2018 - 2019

IMPACT REPORT

ELECTRICAL AND COMPUTER ENGINEERING

BOSTON UNIVERSITY

DEPARTMENT PROGRESS

FACULTY

FACULTY GROWTH

25%

OF ECE FACULTY OVER LAST 5 YEARS ARE NEW HIRES

FELLOWS

34

SOCIETY FELLOWS

WOMEN IN ENGINEERING

DOCTORAL DEGREES

3RD*

IN % OF PHD DEGREES AWARDED TO WOMEN

UNDERGRADUATES

35%

OF UNDERGRADUTE STUDENTS ARE WOMEN

*Most recent data from ASEE

RESEARCH

FUNDING GROWTH

↑14%

AVERAGE ANNUAL GROWTH RATE OVER 10 YEARS

GRANT FUNDING

$31M

FISCAL YEAR 2019

ACADEMICS

SELECTIVITY

26%

UNDERGRADUATE SELECTIVITY

PHD ENROLLMENT

↑19%

AVERAGE ANNUAL GROWTH RATE OVER 8 YEARS

ECE CHAIR, PROFESSOR W. CLEM KARL

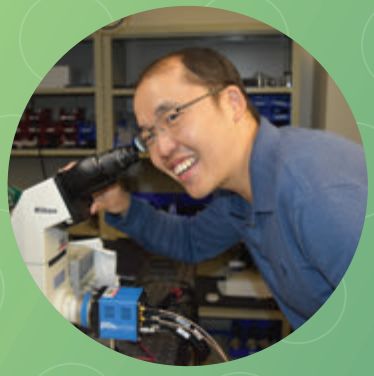
The Department of Electrical and Computer Engineering at Boston University has completed another dynamic year of societal engineering. Our grant funding has continued to grow at an average annual rate of 14 percent, thanks to our energetic faculty. These grants include new large awards such as the $7.5 million MURI for neuro-inspired robots. Recognition of the excellence of our faculty continues apace, with the addition of an NAE status to one, and fellowship election to an additional five. Boston University has also committed to a brand-new, university-level, college-like unit focused on data science. Its home, whose construction has just begun, will be the tallest on campus once completed and become a centerpiece of the Boston skyline. Our degree programs have also continued to expand at all levels. We are especially proud of our success in expanding the number of female students receiving ECE degrees to over double the national average. I hope you'll read for yourself and partake in the excitement brewing on our campus.

JUNIOR FACULTY ON THE RISE

THREE ECE FACULTY RECEIVE NSF CAREER AWARD

MICHELLE SANDER - AN INNOVATOR IN CANCER RESEARCH

Assistant Professor Michelle Sander received an NSF CAREER award to pursue her research project, "Towards Super-Resolution Label-Free Mid-Infrared Photothermal Imaging." Using mid-infrared microscopy, Sander plans to develop a non-invasive method to sample cancerous brain cells. Her approach will intertwine multiple disciplines, from fiber lasers and microscopy to biomedical analysis and chemical spectroscopy. This interdisciplinary approach is expected to advance cancer diagnosis and treatment by providing details on brain cells' biochemical spectral signatures and thermo-physical characteristics.



LEI TIAN - BREAKING BARRIERS IN OPTICAL TOMOGRAPHY

To date, the resolution of optical tomography has been limited to about 100 microns, but Assistant Professor Lei Tian intends to change that. Supported by an NSF CAREER award, "Optical Intensity Diffraction Tomography with Multiple Scattering," he plans to break this resolution limit by advancing the field in terms of both theory and practice through advanced modeling techniques. Ultimately, his research should lead to the development of a better technology and provide the means to study biological samples and phenomena, not accessible today, in areas such as histology, cytometry, brain mapping, and drug discovery.

SAHAR SHARIFZADEH - CHANGING THE WAY WE LOOK AT SOLAR ENERGY

Assistant Professor Sahar Sharifzadeh received an NSF CAREER award for her project, "First-Principles Investigation of Energy Transport Within Ordered Organic Assemblies." Through her research, Sharifzadeh expects to improve the understanding of how the light interacts with carbon-based organic molecules with the ultimate goal of developing new, more efficient materials for solar panels. She plans to integrate this research into education both at the graduate level as well as within the middle and high school curriculum via the Boston University Technology Innovation Scholars Program.

FACULTY RECOGNITION

DAVID BISHOP ELECTED TO THE NATIONAL ACADEMY OF ENGINEERING

Adding to his long list of accomplishments, Professor David Bishop was recently honored by the National Academy of Engineering for his contributions to and leadership in high-capacity optical switch technology. Bishop was recognized for his 50-year research career, 33 years of which he spent at Bell Labs. A year before, Bishop was also elected a fellow of the National Academy of Inventors, another recognition of his innovative and impactful research career.

SIDDHARTH RAMACHANDRAN ELECTED VANNEVAR BUSH FACULTY FELLOW

Professor Siddharth Ramachandran was recently named a Vannevar Bush Faculty Fellow by the Department of Defense to support his breakthrough research on light propagation. Ramachandran is proposing to change the way many engineers study and think about light in fiber optics. His novel assertion that the structure of light does not develop in a straight line, as once previously thought, but rather in a spiral, can create new opportunities for research and development in fiber-optic transmission and laser design.

SAHAR SHARIFZADEH AMONG NATURE'S MOST IMPACTFUL FACULTY

Shooting her way to the top, Assistant Professor Sahar Sharifzadeh was featured in Nature as one of 11 early- and mid-career scientists making an impact in their respective fields. As the Earth's resources are dwindling fast, Sharifzadeh's futuristic thinking is helping change the way we leverage solar energy. The magazine highlighted some of her research that aims to better understand how various materials respond electronically to light. These new insights are expected to help with the development of novel materials for solar panels.

JI-XIN CHENG ELECTED FELLOW OF THE OPTICAL SOCIETY

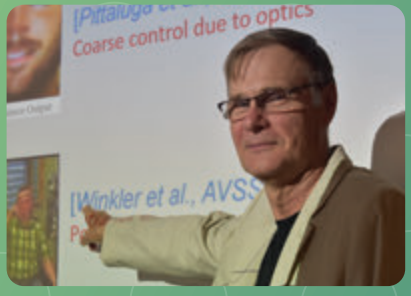
Enlarging his long list of accomplishments, Professor Ji-Xin Cheng was elected a Fellow of the Optical Society. This honor recognizes his recent work on the invention and development of label-free optical spectroscopic imaging technologies. Cheng plans to use the newly-developed technology to create groundbreaking applications in biology, medicine, and materials science.

THREE ECE PROFESSORS NAMED IEEE FELLOWS

Professors David Castañón, Siddharth Ramachandran, and Venkatesh Saligrama were elected IEEE Fellows. Castañón has been recognized for his contributions to discrete-time stochastic control and information fusion; Ramachandran for his impact on the studies of higher-order modes in optical fibers; and Saligrama for his contributions to the theory of distributed detection and estimation of structured signals.

FACULTY IN NUMBERS

32	13	9	12%	10%
Full Professors	Associate Professors	Assistant Professors	Female Faculty	URM Faculty



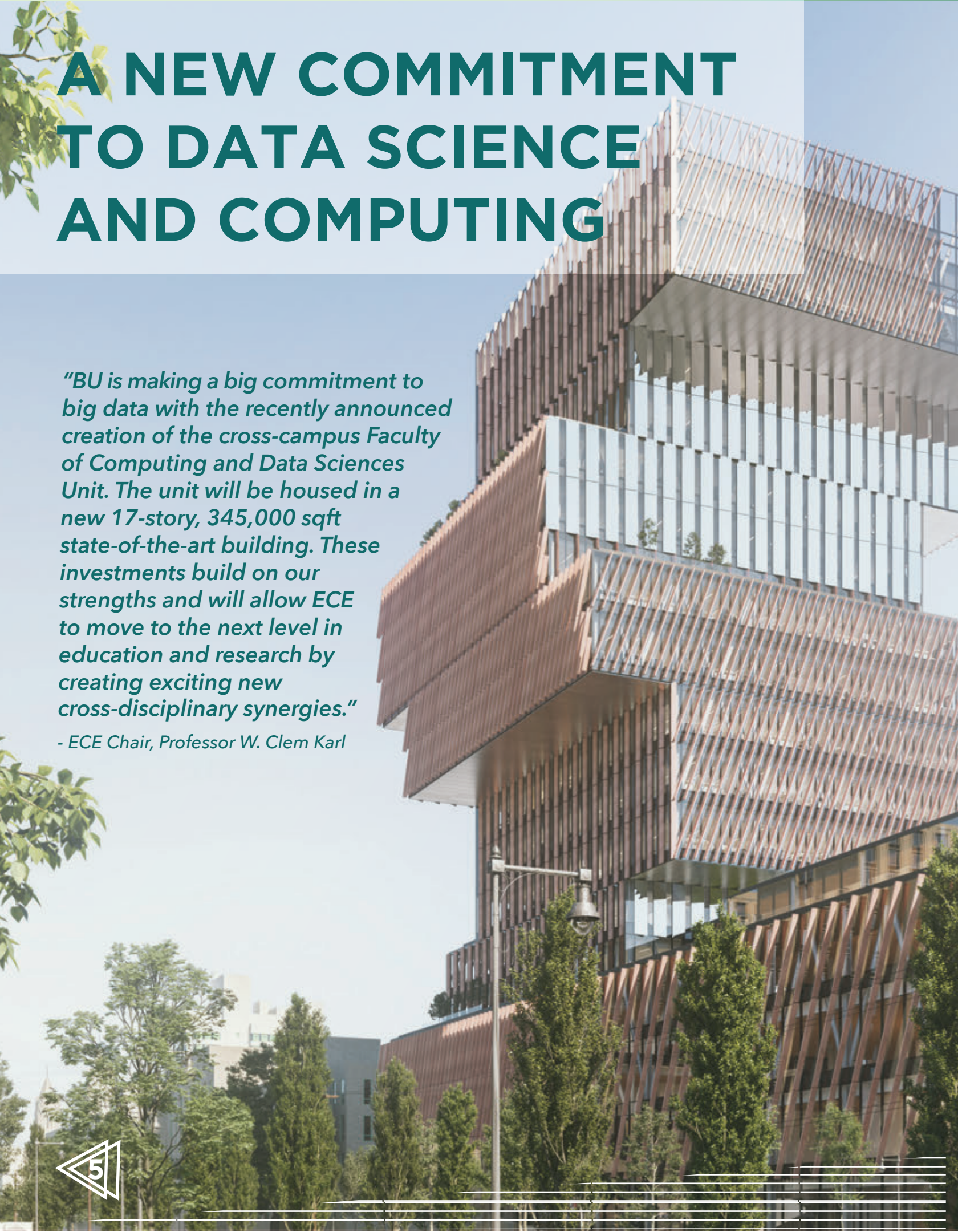
KONRAD NAMED IEEE DISTINGUISHED LECTURER FOR 2019-2020

Each year, the IEEE Signal Processing Society's Distinguished Lecturer Program selects five outstanding educators and authors in various fields of signal processing to serve as ambassadors and deliver lectures both nationally and internationally. Professor Janusz Konrad has been selected as one of the SPS Distinguished Lecturers for a two-year period. His portfolio of lectures includes autonomous video surveillance, user authentication for natural user interfaces (e.g., touch, gesture), and privacy-preserving localization and recognition of human activities.

A NEW COMMITMENT TO DATA SCIENCE AND COMPUTING

"BU is making a big commitment to big data with the recently announced creation of the cross-campus Faculty of Computing and Data Sciences Unit. The unit will be housed in a new 17-story, 345,000 sqft state-of-the-art building. These investments build on our strengths and will allow ECE to move to the next level in education and research by creating exciting new cross-disciplinary synergies."

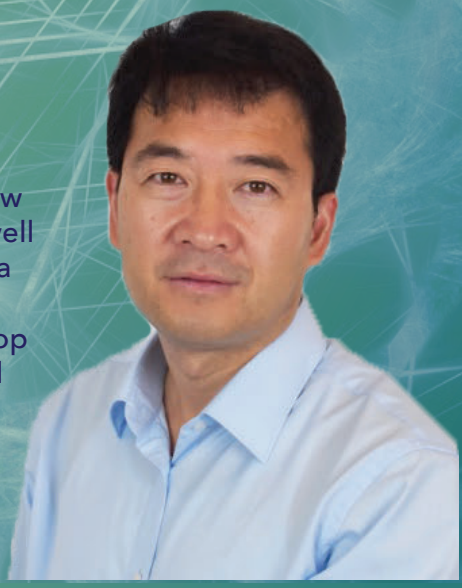
- ECE Chair, Professor W. Clem Karl



RESEARCH THAT CHANGES THE WORLD

JI-XIN CHENG AND MICHELLE SANDER PUSH THE BOUNDARIES IN BRAIN SCIENCE

The brain is still filled with unexplainable mysteries. In efforts to crack open the enigma that is the brain, Professor Ji-Xin Cheng and Assistant Professor Michelle Sander were each awarded a grant from the National Institute of Health's Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative. Cheng and his team received a **$3.3M grant from the BRAIN Initiative** to develop a new foundation for the design of a non-invasive brain stimulation technique, also known as ultrasound neuromodulation. The combination of imaging, opto-acoustic technology and neurotechnology will help them focus on understanding the complex neurons at single cell and subcellular levels. This new design will further advance basic neuroscience research as well as treatment of neurological disorders. In collaboration with a professor from the College of Arts and Sciences, Sander was awarded **$2.7M** from the aforementioned initiative to develop a compact and innovative fiber laser system. This high-speed imaging system aims to capture neuronal activity faster and with higher resolution than previous microscope systems. Using these new tools, both professors hope to unravel the complex labyrinth that is the brain.



DEPARTMENT OF DEFENSE HONORS PROFESSOR PASCHALIDIS WITH A MURI AWARD

The Department of Defense has awarded Professor Ioannis Paschalidis **$7.5 million in Multidisciplinary University Research Initiative (MURI)** funding to develop neuro-inspired autonomous robots. The multi-university team of experts in neuroscience, robotics, computer science, computer vision, artificial intelligence and mathematical systems theory plans to create a new class of robots capable of self-learning and adapting to changing environmental situations.

RESEARCH SNAPSHOT

OFFICE OF NAVAL RESEARCH AWARDS MANUEL EGELE WITH A GRANT FOR CYBERDEFENSE STUDIES

Assistant Professor Manuel Egele was awarded a **$750,000 Office of Naval Research grant** to develop a cyberdefense system that leverages computer malware to deceive attackers by providing intentionally incorrect information. Malware is a constant threat in the 21st century, especially as technology advances, and Egele is determined to strengthen technology's defense.

PRAKASH ISHWAR TEAMS UP WITH OTHER BU PROFESSORS TO ANALYZE GLOBAL MEDIA

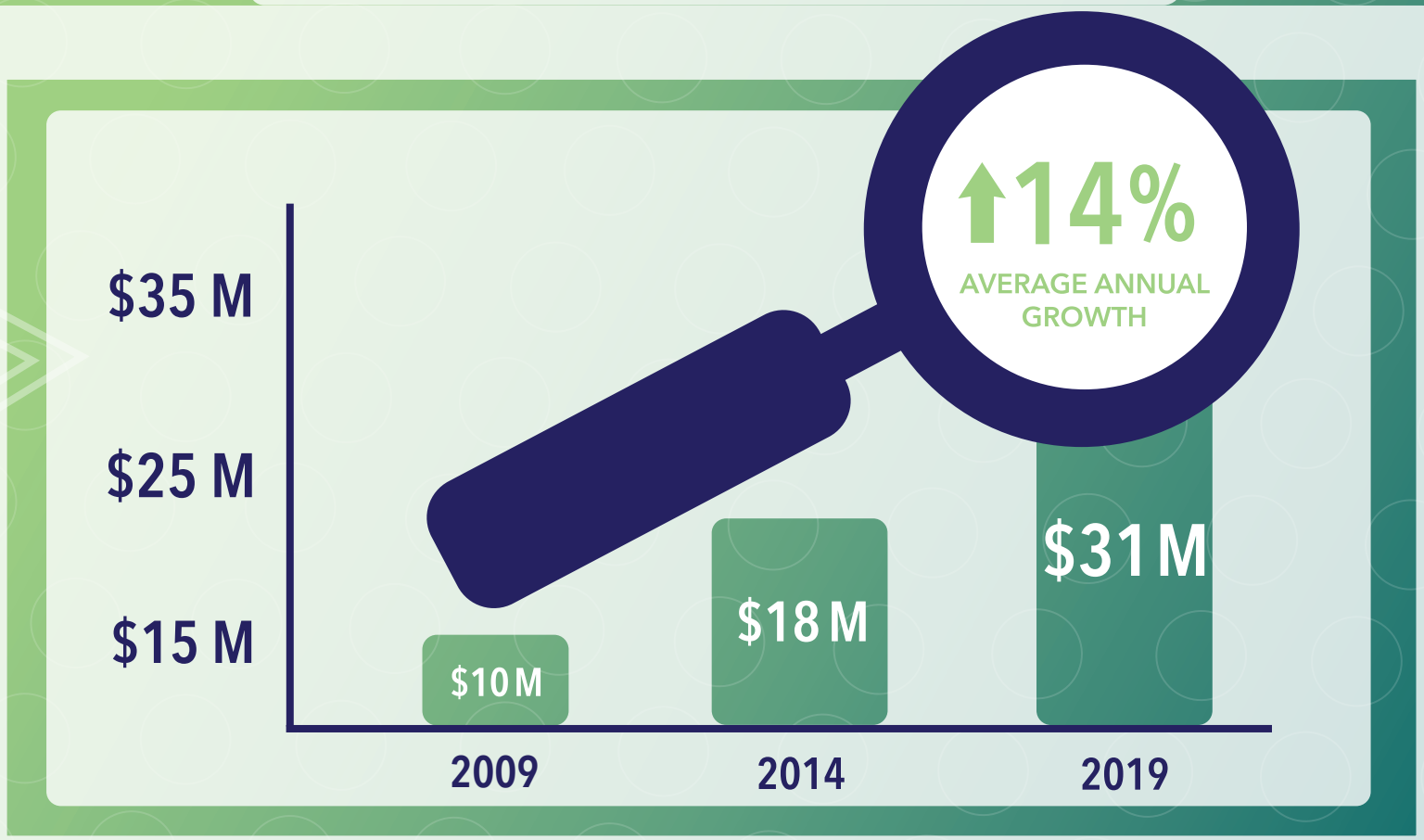
Professor Prakash Ishwar is part of a team that was awarded a **$1 Million National Science Foundation grant** to develop methods and tools for collecting, annotating and analyzing multilingual, multi-platform and multi-modal text and images originating in the US and reported worldwide. Their ultimate goal is to develop analytical tools that can accurately examine the flow of public communications, particularly from the media and press, and improve the transparency of public media sources.

RESEARCHERS WIN NSF GRANT TO PREDICT HEART DISEASE AND DIABETES USING MACHINE LEARNING

Professors Ioannis Paschalidis and Christos Cassandras, along with a collaborator from the Boston Medical Center, were awarded a three-year, **$900,000 National Science Foundation grant** to develop and pilot a health informatics system to predict patients at risk of heart disease or diabetes. The system will use data from wearable, implantable, and home-based, networked diagnostic devices. One of the goals of the project is to develop algorithms to predict future medical events, such as hospitalizations, re-admissions, and significant disease transitions.

GRANTS OVERVIEW

RESEARCH FUNDING



DIVERSE FUNDING PROFILE

$12M	$5M	$2M	$1M	$1M	$10M
NSF	NIH	DoD	NASA	DoE	OTHER

ACADEMIC EXCELLENCE

MORE BU WOMEN EARN ECE BACHELOR'S DEGREE THAN THE NATIONAL AVERAGE

32% @ECE

OF ECE BACHELOR'S DEGREES AT BU AWARDED TO WOMEN IN 2018/2019

14%* NATIONAL AVERAGE

OF ECE BACHELOR'S DEGREES AWARDED TO WOMEN IN 2018/19

*Most recent data from ASEE

TOTAL STUDENTS ENROLLED

830

465	221	144
BACHELORS	MASTERS	PHD

ENROLLMENT GROWTH

19% PHD

13% MASTER'S

11% BACHELOR'S

Average annual enrollment growth over 8 years

CREATING THE SOCIETAL ENGINEER

ECE SENIOR DESIGN AWARDS

BEST ECE SENIOR DESIGN AWARD

TEAM SMART EPIPEN

2019 CORNELL CUP SEMI-FINALIST

Created a smart case for EpiPen injector that alerts specified support circle with the user's GPS location when the injector is removed. The case can also communicate with a wearable device that will notify the wearer if the injector is not in close proximity.

ENTREPRENEURIAL AND DESIGN AWARD

TEAM RIVERSONDE

2019 CORNELL CUP FINALIST

Developed an underwater sensor suite that enables inexpensive remote collection of water-quality data from rivers and streams. The team's product is hydroelectrically-powered by a river's natural current, making it deployable in low sunlight areas, and mesh-networking-ready.

ADVANCED COLLEGE STANDING

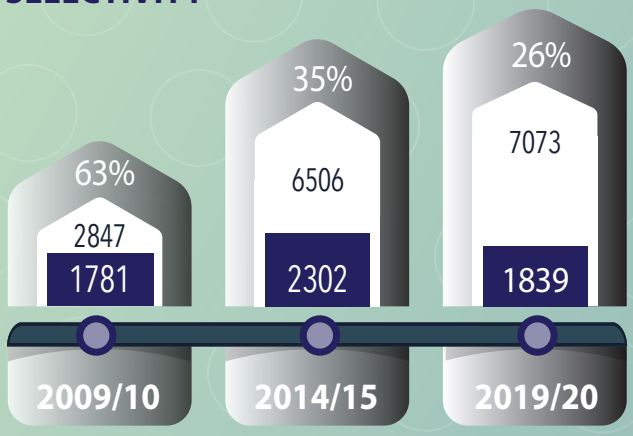
WOMEN IN ENGINEERING

3RD* HIGHEST IN PERCENTAGE OF DOCTORAL DEGRESS AWARDED TO WOMEN

35% OF UNDERGRADUATE STUDENTS ARE WOMEN COMPARED TO THE NATIONAL AVERAGE OF 23%*

*Most recent data from ASEE

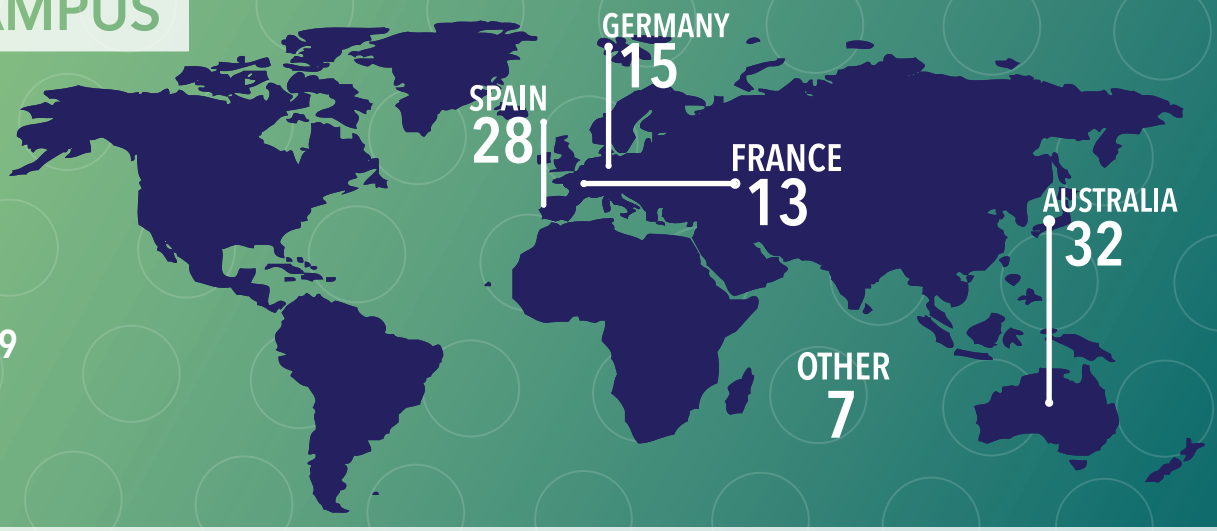
INCREASING UNDERGRADUATE SELECTIVITY



GLOBAL CAMPUS

95

STUDENTS STUDIED ABROAD IN 2018/2019



ECE SENIOR DESIGN PROJECT EXCELLENCE AWARDS

ECE SENIORS HONE THEIR SKILLS SOLVING ENGINEERING PROBLEMS BOTH AROUND BOSTON AND ACROSS THE WORLD. WORKING WITH A CUSTOMER, THEY RESEARCH, DESIGN, AND IMPLEMENT A SOLUTION TO A SPECIFIC CHALLENGE.

TEAM VULCAN

2019 CORNELL CUP FINALISTS
PEOPLE'S CHOICE AWARD

Created an inexpensive, low-power IoT device that monitors air humidity and temperature, as well as soil dryness to preemptively detect when and where the next wildfire may occur.

TEAM SMART BUOY

Created a water-quality measurement system for freshwater rivers, lakes and ponds. The system consists of water-testing buoys and a solar-powered mesh network that transmits the collected data to the cloud for access by authorized users.

TEAM WIZARD CHESS

Developed a hands-free, voice-controlled robotic version of the game of chess by leveraging emerging technologies, such as IoT, augmented reality, indoor light positioning, swarm robotics and block-chain.

Boston University College of Engineering
Department of Electrical & Computer Engineering

8 Saint Mary's Street
Boston, Massachusetts 02215
Tel: (617) 353-2811
Fax: (617) 353-7337
Web: ece.bu.edu

@BU_ece BUece ECE Communications

JI-XIN CHENG RECEIVES ELLIS R. LIPPINCOTT AWARD

Professor Ji-Xin Cheng is the 2019 recipient of the Ellis R. Lippincott Award from the Optical Society for "outstanding contributions in inventing and developing a broad spectrum of vibrational spectroscopic imaging technologies with ground-breaking discoveries and clinical applications." During his career, Cheng has made a number of innovations that allowed vibrational spectroscopic imaging of living systems from a single bacterium to human patient.