UNIVERSITY OF CENTRAL FLORIDA

UCF Researchers Are Developing Computer Vision Systems to Identify People by How They Walk

The work can help boost the nation's security and is critical for identifying people when visibility is limited.

University of Central Florida researchers are working to boost the nation's security by helping develop computer vision systems that identify individuals based on how they move, walk and perform daily activities, which can be key when visibility may be limited.

The work is funded by a four-year, $3.8 million contract from the U.S. Intelligence Advanced Research Projects Activity organization (IARPA) as a sub-contract to Accenture Federal Services (AFS). Universities on the AFS team include University of California, Merced; University of California, Riverside; The State University of New York at Buffalo and Virginia Tech.

Researchers in UCF's Center for Research in Computer Vision are tasked with developing the deep learning approach to solve this challenging problem.

"Vision-based biometrics employing face recognition have been playing an important role in person verification, such as at airports and secured locations, for several years, keeping our nation safe and secure," says project co-investigator Mubarak Shah, trustee chair professor of computer science and founding director of UCF's Center for Research in Computer Vision. "Movement-based biometrics is a new frontier in situations when the face is not visible or it is not facing or parallel to the camera. Video provides motion as an additional cue to appearance in in a static image and also provides multiple instances of the person in different frames of the video."

Biometrics are measurable biological or behavioral traits—like fingerprints, facial recognition, iris scans, voice recognition, and behavioral patterns—that can be used to uniquely identify individuals for security, access control, and verification purposes across diverse fields such as security, law enforcement, and healthcare.

How the System Works

The project will create a smart system that understands how people walk in videos where there are multiple individuals. There are three main parts to the system: first, it spots people in all sorts of videos – whether they're on the ground, up high, or seen from above, even when they're far away from the camera. Then, it pieces together longer walking patterns by combining different bits of walking seen in the first step. Lastly, it learns the unique styles of walking — or gait signatures — dealing with issues like blurry footage and different viewpoints in varied settings.

The researchers' approach is unique because of their focus on biometrics, such as gait, and the person-identification algorithms they are developing that directly learn from raw RGB videos, rather than learning from post-processed files, thus speeding up the learning process.

"We are developing algorithms for person identification from videos captured at a long-range, far away from the camera, where faces are not visible," says project co-investigator Yogesh Rawat, an assistant professor with the center and UCF's Department of Computer Science. "We want to learn their poses and gait pattern. We are also looking into how we can identify individuals using their style while performing daily activities."

He says existing methods struggle as they focus on the appearance aspect, such as clothing and face, whereas in this project, the researchers want to learn biometrics from videos.

The researchers say they already have a good performing algorithm and are working to improve it further.

Leader in Computer Vision Research

Shah says UCF's Center for Research in Computer Vision is uniquely positioned to lead in the field of computer vision research.

"UCF's CRCV is a pioneer in video analysis, action recognition, object tracking and segmentation motion-based recognition," Shah says. "Our Award winning UCF-101 Action recognition dataset is standard benchmark for all research in action recognition. We have developed numerous methods on this topic, which have appeared in some of the most prestigious venues including the IEEE/CVF Conference on Computer Vision and Pattern Recognition, which is ranked by Google among top 4 venues in all sciences. We have been constantly funded

by IARPA for our video work including through their ALADDIN, DIVA and BRIAR programs. Our paper Gabriella: An Online System for Real-Time Activity Detection in Untrimmed Security Videos, developed under the DIVA program, received the ICPR 2020 Best Scientific Paper Award. We also received U.S. patent on this work, and startup under initial funding from the government is in preparation."

Researcher Credentials

Rawat received his doctorate in computer science from the National University of Singapore and joined UCF's College of Engineering and Computer Science in 2019.

Shah is the founding director of UCF's Center for Research in Computer Vision and a professor in the College of Engineering and Computer Science. He is also a fellow of the Association of Computing Machinery, the National Academy of Inventors, the American Association of Advancement of Science, the Institute of Electrical and Electronic Engineers, the International Association of Pattern Recognition, and the International Society for Optics and Photonics.

Writer: Robert H. Wells, Office of Research