Hu)

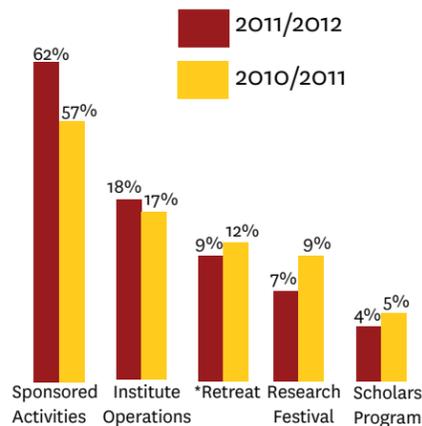


CROSS-CUTTING ACTIVITIES

Activities that seek to enhance the intellectual and social life of the department to benefit faculty and students with the objective to attract and retain the best talents, build an energetic academic environment, and increase visibility.

- 30 year anniversary of Communication Sciences Institute (Andy Molisch & Alan Willner)
- APSIIPA 2012 Conference (C.-C. Jay Kuo, Antonio Ortega & Shri Narayanan)
- ASYNIC 2013 (Peter Beerel)
- SIPI 40th Anniversary Symposium (C.-C. Jay Kuo)
- Industry Seminar Series (Bhaskar Krishnamachari)
- 2012 IEEE Antennas and Propagation Symposium (APS) (Mahta Moghaddam)
- 22nd California Nonlinear Control Workshop (Petros Ioannou)
- Cornell Cup USA: Team VISIONary (Hossein Hashemi)

FINANCIAL OVERVIEW



* 2012 Retreat projected - 10/27/12
Percentage based on actual endowment dollar amount per designated fiscal year

Sponsored activities: approved proposals per fiscal year (*Networks, Computation & Devices, Healthcare & Cross-cutting activities*)

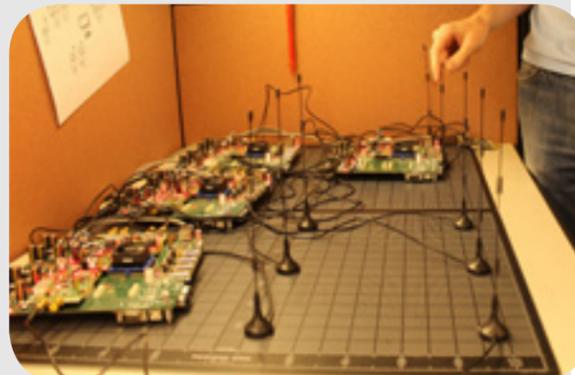
Institute Operations: alumni & EE social events, meetings, payroll, equipment and office operations

Retreat and the Research Festival: annual department events developed, organized and hosted by MHI

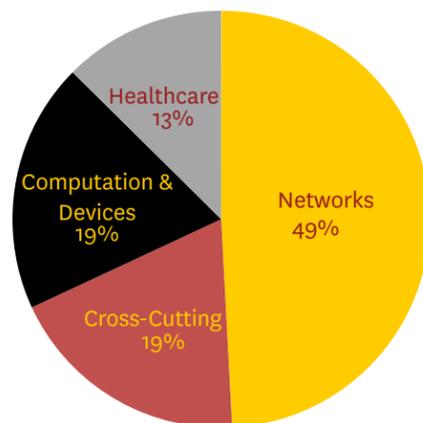
Scholars Program: award, travel funding, workshop and event support

Large-Scale Software-Radio Testbed

The research project team has built an experimental testbed comprising of four Access Points (APs) connected to a server, and four clients. All eight wireless nodes are WARP software radios. They have designed and implemented AirSync, a novel scheme which provides timing and phase synchronization accurate enough to enable distributed multiuser MIMO to achieve full spatial multiplexing gain. For the purpose of demonstration, they have implemented two multiuser MIMO precoding schemes, Zero-Forcing Beamforming (ZFBF) and Tomlinson-Harashima Precoding (THP). In both cases their system nearly achieves the theoretical optimal multiplexing gains. "To the best of our knowledge, AirSync offers the first ever realization of the full distributed multiuser MIMO multiplexing gain, namely the ability to increase the number of active wireless clients per time-frequency slot linearly with the number of jointly coordinated APs, without reducing the per client rate" - Professor Kostas Psounis



ACTIVITIES SUPPORT



Percentage based on sponsorship dollar amount per research theme for 2011/2012

Seminar series in each research thrust include external speakers from top universities and research organizations and prove to be a success by high attendance and positive feedback.

The Visitor Program supported researchers from the Netherlands and China, enabling them to spend several weeks at USC collaborating with faculty and presenting their research to the engineering community at USC.

Networks receives 49% of MHI support mainly for the **Large-Scale Software-Radio Testbed** project that aims to build one of the best software radio testbeds in the world at USC. Technical staff starts in September 2012 to support this project. Visit mhi.usc.edu to view a presentation of the current research results.

PH.D. SCHOLARS

Scholars are considered the top students in the USC Electrical Engineering Department selected by a faculty committee on the basis of their research accomplishments and desire for an academic career.

To help them in their career development MHI Ph.D. Scholars receive:



Bardia Zandian Sunil Kumar Srinivas Yerramalli Chenxi Lin

- Mentorship and recommendations from faculty
- Cash award & funds for travel to give talks at other institutions where they can develop collaborations, increase visibility and receive feedback on their work
- Funds to organize workshops or student events (student liaison)
- Recognition, exposure and valuable experience by having leadership roles in the department and at annual events such as the Retreat and the Research Festival

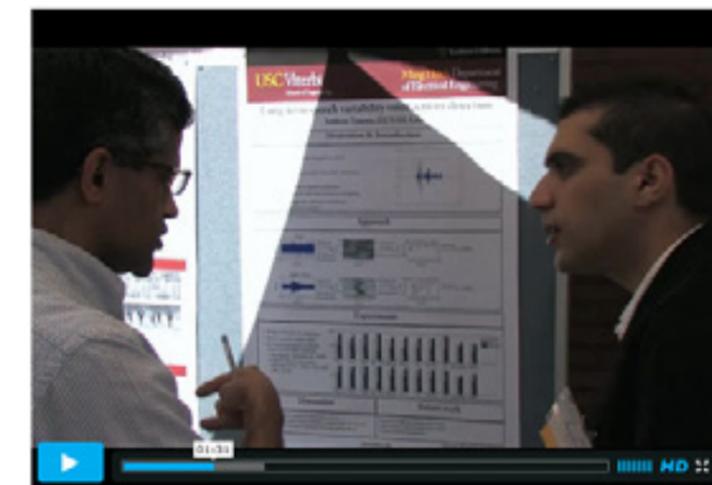
RETREAT

The Electrical Engineering Retreat brings faculty and Ph.D. students together in a social environment to receive updates regarding the department's research accomplishments across the board and to discuss and collaborate on defining the future of Electrical Engineering at USC and beyond. The 1st Retreat, at Lake Arrowhead Resort in March 2011 had a total of 158 guests including 60 Ph.D. students and 36 faculty members (many with their families), 8 of which have been with USC for over 35 years.

Save the date for the 2nd Annual EE Retreat: October 27 - 28, 2012

RESEARCH FESTIVAL

The Annual Electrical Engineering Research Festival hosted by MHI is a day-long



festival that showcases EE Ph.D. student research through posters and oral presentations. The entire USC Viterbi Community, alumni & engineering industry representatives are invited. MHI hosted the 2nd annual Ming Hsieh Department of Electrical Engineering Research Festival on Friday, April 20, 2012

Visit mhi.usc.edu to view videos of all presenters

- 75 top-level graduate student research presentations
- demonstration by M.S. students presenting in Cornell Cup
- a panel session including four successful electrical engineering faculty entrepreneurs (Peter Beerel, Keith Chugg, Chris Kyriakakis & Daniel Singleton)
- presentation by Professor Kostas Psounis on current results for MHI sponsored proposal "**Large-Scale Software Radio Testbed**"
- award ceremony with prizes for outstanding student work bestowed by Institute benefactor and namesake Ming Hsieh and USC Viterbi Dean Yannis C. Yortsos
- Save the date for the next EE Research Festival - February 6, 2013**

MESSAGE FROM THE MHI DIRECTOR

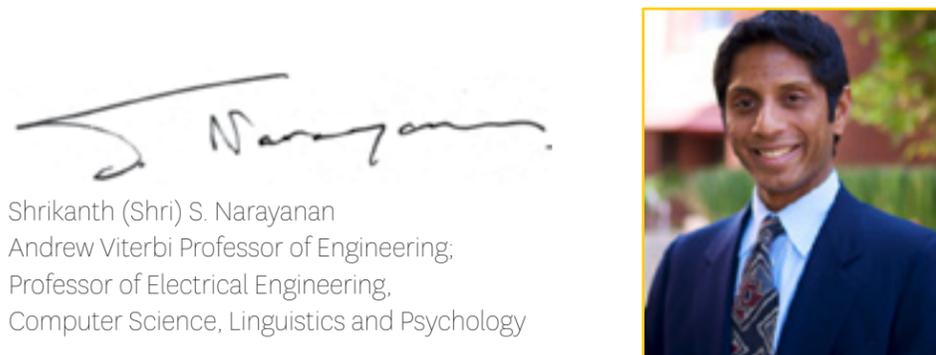
As the Ming Hsieh Institute (MHI) successfully concludes our second year, we welcome you to review this 2011/2012 Annual Report, which provides a glance at activities and research supported by MHI.

Sponsored activities include seminar series, conferences, visitor programs and research grants with the objective to encourage faculty and student collaboration to initiate innovative ideas and conduct projects to demonstrate remarkable research. These activities are aligned with the institute's main goal to position electrical engineering in the forefront in thought leadership and to showcase electrical engineering at USC to the outside world.

Along with supporting faculty research requests, MHI has originated a Ph.D. scholar program and two events that we host annually: the department retreat and the research festival. The MHI Ph.D. Scholars Program targets the most outstanding doctoral students and provides them with career development through exposure and leadership opportunities. Leadership roles include managing the programming at MHI annual department events and being the voice of future electrical engineers. The department retreat and the research festival bring students and faculty together to discuss research results and initiate future collaborations, which is also an effort toward our ultimate goal.

This report provides some highlights of the institute's newly funded activities as well as past accomplishments and goals toward continued success and growth. Please visit our website to view exciting research talks, event videos, photos and results for supported research – mhi.usc.edu

We thank the USC Engineering Community for their continued engagement and support of the Ming Hsieh Institute.



Shrikanth (Shri) S. Narayanan
Andrew Viterbi Professor of Engineering;
Professor of Electrical Engineering,
Computer Science, Linguistics and Psychology

cover image:

(D. Singleton and M. A. Gundersen, "Transient Plasma Fuel-Air Ignition," IEEE Transactions on Plasma Science, Issue 99, 27 May 2011): This image shows streamers generated by ten 1.2 J, 85 ns, 78 kV discharges across a 47 mm gap in air. The pulses were applied to the anode (center), which was a threaded (8-32) 11.8 cm stainless steel rod. The anode was concentric with the grounded cathode (not shown), which was a 98 mm (ID) stainless steel combustion chamber. This image was taken using a Canon EOS10D with a f/5.6 28-200 mm lens with a 10 s exposure time.

ABOUT MHI

The Ming Hsieh Institute (MHI) in the Ming Hsieh Department of Electrical Engineering was launched in July 2010, after a generous endowment gift of 35 million dollars from Mr. Ming Hsieh, an alumnus of the department. One of the main goals of the institute is to position the Electrical Engineering Department at the forefront in thought leadership in the world in the area of electrical engineering and specifically in the development of intelligent technologies to empower mankind. The Ming Hsieh Institute is dedicated to defining the future of electrical engineering in general through positive impact, creativity and invention. MHI is focusing on creating a vibrant intellectual environment at USC while bringing student and faculty researchers together to engage in the development of new ideas.

- To define the future of electrical engineering, enhancing its positive impact on all spheres of human endeavor
- To foster creativity and invention within all facets of USC's electrical engineering including research and education
- To create a vibrant intellectual environment at USC where world-class researchers in electrical engineering and related fields can come together and engage in the development of new ideas



2011 Retreat group photo - by Kaveh Ghahremany

MHI Leadership

Shri Narayanan, Director
Hossein Hashemi, Co-Director
Bhaskar Krishnamachari, Co-Director
Danielle Hamra, Business Officer

Faculty Advisory Council

Murali Annavaram
Martin Gundersen
Petros Ioannou
Richard Leahy
Urbashi Mitra
Michelle Povinelli
Viktor Prasanna

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Ming Hsieh Institute

intelligent technologies to empower mankind



Annual Report 2011/2012

USC Viterbi

School of Engineering
*Ming Hsieh Department
of Electrical Engineering*