3D Face Recognition Utilizing a Low-Cost Depth Sensor

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***Abstract*— This demo shows a working prototype of the 3D face recognition biometric device utilizing a low-cost depth sensor, namely SoftKinetic DS325. It is based on the Intel Celeron board for embedded PCs, the sensor, and a touch screen.**

I. Description

The recognition algorithm was developed in the coordination with Touchless Biometric Systems AG, Switzerland and Brno University of Technology. It is based on the multi-algorithmic fusion of individual recognition units utilizing iso-geodesic curves and specific image filters (Gabor, Gauss-Laguerre, LBP). The hill-climbing selection was used in order to combine only those units that have a positive impact on the overall recognition performance. The input 3D face scan is processed by the individual recognition units and the final decision about the data subject identity is the result of combination of involved recognition unit outputs.

The prototype is able to enroll new users to the database as well as identification of already registered users. It's novelty is in the utilization of the low-cost depth sensor. The presented recognition method requires user collaboration – the scanned subject has to be in a specific range from the sensor, look towards the camera and have a neutral face expression.

The idea of the multi-algorithmic approach has been published in [5, 1]. The paper and the book present the combination of anatomical soft-biometrics and holistic algorithms. It shows that the combination of multiple algorithms improves the recognition performance. We have utilized biometrics fusion in [6]. This paper describes the thermal face recognition pipeline where multiple subspace projection techniques are combined. The further extension of this approach has been presented in [7]. We have added the image filters prior to the subspace projections. The overview of the thermal face as well as 3D face recognition techniques was described in chapter "3D and Thermo-face Recognition" of the book "New Trends and Developments in Biometrics" [2].

The utilization of the hill-climbing unit selection was presented in [3]. This paper describes the basic idea of the iterative selection of recognition units into a resulting multi-algorithmic system. A more robust selection has subsequently been presented in [4]. The main focus of this paper was targeting the 3D face recognition to low-cost depth sensors, such are Microsoft Kinect or SoftKinetic DepthSense DS325.

This research has been realized under the support of the following grants: "The IT4Innovations Centre of Excellence" CZ.1.05/1.1.00/02.0070, "Tools and Methods for Video and Image Processing for the Fight against Terrorism" VG20102015006, and "Reliability and Security in IT" FIT-S-14-2486.

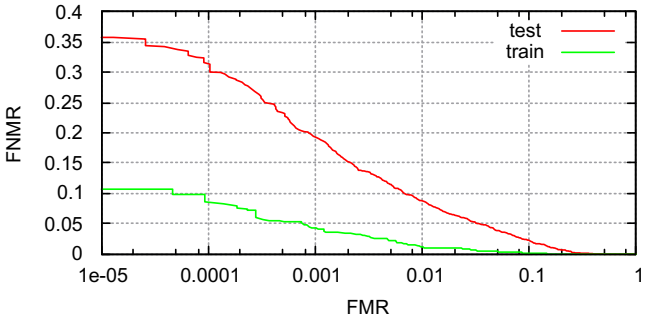

Fig. 1. The detection error curves (DET) of our system evaluation. There were 398 scans of 52 subjects divided into two equal sized portions - training testing set (green) and testing set (red curve).

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