December 7, 2022
Sonia Fernandez

'Innovation and Impactful Contributions'

Electrical and computer engineering professors B.S. Manjunath and Upamanyu Madhow of UC Santa Barbara have been elected to the National Academy of Inventors (NAI). They join 167 distinguished academic inventors chosen this year as NAI Fellows.

"We offer sincere congratulations to Professors B.S. Manjunath and Upamanyu Madhow on their election to the National Academy of Inventors, said Tresa Pollock, interim dean of UCSB's College of Engineering. "This is a well-deserved and prestigious peer recognition of their innovation and impactful contributions to society with leading edge technologies related to computer vision and image search as well as communications and signal processing, respectively."

The NAI Fellows Program highlights academic inventors who have demonstrated a spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on the quality of life, economic development and the welfare of society. Election as an NAI Fellow is the highest professional distinction awarded to academic inventors.

"This year's class of NAI Fellows represents a truly outstanding caliber of innovators," said NAI President Paul Sandberg. Each of these individuals have made significant impact through their work and are highly regarded in their respective fields. "The breadth and scope of their inventions is truly staggering. I am excited to

see their creativity continue to define a new era of science and technology in the global innovation ecosystem."

Seeing is Believing: B.S. Manjunath

"It is an honor to be recognized by this award and it represents the hard work of the students and researchers in the Vision Research Lab over the years," said Manjunath, a pioneer in the field of big image data management.

Images and videos constitute a large proportion of the data that people use and share — from general public applications to uses as specialized as life sciences, cybersecurity and multimedia forensics, which are among Manjunath's specializations. The task for scientists like Manjunath has been to control the flood of image and audiovisual data by corralling it with descriptors and metadata that allow for efficient search and retrieval. His early work led to the development of advanced image descriptors that were eventually adopted in 2000 by the ISO/MPEG-7 standard, and resulted in 24 U.S. and international patents, the technology for many of which was co-invented with students and researchers in his Vision Research Lab. MPEG-7 has since evolved to incorporate face detection and recognition methods, and many have made their way into digital cameras and television.

In addition, Manjunath has spread his expertise to the realm of multimodal big data — data that span several forms such as text and image — particularly in the realm of science and medicine. With his development of the open-source BisQue (Bio-Image Semantic Inquiry User Environment) image informatics platform, scientists and physicians can view, collaborate and discover using a wide array of complex visual data, from 3D visualizations to brain scans and cellular imagery. The National Science Foundation-supported CyVerse open science workspace managed at University of Arizona uses BisQue to manage its images and offers the platform as a core service to its users.

Manjunath continues his vision of creating advanced informatics technologies for real-world applications through his Santa Barbara-based company Mayachitra, Inc., which focuses on delivering computer vision and deep learning solutions. Since 2001, the company has delivered commercial products for image registration and management, cybersecurity and data forensics.

The director of the Center for Multimodal Big Data Science and Healthcare, and also the Center for Bio-Image Informatics at UC Santa Barbara, Manjunath is a fellow of the Association for Computing Machinery and of the Institute of Electrical and Electronics Engineers (IEEE).

Next-Generation Wireless: Upamanyu Madhow

"This award recognizes the technical accomplishments and creativity of the many students and collaborators who I have had the privilege of working with over the years," said Madhow, whose research group applies its expertise in the fundamentals of signal processing and system design to a diversity of applications in next-generation wireless and beyond.

The importance of signal processing to today's world cannot be overstated. It is fundamental to everything from smartphones and wearables to cameras, security and GPS. Any device that sends and receives information benefits from a strong, clear signal and filtering of interference. Madhow's work in this realm has resulted in innovative contributions for wireless communication and sensing, reliable data transport, wireless networking and localization.

Among the most widely used of Madhow's inventions are those related to novel, software-only methods for improving GPS accuracy in urban settings, where location errors can be as large as 50 to 100 meters because of line-of-sight blocking. The technology improves the accuracy of information derived from satellite signal strengths provided by standard GPS software together with 3D maps, while also enabling creation of 3D maps using crowdsourced measurements of satellite signal strengths. As a result, location services are subject to fewer errors due to buildings and other tall structures blocking and distorting satellite signals. This technology was licensed to ShadowMaps, a startup out of Madhow's lab in 2014, and then to Uber, when it acquired ShadowMaps in 2016. The technology has since been deployed worldwide by Uber, and the ShadowMaps team went on to become the core of Uber's location intelligence team.

Prior to ShadowMaps, Madhow's startup Bytemobile — whose technology accelerated data transport over cellular networks —was deployed in 125 wireless carriers in 60 countries, including major carriers such as Orange, T-Mobile, Sprint and Vodafone. Bytemobile was acquired by Citrix in 2012. He also co-founded Wirama, whose technology aims to reduce theft by tracking the location, direction

and movement of RFID-tagged merchandise. Wirama was acquired by Checkpoint Systems in 2009.

Madhow's current research focuses on next-generation communication, with emphasis on robust machine learning, as well as on millimeter wave systems, the technology that underpins 5G communications. He also conducts research on novel architectures and hardware prototypes for very large-scale sensor networks and target tracking using very simple sensors.

Madhow is an IEEE fellow and author of two highly regarded textbooks that evolved from his classroom teaching: "Fundamentals of Digital Communications" (2008) and "Introduction to Communication Systems" (2014), both published by Cambridge University Press.

The 2022 class of fellows will be inducted at the Fellows Induction Ceremony at NAI's 12th Annual Meeting on June 27, 2023 in Washington, D.C.

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.