...WHAT IS ECE?
Electrical and Computer Engineers (ELECs) create, innovate and design technologies in robotics, computing, communications, electronics and automation. ECE uses hardware and software to create better, faster, safer technologies for things like cars, aircraft, computers, smart phones, and surgical robots.

...WHAT DO WE DO?
ELECs are a diverse, smart, creative group of problem-solvers who make cool things that change the world. Smartphones, GPS, cars, and even things like healthcare and national security would not exist as they do today without them. ELECs go on to work in every industry imaginable, including:

**HEALTHCARE • COMMUNICATION • RENEWABLE ENERGY • OIL & GAS • GAMING • SPACE • ENTERTAINMENT • SECURITY • AVIATION**

### RESEARCH AREAS OF RICE ECE:

#### NEUROENGINEERING (NEURO)
The brain is essentially a circuit. Neuroengineering is a discipline that exploits engineering techniques to understand, repair and manipulate human neural systems and networks.

#### DATA SCIENCE (DS)
An emerging field that integrates the tools and techniques involved in data acquisition, data analytics and data storage to enable extraction of meaningful information from massive data sources.

#### PHOTONICS, ELECTRONICS, & NANODEVICES (PEN)
This field strives to improve understanding of the interaction of light and matter, along with the application of that knowledge to develop innovative devices and technologies. PEN has applications in energy & healthcare, among others.

#### SYSTEMS (SYS)
Rice is a leader in Digital Signal Processing. Signal processing is the analysis and transformation of signals (measurements taken over time and/or space) in order to understand, simplify or recast their structure. Image and video analysis and compression, computational neuroscience, and wireless networking fall in this field.

#### COMPUTER ENGINEERING (CE)
The research in this discipline focuses on analog and mixed-signal design, computer architecture and embedded systems, hardware security and storage (and so, so much more).
This guide is organized alphabetically by faculty member, with a brief description of their research. Research news from the department is interspersed. A key of faculty per research area can be found below. Many are in multiple research areas. Full research details can be found at ece.rice.edu. We encourage you to speak with faculty in whose research you are interested.

**NEURO**
- Aazhang
- Babakhani
- Baraniuk
- Clark
- Gabbiani
- Kemere
- Patel
- Pitkow
- Robinson
- Shouval
- Veeraraghavan

**PEN**
- Bharadwaj
- Halas
- Kelly
- Kono
- Naik
- Robinson
- Thomann
- Tittel
- Woods

**CE**
- Babakhani
- Cavallaro
- Kemere
- Simar
- Varman
- Zhong

**DATA SCIENCE**
- Aazhang
- Baraniuk
- Kemere
- Orchard
- Patel
- Pitkow
- Robinson
- Sabharwal
- Varman
- Veeraraghavan
- Zhong

**SYSTEMS**
- Aazhang
- Antoulas
- Baraniuk
- Cavallaro
- Clark
- Frantz
- Knightly
- Orchard
- Patel
- Sabharwal
- Simar
- Veeraraghavan

**RESEARCH THROUGH: VIP**

The Vertically Integrated Projects (VIP) Program at Rice unites undergraduate education and faculty research in a team-based context. Undergraduate Rice VIP students earn academic credits, while faculty and graduate students benefit from the design/discovery efforts of their teams.

VIP at Rice extends the academic design experience beyond a single semester. Rice VIP teams are comprised of students from freshmen to graduate students, with a variety of majors and backgrounds.

VIP provides the time and context to learn and practice professional skills, to make substantial contributions, and experience different roles on large multidisciplinary design/discovery projects.

vip.rice.edu
Behnaam Aazhang*, J.S. Abercrombie Professor, Electrical and Computer Engineering  
aaz@rice.edu   ece.rice.edu/aaz.aspx  
Research areas: Data Science; Neuroengineering; Systems  
Dr. Aazhang researches neural circuits in the hopes of mitigating disorders such as epilepsy, parkinson, depression and obesity. Other areas of study include communication and information theory. **REU opportunities available.**

Athanasios C. Antoulas, Professor, Electrical and Computer Engineering  
aca@rice.edu   ece.rice.edu/antoulas.aspx  
Research areas: Computer Engineering; Systems  
Dr. Antoulas is interested in large-scale dynamical systems, approximation, computation, and linear algebra.

Aydin Babakhani, Assistant Professor, Electrical and Computer Engineering  
ab28@rice.edu   ece.rice.edu/babakhani.aspx  
Research areas: Computer Engineering, Neuroengineering, Systems  
Dr. Babakhani’s research focuses on integrated sensors and systems and his work impacts high-speed wireless, radar, medical imaging, security, biosensing, and oil/gas monitoring. **REU opportunities available.**

Richard G. Baraniuk, Victor E. Cameron Professor of Electrical and Computer Engineering  
richb@rice.edu   ece.rice.edu/baraniuk.aspx  
Research areas: Data Science, Neuroengineering, Systems  
Dr. Baraniuk is the founder of OpenStax, providing free college textbooks! He is interseted in multiscale, computational signal and image processing and open access, collaborative scholarly publication. **REU opportunities available.**

Palash Bharadwaj, Assistant Professor, Electrical and Computer Engineering  
palash.bharadwaj@rice.edu   ece.rice.edu/bharadwaj.aspx  
Research areas: Photonics, Electronics & Nanodevices  
Dr. Bharadwaj is interested in light-matter interaction at the nanoscale, optical antennas, nanoscale energy transduction, plasmonics, spectroscopy and microscopy, and optoelectronics. **REU opportunities available.**

Joseph R. Cavallaro*, Professor, Electrical and Computer Engineering & Computer Science  
cavallar@rice.edu   ece.rice.edu/cavallaro.aspx  
Research areas: Computer Engineering, Systems  
Dr. Cavallaro’s research impacts the development of the next generation of cellular mobile phones. He studies Wireless Communication Systems Architectures, VLSI Systems Design and Prototyping. **REU opportunities available.**

Epilepsy is the 4th most common neurological disease in United States, and many patients don’t respond well to traditional treatment like drugs. The Aazhang group is working to predict the onset of seizure.

*Denotes VIP Faculty
ECE is Lensless Cameras
ECE Researchers have developed a flexible, lensless camera, smaller than a dime. It’s called “FlatCam”.

John W. Clark, Jr., Professor, Electrical and Computer Engineering & Bioengineering
jwc@rice.edu  ece.rice.edu/clark.aspx
Research areas: Neuroengineering, Systems
Dr. Clark’s research impacts the medical field through his work in electrophysiology (neural, cardiac). He’s interested in mathematical modeling of biological systems; signal processing methods applied to biological systems; nonlinear system dynamics; electromagnetic field theory.

Gene Frantz, Professor in the Practice, Electrical & Computer Engineering (Signal Processing)
genef@rice.edu  ece.rice.edu/genefrantz.aspx
Research areas: Systems
Gene Frantz is interested in entrepreneurship and intrepreneurship. He is an expert in Digital Signal Processing.

Fabrizio Gabbiani, Professor, Electrical & Computer Engineering
Professor of Neuroscience, Baylor College of Medicine
gabbiani@bcm.edu  http://bit.ly/2izX2Bg
Research areas: Neuroengineering
Dr. Gabbiani is interested in computational aspects of sensory information processing from the single cell to the network level.

Naomi J. Halas, Stanley C. Moore Professor, Electrical & Computer Engineering
Professor of Biomedical Engineering, Chemistry, Physics and Astronomy
halas@rice.edu  ece.rice.edu/halas.aspx
Research areas: Photonics, Electronics & Nanodevices
Dr. Halas’ group harvests solar radiation for energy applications and researches nanoparticle use in cancer therapy. She designs and fabricates optically responsive nano structures, nanophotonics, and plasmonics.

Kevin Kelly, Associate Professor, Electrical and Computer Engineering
kkelly@rice.edu  ece.rice.edu/kelly.aspx
Research areas: Photonics, Electronics & Nanodevices
Dr. Kelly is interested in imaging and spectroscopy at the nanoscale, and understanding the role of mathematics in image acquisition and interpretation. Other interests include Scanning Probe Microscopy, Electronic Materials, Compressive Infrared and Hyperspectral Imaging.
Edward W. Knightly, Chair, Electrical and Computer Engineering, Professor, Electrical and Computer Engineering & Computer Science
knightly@rice.edu   ece.rice.edu/knightly.aspx
Research areas: Systems
Dr. Knightly is the founder of Technology for All, bringing tech to underserved areas. He is interested in wireless networks, urban-scale testbeds, clean-slate design, diverse spectrum access, multi-antenna systems, hardware platforms, high-performance protocol design, security, & performance evaluation. REU opportunities available.

Junichiro Kono, Professor, Electrical and Computer Engineering, Physics & Astronomy
kono@rice.edu  ece.rice.edu/kono.aspx                    nakatani-ries.rice.edu
Research areas: Photonics, Electronics & Nanodevices
Dr. Kono’s research results in increased understanding of quantum states. He’s interested in condensed matter physics, optics and photonics, nanoscience and nanotechnology. REU opportunities available.

Gururaj Naik, Assistant Professor, Electrical & Computer Engineering
guru@rice.edu   ece.rice.edu/naik.aspx
Research areas: Photonics, Electronics & Nanodevices
Dr. Naik is interested in light and heat management for clean energy: thermovoltaics and photovoltaics; materials for plasmonics and metamaterials; and large-area nanofabrication and integration. REU opportunities available.

Michael T. Orchard, Professor, Electrical & Computer Engineering
orchard@rice.edu   ece.rice.edu/orchard.aspx
Research areas: Data Science, Systems
Dr. Orchard researches image and video modeling and compression.

ECE is Engineering the Brain
The Kemere lab designs systems to interact with complex neural circuits to explore how information is processed, stored and retrieved in both healthy brains and those with disorders, focusing on memory and Deep Brain Stimulation.
ECE is Research in Education
The Baraniuk lab researches how the brain perceives depth and 3D vision. They are interested in machine learning and image and neural information processing.

Ankit Patel, Assistant Professor, Electrical & Computer Engineering
Assistant Professor, Neuroscience, Baylor College of Medicine
abp4@rice.edu   ece.rice.edu/patel.aspx
Research areas: Data Science, Neuroengineering, Systems
Dr. Patel is interested in probabilistic theories of Deep Learning from first principles; neurally-inspired learning and computation; medical imaging diagnosis; reverse-engineering neocortex; and Deep Learning for particle physics.

Xaq Pitkow, Assistant Professor, Electrical and Computer Engineering
Assistant Professor, Computational Neuroscience, Baylor College of Medicine
xaq.pitkow@rice.edu   ece.rice.edu/pitkow.aspx
Research areas: Data Science, Neuroengineering
Dr. Pitkow’s research includes teaching monkeys how to play video games, as part of his work on theories of neural computation in animal brains. Topics include: probabilistic inference, control theory, nonlinear dynamics, population codes. Current projects include analyzing behaviors of animals playing video games; designing animal virtual reality environments; stimulating and analyzing computation in neural networks.

Jacob T. Robinson, Assistant Professor, Electrical and Computer Engineering & Bioengineering
jacob.t.robinson@rice.edu   ece.rice.edu/robinson.aspx
Research areas: Data Science, Neuroengineering, Photonics, Electronics & Nanodevices
Dr. Robinson uses nanotechnology to interact with the brain and to treat neurological disorders. In other words, he uses nanotechnology to measure and manipulate neural activity.

Ashutosh Sabharwal*, Professor, Electrical and Computer Engineering
ashu@rice.edu   ece.rice.edu/sabharwal.aspx
Research areas: Data Science, Systems
Dr. Sabharwal is interested in mobile health - using smart devices to diagnose and treat patients in more scenarios, to measure medicine adherence, and to impact health behaviors. He’s also interested in wireless networks, information theory, multiple antenna systems, coding and computation. **REU opportunities available.**
Harel Shouval, Professor, Electrical and Computer Engineering
Professor, Neuroscience, UT Health
harel.shouval@uth.tmc.edu http://bit.ly/2j128VY
Research areas: Neuroengineering
Dr. Shouval is interested in forming an integrated picture of learning, memory and development, processes that share many common mechanisms.

Ray Simar*, Professor in the Practice, Electrical and Computer Engineering (Digital Signal Processing Architecture)
ray.simar@rice.edu ece.rice.edu/simar.aspx
Research areas: Systems
Dr. Simar’s team has built a putter that gives active feedback to golfers. They’re now working on a self-driving motorcycle. His research includes digital signal processors, design methodology and programming tools.

Isabell Thomann, Assistant Professor, Electrical and Computer Engineering
it6@rice.edu ece.rice.edu/thomann.aspx
Research areas: Photonics, Electronics & Nanodevices
Dr. Thomann creates novel materials and nanostructures to solve practical problems in the areas of energy and photocatalysis. She is interested in interdisciplinary problems in energy, photocatalysis, ultrafast spectroscopy and nanophotonics. REU opportunities available.

Frank K. Tittel, J.S. Abercrombie Professor, Electrical and Computer Engineering, Professor, Bioengineering
fkt@rice.edu ece.rice.edu/tittel.aspx
Research areas: Photonics, Electronics & Nanodevices
Dr. Tittel’s research includes developing sensor technology for the oil & gas industry. He is interested in quantum electronic devices, laser spectroscopy with applications in environmental monitoring, atmospheric chemistry, industrial process analysis and control, medical diagnostics based on breath analysis, the life sciences, defense applications and homeland security.

Peter J. Varman, Professor, Electrical and Computer Engineering & Computer Science
pjv@rice.edu ece.rice.edu/varman.aspx
Research areas: Computer Engineering, Data Science
Dr. Varman researches computer systems, storage and memory systems, virtualization and resource management, and cloud computing.

ECE is Design Challenges
Team DISSECT is creating an autonomous motorcycle using advanced feedback control, gyroscopic principles and precise sensors.
ECE is Being A RockStar
Lin Zhong is an actual ECE RockStar - he won the 2014 SIGMOBILE RockStar Award. His group recently developed RIO - a system solution for sharing I/O between multiple mobile devices.

ECE is Mobile Health
The Veeraraghavan Group developed a highly-accurate, touch-free system to monitor patients’ vital signs long-distance, just by looking at their faces via video. The technique compensates for skin tone, light, and movement.

Ashok Veeraraghavan, Assistant Professor, Electrical and Computer Engineering
vashok@rice.edu  ece.rice.edu/veeraraghavan.aspx
Research areas: Data Science, Neuroengineering, Systems
In addition to his recent development of a lensless camera, Dr. Veeraraghavan has a strong interest in mobile health and using smart devices to diagnose and treat patients. He is interested in computational imaging, compressive sensing for imaging, signal processing and computer vision. REU opportunities available.

Gary Woods*, Professor in the Practice, Electrical and Computer Engineering (Computer Technology)
gary.woods@rice.edu  ece.rice.edu/garywoods.aspx
Research areas: Photonics, Electronics & Nanodevices
Dr. Woods is interested in mobile health, semiconductor failure analysis, and optical probing and debugging of advanced integrated circuits. He has advised groups who’ve gone on to: develop a vest to help the deaf hear; develop a dynamic radar and digital imaging system; and design a virtual fitting room.

Lin Zhong, Professor, Electrical and Computer Engineering
lzhong@rice.edu  ece.rice.edu/lzhong.aspx
Research areas: Computer Engineering, Data Science
Dr. Zhong’s team recently developed RIO, which allows an application on one mobile system to utilize I/O from another. He’s interested in mobile and embedded systems, human-computer interaction, and nanoelectronics.
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