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Privacy-Aware Computer-Vision Based Human Motion Tracking

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Abstract

Computer-vision based human motion tracking has undergone intensive research for the past several decades. As exemplified by Microsoft Kinect, inexpensive portable computer-vision based motion sensors can now be used to accurately track human motions in many application domains, particularly in the healthcare area, such as rehabilitation exercises, fall detection, and safe patient handling. However, such computer-vision based technology is rarely used in venues such as hospitals and nursing homes, primarily due to privacy concerns. Even if a patient or a health caregiver has consented to being monitored, the vision-based motion sensor cannot guarantee that only the consented person is tracked due to the indiscriminative nature of the vision technology itself: anyone in its view might be automatically tracked.

The primary objective of this project is to create a set of methodologies and a companion framework that facilitate privacy-aware human motion tracking, which include: (1) Privacy-aware human motion tracking. A consented subject is required to wear a programmable wearable device, such as a smart watch. One or more programmable depth cameras are used to track the activities of the consented subject. Discriminative tracking is achieved by a registration mechanism executed when the subject enters the view of a camera and periodically while the subject stays in the view. The registration mechanism identifies the consented subject in the view of the camera by matching a predefined set of gestures that are simultaneously captured by both the wearable device and the depth camera. After the registration step, only the consented subject is tracked and the motion data collected for all non-consented subjects will be discarded immediately. (2) Real-time human activity recognition based on a set of invariance rules that dictate the expected correct movements, and realtime haptic feedback delivered via the wearable device worn by a consented subject.