

Abstract

This work presents an integrated computer vision system for automated user identification, tracking, emotion and behavioral analysis. For this, state-of-the-art computer vision techniques are reviewed, tested, and combined into an integrated system.

Automation of behavioral analysis allows to capture and analyze behavior of the subject(s) continuously and in real-time. It can be useful for detecting abnormal and dangerous behavior, for surveillance systems as well as for assessing well-being of children or elderly.

The research involves identifying promising technologies and solutions for object detection, face detection, face recognition, object tracking, facial emotion recognition, action recognition, and integrating them as components into one system. Further, the solutions that are insufficient (e.g. not ready for the practical use) are detected and extended.

The outcome is a system that is able to identify people with accuracy of 99.38%, recognize performed actions from daily scenarios with accuracy of 93.46% and to assess emotions from facial expressions with accuracy of 73.11% based purely on RGB camera video. A ready-to-use action recognition component is developed and it is shown that this component runs in nearly real time with frame rate of 27.7798 FPS on an off-the-shelf, affordable testing PC, with video frame rate set to 30 FPS. Further, the experiments conducted on the whole integrated system show that the system with all its components could potentially run in real time if executed on a stronger PC and/or when the component use is further optimized.

The contributions of this work are two-fold. (1) A 2D-skeleton dataset based on a large-scale action recognition NTU-RGBD dataset is derived and proposed. Based on this dataset, an accurate (93.46% of correct predictions on the test set) and ready-to-use action recognition component working in nearly real-time from RGB video is created. (2) Further, practical review of the integrated system analyzing people doing domestic behaviors is presented.