New COE Faculty

Two new computer science faculty members are thrilled to work with "giants" in their fields

UC Santa Barbara's Computer Science (CS) Department welcomed two assistant professors this spring, each of whom further strengthens areas of research in which College of Engineering faculty have already established themselves as pioneers: quantum computing and computer security. **Divyakant Agrawal**, professor and chair of the CS Department, says that the additions of **Murphy Niu** and **Wenbo Guo** will ensure that the department "remains at the forefront of research" in those two specialty fields.

Wenbo Guo (left) and Murphy Niu.

MURPHY NIU

UCSB and the surrounding area have become a hot spot for quantum research and breakthroughs. Led by UCSB physics professor **John Martinis,** a team of Google and university scientists made history in 2019 by achieving "quantum supremacy." Google has since opened a Quantum AI Campus in Santa Barbara. UCSB is also home to Station Q, Microsoft's headquarters for quantum-computing research, and the Quantum Foundry, the National Science Foundation's first quantum center, where researchers are developing next-generation materials to power quantum-based electronics. Niu, who joined the university's CS Department this spring as an assistant professor, is thrilled to collaborate with the vibrant quantum-research communities at UCSB and to play a key role in helping the CS Department define its unique strengths in quantum computing.

"Google and the Quantum Foundry, which is one of the top fabrication facilities that focuses on the material-science side of quantum research, were two of the biggest draws to UCSB," said Niu, who received her PhD in theoretical and mathematical physics from MIT in 2018. "But I'm also very honored to be the first quantum-focused faculty member in the Computer Science Department."

Niu takes a theoretical approach to everything having to do with real, rather than conceptual, quantum technology. She works from the bottom up, trying first to understand what a particular quantum-computing system does and does not do. She then uses that information to develop quantum algorithms covering the full stack of error corrections, quantum control, quantum measurements, and application design. Now that she is a UCSB faculty member, she has access to plenty of actual devices on campus on which to translate her theory-based work.

"I'm a physicist by training, so I focus on understanding the novel physics of the system, and I'm also a computer scientist who is passionate about machine learning. So, my research deals with harnessing both the imperfections and the unique advantages of different quantum hardware through machine learning and algorithm designs," explained Niu, who previously worked as a senior research scientist on the Google Quantum AI team. "My research sits at the intersection of experiments and theory, as well as of physics and computer science."

Her ultimate research goal is to develop quantum-computing models for how to better program, control, characterize, measure, and error-correct a large-scale quantum computer without making various unrealistic demands on the quantum hardware that prevent scalability. Niu also investigates how to use machine learning with and for quantum computers.

Niu has an additional goal, which is to cultivate the next generation of quantum researchers, which she hopes to do by developing and teaching undergraduate and graduate-level quantum-computing classes at UCSB.

"I became interested in quantum computing when I was an undergraduate student," said Niu. "I think that having early exposure across all engineering departments, and even physics and mathematics, will foster students' interest and could inspire more of them to pursue quantum research and, in turn, computer science at the graduate level."

WENBO GUO

To say that Wenbo Guo was excited to join UCSB's CS Department as an assistant professor this spring would be a big understatement.

"It feels like a dream come true, because the CS Department has a long history of success in computer security. I've admired UCSB's SecLab ever since I started graduate school," said Guo, referring to the Computer Security Lab, which is run by professors **Giovanni Vigna** and **Christopher Kruegel**. "SecLab has been a leader in computer-security research and has produced the top computer-security researchers for decades. Now, I get to work with the great researchers in that lab and many other talented members of the department. I'm incredibly lucky."

Guo's research blends cybersecurity with machine learning (ML). He works to design effective and trustworthy ML-based solutions for a wide range of security problems, including for software security and large-language models like ChatGPT. A self-described life-long learner, he says that his research endeavors are driven by real-world problems that he encounters on his own. For example, while learning about software security, he found himself wondering if ML models could be applied to security applications. This novel approach became the subject of a paper that received the ACM CCS Outstanding Paper Award at one the top security conferences in the world.

"I look at myself as an outcome-driven researcher who is motivated by tackling novel and difficult research challenges," explained Guo, who received his PhD from Pennsylvania State University and completed his postdoctoral research at UC Berkeley. "I work to solve a real-world issue by developing new and more practical techniques."

Most recently, he pivoted his research in response to the emergence of ChatGPT, investigating how to make it and other similar models safe and secure, while at the same time studying how those models can help solve security problems. "For instance," he noted, "people may turn to ChatGPT to generate a code, but how do they know if the code is secure or not?"

Guo says that his appetite for learning new things is not limited to computer-related topics. Since moving to UCSB, he has ventured into that most idiosyncratic of Santa Barbara pursuits: learning how to surf.