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Computer Graphics and Vision Expert Elected ACM Fellow

Ravi Ramamoorthi

San Diego, CA, December 11, 2017 -- University of California San Diego computer science and engineering professor Ravi Ramamoorthi has been elected a Fellow of the Association for Computing Machinery (ACM), the world's largest educational and scientific computing society.

Ramamoorthi is the inaugural holder of the Ronald L. Graham Endowed Chair of Computer Science in the Computer Science and Engineering (CSE) department, which he joined in July 2014. He is also founding director of the Center for Visual Computing (VisComp) in UC San Diego's Jacobs School of Engineering.

In announcing the Class of 2017 ACM Fellows, the organization cited Ramamoorthi for his "contributions to computer graphics rendering and physics-based computer vision."

"Professor Ramamoorthi pioneered a signal-processing framework in rendering and visual appearance for computer graphics and vision," said UC San Diego Computer Science and Engineering Department chair Dean Tullsen. "His contributions have revolutionized both theory and practice, and he is widely recognized as the leader of his generation in graphics and vision. He richly deserves this honor of being elected by his peers to be a Fellow of the ACM."

The addition of Ramamoorthi (and fellow computer science professor Geoffrey Voelker) brings the number of ACM Fellows among active computer science faculty to ten. They include Victor Vianu (2006), Pavel Pevzner (2010), Stefan Savage (2010), Dean Tullsen (2011), Andrew Kahng (2012), Yuanyuan Zhou (2013), Mihir Bellare (2013), Rajesh Gupta (2016) as well as Ravi Ramamoorthi and Geoffrey Voelker (both in 2017). Ramamoorthi – who became an IEEE Fellow at the beginning of the year – is now one of only five computer science faculty to be simultaneously fellows of both ACM and IEEE. The others are Kahng, Tullsen, Zhou and Gupta.

Elected ACM Fellows represent the top 1 percent of ACM members for outstanding accomplishments in computing and information technology. The induction of new ACM Fellows will take place on Saturday, June 23, 2018 in San Francisco at the annual ACM Awards Banquet.

With 64 papers in *ACM SIGGRAPH* and the *ACM Transactions on Graphics,* Ramamoorthi is widely acknowledged as the leading researcher in rendering (one of the four main areas of computer graphics). He has published more than 140 papers to date, in computer graphics and computer vision.

As early as 2007, Ramamoorthi received the ACM SIGGRAPH Significant New Researcher Award for his "groundbreaking work on the mathematical representations and computational models for the visual appearance of objects." One year later, at the White House, he was awarded a Presidential Early Career Award for Scientists and Engineers (PECASE) for his work in physics-based computer vision.

Among other honors, Ramamoorthi has received an NSF CAREER Award and Sloan Fellowship (both in 2005), an Office of Naval Research Young Investigator Award in 2007, an Okawa Foundation Research Grant in 2011, five recent Google Research Awards, and was named an ACM Distinguished Scientist in 2015.

The computer scientist notes that he is particularly proud of his role in teaching and mentoring the next generation of graphics and vision researchers. "In the course of my career, I have advised and graduated more than 20 postdoctoral scholars and Ph.D. students," explained Ramamoorthi. "When I came to UC San Diego, I set out to develop a leading research group here, and I am proud to say we are succeeding, just as we did previously at UC Berkeley, and before that at Columbia University."

Ramamoorthi first introduced a revolutionary signal-processing framework for light reflection in his Ph.D. thesis and a series of papers at SIGGRAPH and the Journal of the Optical Society of America (JOSA) in 2001 (which have been cited more than 1,500 times to date). He expressed reflection for a curved surface as convolution, with incident illumination playing the role of the signal, and the reflectance function of the surface playing the role of the filter. "To do so, we had to address problems that were open for more than two decades in computer graphics and vision," recalled Ramamoorthi. "This solution became standard for complex lighting in computer vision for applications ranging from lighting-insensitive face recognition to 3D reconstruction."

The computer scientist's approach to spherical-harmonic lighting is now standard in video games (such as Halo) as well as movies (including Avatar), and since mid-2011, the technique is part of the industry-standard Renderman software. Ramamoorthi was also a consultant to Pixar when the company changed its rendering pipeline to include importance-sampling with physically-based shading in 2011.

Ramamoorthi's papers on structured importance sampling (developed collaboratively with fellow UC San Diego professor Henrik Wann Jensen) for complex lighting and later reflectance functions at SIGGRAPH 2003 and 2004 established the first methods for efficiently rendering with environment lighting and measured reflectance. In a sequence of papers from 2009 to the present, Ramamoorthi also developed the theoretical foundations and practical methods for sparse sampling and reconstruction in Monte Carlo image synthesis, which have produced the most dramatic recent sample count reductions, and revolutionized industrial practice. A 2015 Eurographics State-of-the-Art Report identified Ramamoorthi's SIGGRAPH and SIGGRAPH Asia 2009 papers as seminal.

Ramamoorthi has also made key contributions to data-driven methods. His SIGGRAPH 2006 paper on inverse shade trees is widely reproduced to acquire, represent and 3D-print spatially-varying reflectance. He also pioneered signal-processing methods to acquire complex light transport, developing the first compressive sensing methods in vision/graphics. His works on 3D scanning, including spacetime stereo and combining positions and normals are believed to have been the inspiration for methods in modern depth-sensors such as Kinect or Real-Sense. Ramamoorthi, along with former postdoc and now fellow computer science professor Manmohan Chandraker, has also derived new photometric invariants based on differential measures for shape recovery with general reflectance. These have the potential to revolutionize textbook approaches to 3D recovery in physics-based computer vision.

Ramamoorthi's most recent work on simulating light "glints" off fine-surface detail (in a paper at SIGGRAPH 2016) has generated wide press coverage.

Also to his credit, Ramamoorthi pioneered the first massive open online course (MOOC) in computer graphics while at UC Berkeley. The online course was one of the first nine offered on the edX platform. Now part of UC San Diego's presence on edX as the first UC San DiegoX course, Ramamoorthi's CSE167x has reached over 100,000 registrations, while his lectures posted on YouTube have attracted more than half a million views. The course has also been translated into Mandarin and licensed for Chinese students. Ramamoorthi was one of 10 finalists worldwide across all subject areas for the inaugural edX Prize for Exceptional Contributions in Online Teaching and Learning, first in 2016 and again in 2017. Ramamoorthi was the only computer science professor to be so honored, and the only two-time finalist.

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