

# Center for Visual Computing

## Revolutionizing the way we capture, image and display the visual world.

At the UC San Diego Center for Visual Computing, we are researching and developing a future in which we can render photograph-quality images instantly on mobile devices. A future in which computers and wearable devices have the ability to see and understand the physical world just as humans do. A future in which real and virtual content merge seamlessly across different platforms.

The opportunities in communication, health and medicine, city planning, entertainment, 3-D printing and more are vast... and emerging quickly.

To pursue these kinds of research projects at the Center for Visual Computing, we draw together computer graphics, augmented and virtual reality, computational imaging and computer vision.

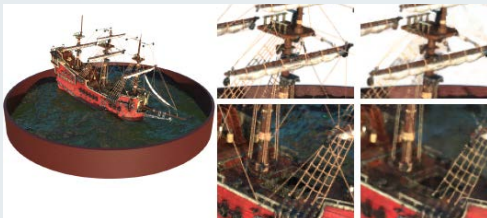
### Unique Capabilities and Facilities

Our immersive virtual and augmented-reality test beds in UC San Diego's Qualcomm Institute are an ideal laboratory for our software-intensive work which extends from the theoretical and computational to 3-D immersion.

**Join us in building this future.**



Unbuilt Courtyard House by Ludwig Mies van der Rohe. This rendering demonstrates how photon mapping can simulate all types of light scattering.



### MOBILE VISUAL COMPUTING AND DIGITAL IMAGING

- New techniques to capture the visual environment via mobile devices
- Improved computational imaging and computer vision in the wild
- Advanced rendering on a variety of mobile platforms



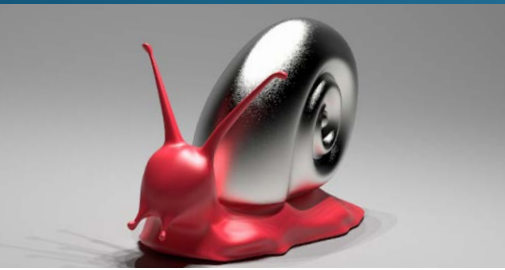
### INTERACTIVE DIGITAL (AUGMENTED) REALITY

- Achieving photograph-quality images at interactive frame rates to enable the rendering of digital reality in real time
- Seamless rendering and mixing of real and virtual content in real time



### UNDERSTANDING PEOPLE AND THEIR SURROUNDINGS

- Computer vision systems with human-level understanding of gestures, scene semantics, activities and groups of people
- Medical, biological and city-planning applications



## COMPUTER SCIENCE AND ENGINEERING

### Ravi Ramamoorthi

Theoretical foundations, mathematical representations and computational models for the visual appearance of objects, digitally recreating or rendering the complexity of natural appearance. His work on spherical harmonic lighting and irradiance environment maps is widely used in movie production and video games.

### Manmohan Chandraker

Leader of collaborations with the automobile industry aiming towards low-cost, real-time visual systems for navigation, recognition and prediction in traffic scenes. Theoretical frameworks and practical systems for applications in autonomous driving, robotics, security and human-computer interfaces.

### Albert Chern

With backgrounds in both numerical analysis and differential geometry, Chern studies the interplay between differential geometry, algebraic topology, differential equations and computational mathematics. His research resulted in successful and novel applications in fluid dynamics, geometry processing, as well as classical numerical PDE challenges.

### Tzu-Mao Li

Li's research focuses on the interactions between three domains: visual computing, programming systems, and statistical learning. His work added 3D understanding to computer vision models; used data to improve camera imaging pipeline quality; and made light transport simulation faster by using information implicitly defined by rendering programs.

### Zhijan Liu

Liu's research focuses on efficient AI. He has developed efficient ML algorithms and provided them with effective system support. He has also contributed to accelerating computation-intensive AI applications in computer vision, natural language processing, and scientific discovery

### Marc Niethammer

Research at the intersection of medicine and machine learning focusing on the design of computational algorithms to extract quantitative measures from medical data (most commonly involving images) including approaches for image segmentation, image registration, shape analysis, imaging biomarkers, and general multi-modal models.

## ELECTRICAL AND COMPUTER ENGINEERING

### Nick Antipa

Co-design of optical systems and algorithms. By considering both the hardware and digital domains, new computational optical systems emerge that extend capability beyond what is available with conventional approaches. The research aim is to develop design frameworks that merge optical models with state-of-the-art algorithms, allowing joint optimization of both components.

### Nuno Vasconcelos

Leader in fundamental and applied problems in computer vision, image processing, machine learning, and multimedia. Focused on development of intelligent systems that combine image-understanding capabilities with additional information to enable sophisticated recognition, parsing, retrieval, classification, indexing, browsing, modeling, and compression of visual content.

### Xiaolong Wang

Wang studies data structure for learning visual representations and its connection to 3D and semantic structures. He uses structure information from the data itself as a supervisory signal for learning visual representations; and explicitly models data structure for human activity analysis, scene affordance reasoning and learning object interaction.

## COGNITIVE SCIENCE

### Zhuowen Tu

Intersection of computer vision, machine learning, neural computation and cognition, and neuroimaging. Focused on statistical learning/computing models for structured, large-scale, and multi-modal data prediction. His research has broad applications, notably for medical imaging.

## QUALCOMM INSTITUTE

### Tom DeFanti

Leader of teams that have developed the CAVE virtual reality (VR) systems and large-scale 10/40/100 Gbps networks. Co-PI of the Pacific Research Platform that connects 20 major universities for data-intensive computing. Building machine learning ecosystems.

## PARTNER BENEFITS

- » A seat on the Center for Visual Computing's Board of Advisers for discussion of Center priorities
- » Opportunities to engage Center faculty through research-oriented meetings
- » Opportunities to engage graduate students affiliated with the Center regarding jobs, internships, and co-ops
- » Invitations to annual research reviews, workshops, and seminars

## CONTACT US

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