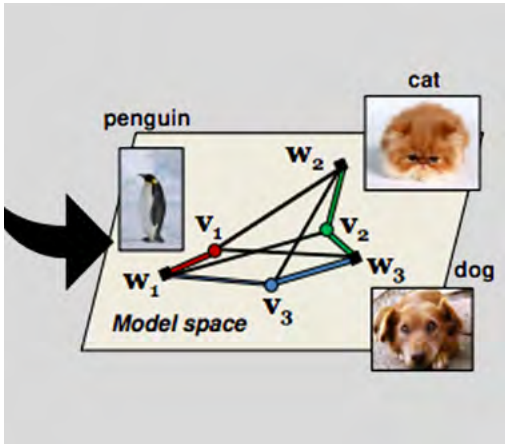
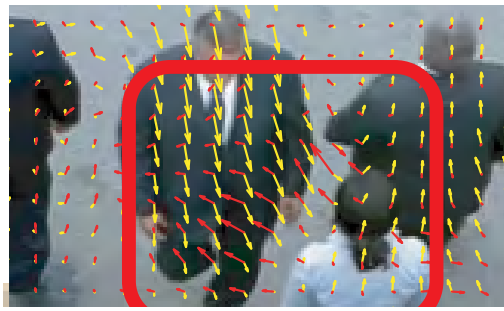
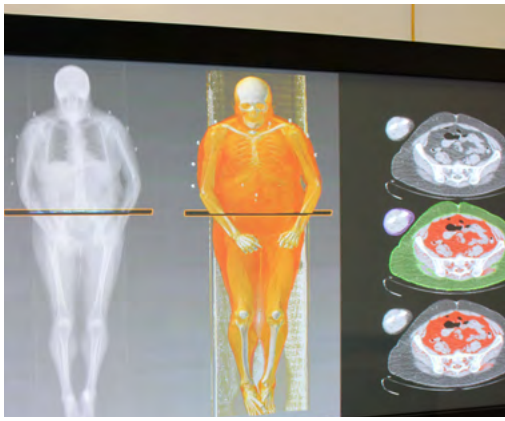
UNIVERSITY OF CENTRAL FLORIDA | ORLANDO

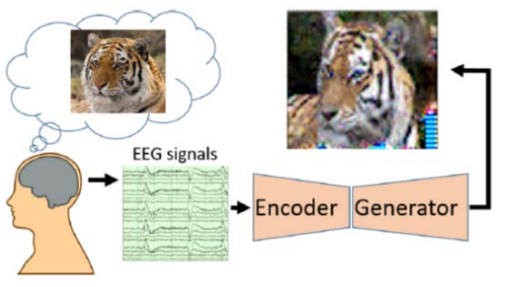
Center for Research in Computer Vision

Computer vision is used in crowd surveillance, visual tracking, human behavior analysis, geo-spatial location determination of an image or video, unmanned aerial video analysis and biomedical image analysis. Our technology can be used in scanning crowd scenes, analyzing brain scans for tumors, environmental monitoring, indexing and searching massive databases of images and videos, and more.









UCF Center for Research in Computer Vision

COMPUTER VISION is a field within computer science that uses computers to quickly recognize and analyze patterns, gestures, facial features and objects in images such as photographs, videos and medical scans. Our center advances the science of processing and analyzing images and videos, using complex computational methods.

THE UCF DIFFERENCE

CRCV is led by Mubarak Shah, one of the highest-cited authors in computer vision, with more than 40,000 citations. This level of expertise ensures state-of-the-art solutions applied to challenging computer vision problems.

Dr. Shah specializes in developing the theory and algorithms used for such disparate tasks as scanning crowd scenes for suspicious people, analyzing brain scans for tumors, indexing and effectively searching a large database of images and videos and more.

OUR EXPERTISE

Video surveillance and monitoring
Wide area surveillance
Biological vision
Visual attention
Biomedical image analysis
Radiology, nuclear medicine imaging
Domain adaptation
Zero-shot learning
Human behavior recognition
Facial recognition
Visual tracking
Unmanned aerial vehicle video analysis
Visual crowd analysis

CORE FACULTY

The work of CRCV's core faculty members is enhanced with nine associated UCF faculty and visiting faculty from institutions worldwide.

Ulas Bagci, Ph.D.
Assistant Professor
Expertise: Medical-image processing and analysis, statistical machine learning.

Abhijit Mahalanobis, Ph.D.
Associate Professor
Expertise: Systems for information processing, computational sensing and imaging, video/image processing for information exploitation, ATR.

Yogesh Rawat, Ph.D.
Assistant Professor
Expertise: Video understanding and analytics, multimedia analysis, social multimedia computing.

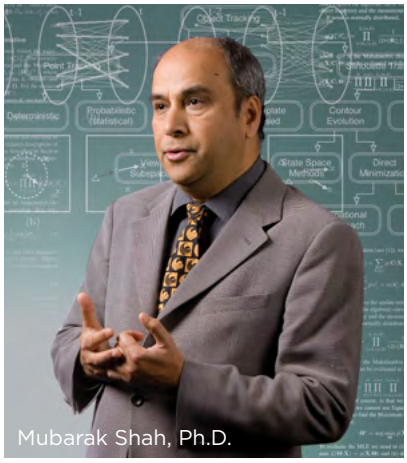
Mubarak Shah, Ph.D.
UCF Trustee Chair Professor, Director
Expertise: Video surveillance, visual tracking, human activity recognition, visual analysis of crowded scenes, video registration, UAV video analysis.

OUR STUDENTS

The CRCV attracts graduate students from around the world who come to UCF specifically for computer vision research. UCF undergraduates can pursue a variety of CRCV research projects. Each summer, 10 undergraduates from other U.S. institutions work at CRCV through the NSF's Research Experience for Undergraduates (REU) program.

OUR PARTNERS

Local and national high-tech partners include LSI Logic, BBN, SRI, Harris Corporation, Kitware, Intel, SAIC and Kodak. For more than 10 years, Dr. Shah's partnership with Lockheed Martin Fire & Missile Systems has resulted in multiple grants from federal agencies.


Mubarak Shah, Ph.D.

"Computer vision has changed how we examine the world and solve problems. Every day we are reminded that investment in this technology is of significant benefit to society."

—Muburak Shah
UCF Trustee Chair Professor, CRCV Director

"When I was in China, a friend told me that UCF's Center for Research in Computer Vision offered many challenging research opportunities. Working on my Ph.D. at UCF helped me get my internship and my job at Google."

—Yicong Tian, '16

Nation's Longest-Running
NSF REU SITE

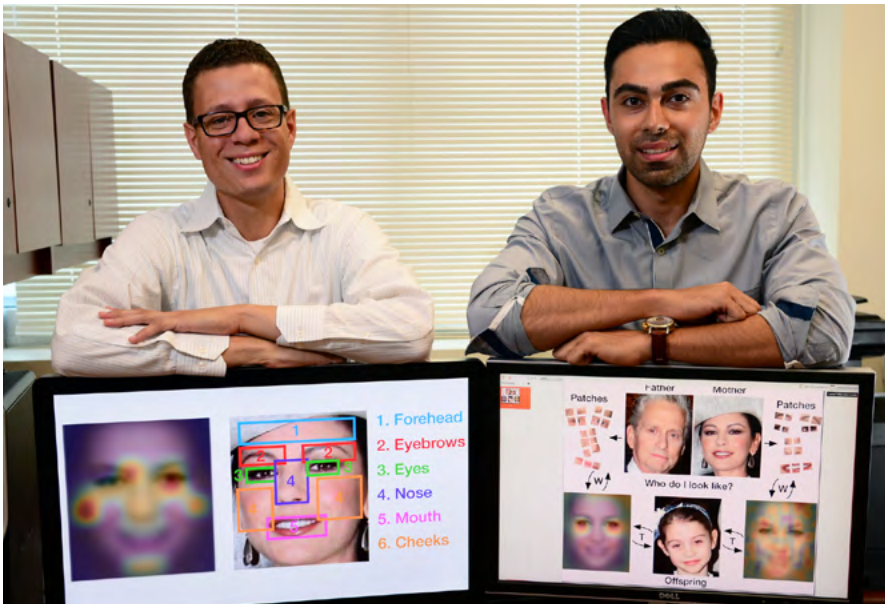
33

CONSECUTIVE YEARS
NSF Research Experience for Undergraduates in Computer Vision at UCF

Our Projects in the News

NEW FACIAL RECOGNITION TOOL

Students developed a tool that promises to be useful in rapidly matching pictures of children with their biological parents. In the future, the software could help locate missing children as they age, assist in law enforcement and homeland security, and help families confirm relatives.



DETECTING POTENTIAL THREATS IN LARGE CROWDS

In the article, "Visual Crowd Surveillance through a Hydrodynamic Lens," the cover story of the Dec. 2011 issue of *Communications of the ACM*, Dr. Shah and his research team explain CRCV's efforts to develop systems that detect potential threats in large crowds, based on the science of how fluids move.

UCF PERFORMS WORLD'S FIRST AUTOMATED MASS-CROWD COUNT

The task was performed using UCF's computer vision tool that scans and analyzes aerial photographs quickly. Counting large-scale crowds (in the hundreds of thousands) typically is a tedious process involving people hand-counting the number of heads per inch in small sections of aerial photographs, which can take up to a week. It took only 30 minutes for UCF's software to scan 67 images of a Barcelona rally. UCF's computer count of about 530,000 was confirmed manually by researchers in Spain. The tool can provide critical information for event planning and emergency response scenarios.

CRIME-SCENE VIDEO ANALYSIS GOES HIGH-TECH WITH $1.3 MILLION GRANT

Funded by the Department of Justice, technology will be developed at UCF to automate and significantly speed-up the process of monitoring and reviewing thousands of hours of video streams fed from multiple cameras. With the ability to detect and flag behavior anomalies, the technology may produce faster leads for criminal investigations.

A CRCV Success Story

Ms. Barbara Schudel sought CRCV's help in applying UCF's paternity recognition tool to confirm whether the man in her family photos was her father. She submitted two photos of herself and three of the man.

Hi Ms. Schudel,
We finished the experiments on your photos. The average resemblance score among all six possible pairs of photos you provided resulted in 75.56% resemblance score. Although it is not a very high number, it is still above the average, indicating some paternity signs. The paternity score in one pair is more than 90 percent.

I hope you find these results helpful.

—Afshin Dehghen, computer vision researcher

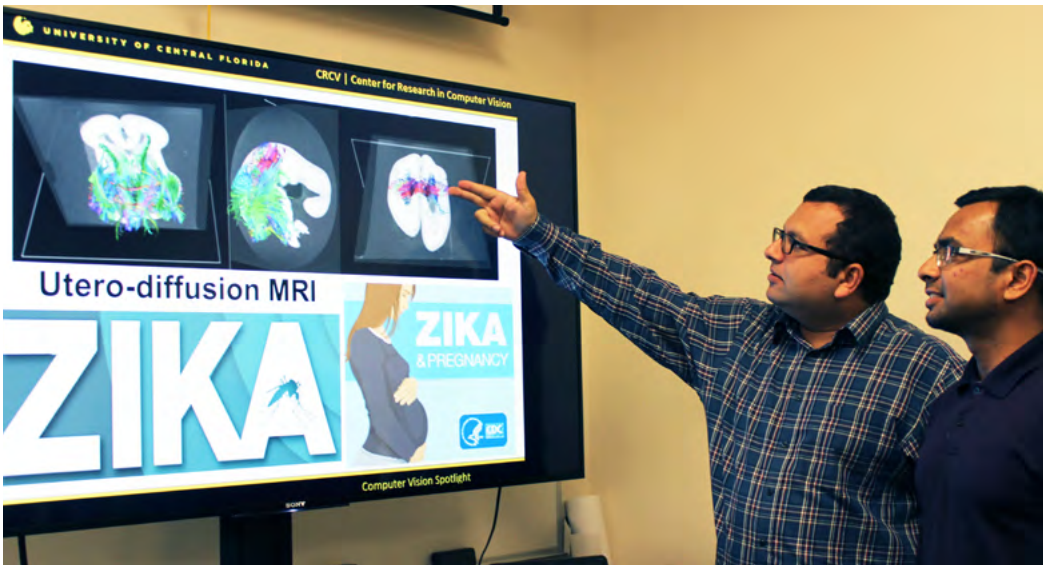
Dear Afshin,
What wonderful news! I needn't tell you what a hide-n-seek story my father has been. My mother didn't tell me until I was 16 that her husband wasn't my father - and it wasn't until I was well into my 40s that I was given the whole story. I accept that this can only be considered as 'secondary proof', but, as I never will have any other, it's worth a pot of gold to me! Thank you from the bottom of my heart. You have made a 71-year-old woman very happy.

—Barbara Schudel

Our Technology Improves Lives

PROJECT SEARCHES, ANALYZES ZIKA INFECTION IN FETUSES

Researchers are using advanced imaging technology called Diffusion Tensor Imaging to detect hidden cases of Zika infection in fetuses, looking for signs that cannot be seen with ultrasound. Ultrasound can reveal abnormalities found in Zika-infected fetuses, such as microencephaly (an unusually small head size). But since the majority of infected fetuses do not develop an abnormality, ultrasound images don't go far enough. DTI can help medical researchers better understand the Zika virus and how it spreads from mother to fetus. Such research could lead to better preventive and treatment methods.



ADAPTIVE VISION SYSTEM ACHIEVES GREATER EFFICIENCY

Deep CNNs can accurately recognize a large number of object classes. However, deployed CNNs do not account for unknown prior probabilities and process each image with equal importance. We are motivated by the observation that a smart vision system should be able to specialize in a subsets of classes that occur frequently, and process them in a computationally efficient manner. This is a challenging task because the probability of occurrence of all classes is not the same, and may vary over time and by location. We introduce a Network for Efficient Object Recognition using guided Attention during online Distillation (NEORAD), in which a lightweight and efficient binary student network is guided by a high-performance teacher network to adaptively learn the subset of most frequently occurring classes. The student network must also determine when a rare (or unknown) class is present so that the teacher network can be used in such cases. To achieve this, we propose an attention triplet loss, to ensure the student network not only learns the class labels from the teacher network's decisions, but also emphasizes the same semantically relevant regions of the image as the latter. We have shown that this approach results in 50X fewer FLOPs, 6X speedup on the GPU and 30X less memory.

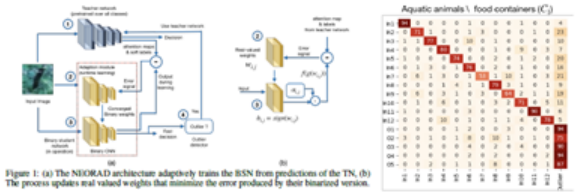


Figure 1: (a) The NEORAD architecture adaptively trains the BSN from predictions of the TN, (b) The process updates real valued weights that minimize the error produced by their binarized version.

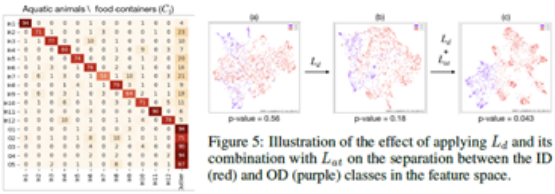
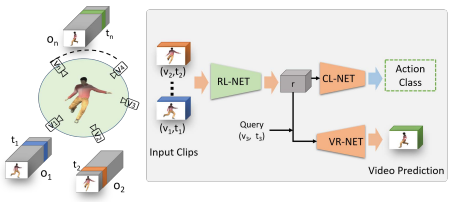


Figure 5: Illustration of the effect of applying L_{td} and its combination with L_{spl} on the separation between the ID (red) and OD (purple) classes in the feature space.

UCF RESEARCH ADVANCES ACTIVITY RECOGNITION FROM UNSEEN VIEWPOINTS

Research lead by UCF assistant professor Yogesh Rawat known as "view-invariant learning" has significantly advanced the way computers "see" and recognize activities in videos from previously unseen viewpoints. The work has the potential to advance the field without any need of skeleton or pose information which requires additional sensors and processing.



UCF | **Center for Research in Computer Vision**

College of Engineering and Computer Science

UNIVERSITY OF CENTRAL FLORIDA

4328 Scorpius St., Suite 245 | Orlando, FL 32816-2365

407-823-1119 | info@crcv.ucf.edu

For more information, visit **crcv.ucf.edu**.

8-26-2020