THE NAE GRAND CHALLENGES SCHOLARS PROGRAM

Based on acquiring five competencies: experiential learning through research and hands-on projects; interdisciplinary immersion, including communication; innovation and entrepreneurship business models; cultural awareness through global and other immersion; and societal consciousness, the Grand Challenges Scholars Program created jointly by Duke University, Olin College and USC Viterbi in 2009 is changing the nature of engineering education.

This year, the Grand Challenges Scholars program celebrates 9 years since its founding as a novel engineering undergraduate program. It has now been adopted by more than 50 engineering schools worldwide (and actively considered by an additional 40 schools), while more than 120 engineering deans pledged in a 2015 letter to U.S. President Obama to adopt it in their schools. In addition, it has been endorsed by the National Academy of Engineering as the program that will produce the engineering talent needed to advance the solution of the NAE Grand Challenges for Engineering.

"THE THING THAT MOTIVATED ME AND A LOT OF MY COLLEAGUES TO COME INTO TECHNOLOGY IS THE SERVICE . . . SO, IF YOU'RE TEACHING IN THIS FIELD, YOU NEED TO START WITH IMPACT AND THEN GET TO THE MATH." — Megan Smith

Third Chief Technology Officer of the United States

THE MIN FAMILY ENGINEERING SOCIAL ENTREPRENEURSHIP CHALLENGE

Established by alumnus Bryan Min and his wife Julie Min, **The Min Family Social Entrepreneurship Challenge (MFC) supports students' use of engineering and technology to develop sustainable and effective solutions for global problem**s. To date, the MFC has nurtured concepts ranging from technologies for preventing infant blindness to digital solutions for the "underbanked."

In the wake of Hurricane Harvey, Irma, Jose, and Maria and devastation from Mexico's strongest earthquakes in a century, **the 2017-18 MFC focused on developing sustainable technology ventures to enhance relief and recovery efforts for the hurricane victims and mitigate impact of future disasters**. The initiative allowed teams of students to travel to the Houston area, a testbed, for field research, then develop technical solutions for a specific problem resulting from Hurricane Harvey's aftermath.

For 2018-2019, the MFC will concentrate on issues related to refugee camps. Over the course of the year, USC students in Los Angeles and refugees in various camps will partner virtually to **seek at least five life-saving or life-improving technology and engineering innovations aimed at the most vulnerable impacted by the refugee crisis**.

In particular, a team of USC students traveled in September 2018 to the Greek island of Lesvos where they worked together with global NGOs, local government and refugees in the island's refugee camps to find innovative engineering solutions to problems such as, access to clean water, shelter and sanitation, women's health and camp security, and education and access to information. This effort is part of a new class offered in Civil and Environmental Engineering at USC Viterbi, *Innovation in Engineering Design for Global Challenges*, taught by Dr. Burçin Becerik-Gerber, associate professor and the Stephen Schrank Early Career Chair in civil and environmental engineering.

USC VITERBI AT A GLANCE

USC Engineering began in 1905

Student Population
Approximately 2,600 undergraduate students and 5,700 graduate students

Faculty
189 tenure-track faculty, with 94 endowed chairs and professorships, 74 NSF Career Awardees, 16 full-time and just over 40 affiliated faculty who are members of one or more National Academies (NAE, NAS, NAM, and NAI), 15 MIT TR35 winners

Academic Departments
Eight

Alumni
More than 76,000

Annual Research Expenditures
More than $204 million, with more than 50 research centers and institutes

Research Centers and Institutes

Home to:
- » Information Sciences Institute (ISI)
- » The Ming Hsieh Institute
- » The Daniel J. Epstein Institute
- » Two (now graduated) National Science Foundation (NSF) Engineering Research Centers (ERC)
  - › Integrated Media Systems Center (IMSC)
  - › Biomimetic MicroElectronic Systems Center (BMESC)
- » University Center of Excellence of the U.S. Department of Homeland Security - Center for Risk and Economic Analysis of Terrorism Events (CREATE)
- » DOE/White House Materials Genome Initiative Center
- » Center for Energy and Nanoscience at USC
- » HTE@USC (Health, Technology and Engineering@USC)
- » LADWP/DOE Smart Grid Demonstration Project
- » USC-Lockheed Martin Quantum Computation Center
- » Center for Interactive Smart Oilfield Technologies (CiSoft)
- » Pratt & Whitney Institute for Collaborative Engineering (PWICE)
- » Airbus Institute for Engineering Research (AIER)
- » Center for Advanced Manufacturing (CAM)
- » Center for Artificial Intelligence in Society (CAIS)
- » Northrop Grumman Institute of Optical Nanomaterials and Nanophotonics (NG-ION^2)
- » USC Machine Learning Center (MASCLE)
- » Center for Interdisciplinary Decisions and Ethics (DECIDE)

Affiliated with:
- » Alfred E. Mann Institute for Biomedical Engineering (AMI)
- » USC Institute for Creative Technologies (ICT)
- » USC Stevens Center for Innovation

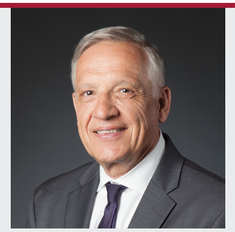
Education Centers
- » Division of Engineering Education
- » Min Family Engineering Social Entrepreneurship Challenge
- » KIUEL (Klein Institute for Undergraduate Engineering Life)
- » VAST: Viterbi Adopt-a-School, Adopt-a-Teacher
- » Maseeh Entrepreneurship Prize Competition (MEPC)

USC Viterbi
School of Engineering

HEROIC ENGINEERING*

2018 DEAN'S REPORT

**with acknowledgment and gratitude to Megan Smith, third CTO of the US Government, who coined the term*



HEROIC ENGINEERING

USC Viterbi School of Engineering

In her graduate commencement speech to the USC Viterbi graduating M.S. and Ph.D. class of 2017, Megan Smith, the third U.S. Chief Technology Officer, urged our graduates to become engaged in ***heroic engineering***. This concept is now the top entry in the google search on this subject.

In today's world, where engineering and technology are empowering everything we do, ***heroic engineering*** provides purpose to our students to apply their skills and knowledge to better society. We cultivate this sense of purpose with the following activities:

- The NAE Grand Challenges Scholars Program, co-founded by Duke University, Olin College and USC Viterbi in 2009, and now spreading globally, which has ***societal impact*** as one of its five objectives.
- We now challenge our engineering students to collectively volunteer 100,000 hours per year, ***100,000 hours per year of heroic engineering***.
- The Min Family Engineering Challenge addresses the solution of societal problems through ***social entrepreneurship***, including, last year, the impact of natural disasters and disaster relief, and this year empowering refugees living in camps.
- Use of AI for social good, e.g. to address the ***opioid epidemic*** and to combat ***human trafficking*** and illegal poaching.

Heroic Engineering is now an integral part of our mission and a catalyst for changing the conversation about engineering. It complements the adoption of a ***mindset of growth***. This mindset inspires our students and faculty to establish a culture of forward-looking and positive attitude, one in which ***all problems are solvable***.

A growth mindset is a heroic mindset, aspiring to new heights. It encourages our students and faculty to look forward and outwards, rather than backwards and inwards. And to help prepare our students for a world in which they can use their engineering talents and innovative thinking for solutions that positively and exponentially impact the human condition.

Yannis C. Yortsos

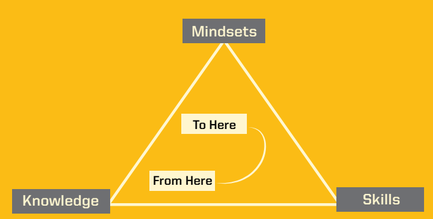
Yannis C. Yortsos
Dean, USC Viterbi
School of Engineering

100K HOURS OF SERVICE PER YEAR

From USC Viterbi computer science students volunteering their expertise to develop an app aimed at preventing heat-related deaths, to robotics demos and free coding lessons given by graduate students to resource-strained schools, a culture of service is evident at every turn at USC Viterbi. Now, we have a way to capture it all.

Volunteering and understanding the societal impact of engineering not only provides an opportunity for students to make a difference in their communities, but also to develop technical, academic, and social skills. Our vision for heroic engineering entails **USC Viterbi piloting a school-wide volunteer initiative – to provide 100,000 hours of heroic engineering every year**. Utilizing a mobile platform to explore volunteer opportunities and track engagement, students will commit to service projects that link volunteering and engineering for societal impact.

Cultivate a mindset of social consciousness
Change the conversation about engineering



AI FOR GOOD

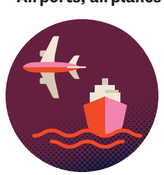
USC Viterbi researchers, in collaboration with scholars from other disciplines and universities, are using machine learning and AI to tackle a host of societal problems — to enrich life for all. The following are examples in four key areas, inspired by the NAE Grand Challenges framework.

SUSTAINABILITY

Protecting against poachers — A game theory software has been tested in Uganda to target poachers. This (PAWS) software is designed to address the shortcomings of porous security networks across many different areas. A similar software has also been tested in Malaysia to help save its dwindling tiger population. Forest, fishery and wildlife protection are another part of PAWS.

Climate change and air pollution — Big data analytics is being used to better understand climate change and urban air pollution, two of today's great sustainability challenges, and to come up with solutions such as reflective cool roofs, vegetative roofs, solar reflective cool pavements and street-level vegetation. The research involves the three distinct fields of machine learning, environmental engineering, and earth science.

PUBLIC SAFETY AND SECURITY



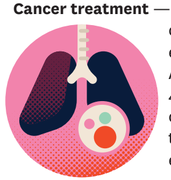
Airports, airplanes and ports — Game theory software prevents would-be terrorists from accomplishing their mission, based on algorithms that intelligently randomize schedules of airport police, thus making it difficult to identify exploitable patterns. The software continually improves with the input of new data, such as when and where past attacks have occurred. One program intelligently randomizes the schedules of federal air marshals. Another is used at ports.

AI FOR GOOD

HEALTH

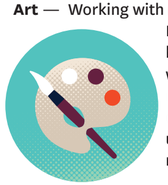
The opioid crisis — The biggest health crisis in decades leads to some 115 deaths every day in the United States. Viterbi researchers are using deep learning methods to identify likely candidates for addiction, applying signal processing to improve the performance of therapists who specialize in addiction, and employing algorithms to more effectively help the recovery of addicts.

HIV and homeless youth — Homeless youth are 20 times more likely to be HIV-positive. An algorithm has been developed to better identify this ever changing population of L.A.'s homeless youth and, using sequential planning and decision theory, to better analyze the complex map of social media friendships in order to help them seek medical help.

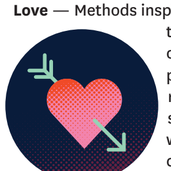


Cancer treatment — An automated pattern-recognition technique called correlation explanation (CorEx) is being used to extract useful information on the Cancer Genome Atlas, which includes genetic sequences on about 400 ovarian tumors. The aim of CorEx is to explain correlations in large data sets and determine the right treatment for a cancer patient's gene expression data.

JOY OF LIVING



Art — Working with researchers at USC Viterbi's Information Sciences Institute, 14 art museums across the United States have created Linked Open Data about their artwork, which links data about artists and related archival material in a consistent way, deepening research connections for scholars and curators, and creating uniform public interfaces for students, teachers and museum visitors.



Love — Methods inspired by quantum physics are being used to improve the matchmaking algorithms that run eHarmony, one of the most successful online dating sites. Using the process of correlation explanation, or CorEx, researchers are minimizing the number of questions site users must answer to create personality profiles without losing the predictive power of eHarmony's compatibility models.