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Person Recognition based on Touch Screen Gestures
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Abstract

Biometrics is based on the analysis of biometric features and is usually used for person recognition. In this article we analyze biometric features related to touch screen gestures. The proposed approach to person identification has a great application potential due to the popularity of mobile devices, so research in this area will be an important direction of technological development. The aims of this research are to design and build a data acquisition system to collect surveys resulting from the execution of single finger gestures on a mobile device screen and to propose data preprocessing procedure and to indicate the best classification method for person recognition based on these surveys. The experiment with fifty persons, nine gestures and ten repetitions was performed, so 4 500 surveys acquired and analyzed within the developed system. Depending on the classification method the accuracy of the task of gesture-based person recognition was in the range from 96.60% to 99.29%. All the patterns, which achieved the highest performance in terms of the typical performance measures consist of a single connected movement of a finger over the touch screen. The patterns which include multiple disconnected segments and/or taps are less successful in the task of recognizing people.

Keywords:
Touch screen gestures, Biometrics, Computational intelligence methods, Pattern recognition

1. Introduction

Both biometric identification and verification are based on a statistical variability of the population of organisms. The general idea behind them is to compare a set of human attributes (features of the body or behavioural characteristics) with the comparative collected samples. These sets of attributes must be present in as many humans as possible, while the values of these attributes must be individual. In addition, these features cannot change over time, or through any physical actions. A biometric attribute should be: universal (applying to each person), distinctive (between any two persons), permanent (for a specific time), and collectable (available for measurement) [12]. From a practical point of view, additional properties of performance (quick and accurate recognition), acceptability (feature measurement is accepted by people), and circumvention (fraud-proofing) should be considered.

Features of the body that may be used as biometric attributes include among others face, fingerprint, hand, iris, ear, DNA (deoxyribonucleic acid), thermogram, odour, retina, vein, palm print, and electroencephalogram [18]. Behavioural features of the biometric include signature, keystroke, gait, voice and gesture, and many more [39].

Biometrics is usually applicable in industry solutions and products for the recognition of persons who take control of access to resources (facilities, equipment, documents, files, banking information, etc.).

In this article we consider usefulness of gestures in biometry. Gestures may be recorded with special gloves ([24] and [27]), mouses / touchpads [10], video cameras [38] or touch screens. The latter method is employed in ubiquitous mobile devices.

The issues related to the person recognition based on the gestures executed on a keypad or a touch screen of a mobile device rely on the selection of the the associated biometric features. In work [30] authors recorded hold-time, inter-key, and finger pressure to recognise a person using a 10-digit numbers input via a numeric keypad. A similar approach, but tested on multi-character words (10-18 characters) was presented in [31]. In [6] a graphical-based password authentication keystroke dynamic system for touch screen mobile hand held devices was demonstrated. The article [17] presents a technique to verify the device user based on a manually entered string. Ten features were analyzed, some on the mobile side and the other on the server.

Mobile device screen gestures are widely used to control the operation of these devices and the applications running on these