Biometric Gait Identification and Authentication

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Abstract

A person's gait, or the way he walks, has shown potential as a biometric identifier for identification and authentication systems. We take a sensor-based approach, using acceleration, angular velocity, orientation, and audio data collected from an Android phone. We chose to use an Android device because of the ubiquity of smartphones today; we want to minimize hardware obstacles for replication or implementation of our results. Four participants (3 female, 1 male) wearing sneakers and jeans provided data from the phone strapped to the right ankle and the phone placed in the right back pocket of a pair of jeans. Using MATLAB and deep learning techniques, we train and tune a convolutional neural network classifier for the data. The neural network automatically learns which features are most useful and focuses on those. We analyze our results by comparing detection error tradeoff (DET) curves, receiver operating characteristics (ROC) curves, and equal error rates (EER). Our findings can be applied to both identification and authentication systems. For identification, we can imagine a person approaching a restricted room with a phone in his pocket. The system can identify the person based on his gait and give him seamless access to the room while he approaches. For continuous authentication, we can imagine a phone staying unlocked in its owner's pocket, but locking itself once it detects that it is in someone else's pocket. Gaits are a promising, unobtrusive biometric for incorporation into identification and authentication systems.

Keywords

Biometric, Gait, Identification, Machine Learning, Signal Processing