# NSF Selects Two UC San Diego Experts in Computer Vision to Receive Five-Year CAREER Grants

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The National Science Foundation has singled out two young faculty members at UCSD for their work in the burgeoning field of computer vision.

The funding agency has awarded five-year Faculty Early Career Development (CAREER) grants to 30-year-old computer scientist Serge Belongie, and electrical engineer Nuno Vasconcelos, 39. The awards support research by young faculty members early in their careers.

Vasconcelos and Belongie are assistant professors in UCSD's Jacobs School of Engineering, but they are based in different departments that have made computer vision research a priority.

"Computer vision has arrived," said Belongie, who is one of the organizers of the IEEE Computer Society's International Conference on Computer Vision and Pattern Recognition 2005, an academic conference that takes place June 20-25 in San Diego. "Although we may come at it from different directions, computer scientists, computer engineers and electrical engineers have a common stake in delivering on the promise of computer vision, and our getting these CAREER awards in the same year is evidence of the NSF's growing interest in this area."

Belongie will use his nearly $400,000 award to make it easier for computers to recognize and track moving, non-rigid objects such as animals and humans in motion. The $435,000 CAREER grant to Vasconcelos will support his research on techniques that could accelerate the day when computers can easily recognize millions of objects.

"There is certainly overlap in what we do, particularly in pattern recognition and statistics," said Vasconcelos, who directs the Statistical Visual Computing Laboratory at UCSD. "I have been more interested in things that overlap with what is traditionally considered signal processing, such as statistical image modeling, image search on databases, and object recognition. Serge works more on three-dimensional scene analysis and reconstruction, which traditionally have been done mostly by computer scientists."

Belongie started out with an electrical engineering degree from Caltech. In graduate school at UC Berkeley, he focused on object recognition, notably of two-dimensional objects and shapes, including character recognition. He also authored the central algorithm for the world's first mass-market fingerprint recognition device, built by Digital Persona, a company he co-founded before joining UCSD's Computer Science and Engineering department in 2000.

The NSF CAREER grant will help Belongie shift from recognizing 2D, static shapes to "algorithms for non-rigid structure from motion." Put simply, non-rigid shapes such as animals, fish and humans are orders-of-magnitude harder for a computer to 'see' because they change so rapidly. "It's very important to have techniques that make sense of objects that aren't rigid over time," said Belongie, co-director of UCSD's Computer Vision Laboratory. "If

you want to track a car using vision techniques, it is fairly easy as long as you know the shape of the car from the beginning. But recognizing and tracking a person who is running down a street is much more complicated."

Ironically, it was the lowly mouse that led Belongie to the grant proposal that won over the NSF. His Smart Vivarium project is funded by the California Institute for Telecommunications and Information Technology (Calit2), and is harnessing computer-vision methods for non-stop observation and analysis of laboratory mice. Mice are hard to recognize, admits Belongie, but humans are harder. "Mice are like blobs because their limbs are not very visible to the eye, while humans are much more difficult to follow because they are more highly articulated," said Belongie. "Whether in bioinformatics or computer vision, we are finding that it's good to begin developing algorithms for mice, and only then generalize them for humans."

Nuno Vasconcelos grew up in Portugal and got his Ph.D. from the Massachusetts Institute of Technology. He later worked for Compaq Research and Hewlett-Packard, before joining the Electrical and Computer Engineering faculty at UCSD in 2003.

The NSF approved the Jacobs School professor's research into 'weakly supervised recognition,' i.e., systems that can more easily detect and recognize objects in large image and video repositories. "We have all these big databases, and we need to be able to recognize and extract objects using algorithms that learn better and faster and are more sophisticated than current ones," said Vasconcelos. "This project lays the foundation for a long-term vision of recognition systems that would contain banks of recognition modules fully trainable by naive users, with minimal requirements in terms of manual data pre-processing and computational complexity. We want to make this process scalable, so a computer could eventually recognize millions of objects."

Belongie, Vasconcelos and their respective labs are well represented at this week's CVPR 2005 conference in San Diego. Vasconcelos has co-authored four papers with graduate students, and Belongie three. Other UCSD faculty making major presentations at the computer-vision conference include computer scientist David Kriegman and electrical engineering professor Mohan Trivedi, director of the Computer Vision and Robotics Research laboratory.

Concluded Vasconcelos: "In the end, I think that computer vision is an area that fits equally well in computer science or electrical and computer engineering."

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