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(Tehran Polytechnic)

Department of Computer Engineering and Information Technology

Master of Science in
Computer Engineering (Artificial Intelligence)

Title:

**Fusing Face and Gait Biometrics for Video-based
Human Identification**

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Abstract

Today recognizing unauthorized people for secure environments has caused a need for Identification (recognition) systems in Metropolitan regions. In most of these conditions due to non-cooperative subjects non-intrusive biometrics like gait or face are required. A recognition system based on an individual biometric usually has lower recognition rate due to factors like failure in capturing features, noise and etc. In this thesis we propose a human recognition system that uses both gait and face traits. Frontal face recognition and gait recognition from side are two biometrics that give good features of a walking person. Our system applies only one camera for feature acquisition. Therefore, the combinatory recognition system is based on gait and face features captured only from side view.

The goal of this research is to propose a system for human recognition via video, under covariate walking conditions like wearing coats or carrying bag-packs. The input to the system is a video that is captured using a camera positioned perpendicular to the direction of walking. The proposed system comprises two sub-systems for recognition; Gait Recognition, Face Recognition.

In the first step, four compact representations of gait that have been proposed in recent years are analyzed to see if they can be used in the combinatory system. These four representations are: Gait Energy Image (GEI), Gait Entropy Image (GENI), Gait Flow Image (GFI), and Active Energy Image (AEI). We have also proposed a method that uses both masked gait flow feature and masked gait energy features for gait recognition. We show that these entropy-based selected features give the best rates in recognition amongst these gait recognition methods.

The face recognition sub-system has four steps. In the first step, an enhanced face is constructed from ten frames in a video using an iterative method and in two steps. In the next step, a normalization procedure is applied to the face data and the profile line is extracted after estimating positions of fiducial points. In the third step, a mask is designed to eliminate pixels different from facial pixels. And finally in the last step, Gabor filters are applied to all pixels on the profile line to extract adequate features from face.

We have proposed two different approaches for combination of gait and face at the match score level and at the feature level. For each of these approaches we have used five different gait classifiers in combination with the face classifier. All of the proposed combinatory methods result in better recognition rate than each of the gait and face sub-systems. Our experiments have been conducted on three different walking conditions. These covariate conditions are normal walking, walking while wearing a coat and walking while carrying a bag. The combinatory method increases the recognition rate to a great extent. The achieved recognition rate on the gathered dataset is more than 90 percent.

Key Words: Face Biometric, Gait Biometric, Biometric Fusion.