PAIRUE

PERSON ACTIVITY AND IRIS RECOGNITION IN UNCONTROLLED ENVIRONMENTS

In this project, a biometric identification system, based on the way a person walks (i.e., gait) and also on the person's eye region, to be used in uncontrolled data acquisition scenarios, was developed. By not imposing any specific constraints on the subjects, the user's discomfort and acceptance were improved with respect to biometric identification systems that are based on controlled acquisition of data.

The use of biometrics (e.g., irises, faces, fingerprints, palmprints) for recognizing individuals is becoming increasingly popular and many applications are already available. In particular, biometric recognition with controlled data acquisition is a relatively mature technology that has already proven its effectiveness in many different scenarios, such as computer access control, airport check-in and border control. However, the feasibility of biometric recognition with uncontrolled data acquisition setups and without imposing any constraints on subjects participation is still considered a grand-challenge, due to the evident economic and security implications that it could have in modern societies. The ability to perform recognition in uncontrolled environments will broaden the applicability of biometric technology to any domain where the subject cooperation is not expectable (e.g., surveillance and forensics), or whenever only a very limited user cooperation is to be asked for (e.g., access control).

The main objective of this project was to design a biometric identification system, based on gait and eye biometric data, to be used in uncontrolled data acquisition scenarios. In order to do this, and thus enjoy all the advantages of this type of systems mentioned above, there are four main challenges that had to be solved. These challenges can be summarized as: i) acquisition of data with enough discriminating information; ii) accurate biometric data segmentation; iii) correction of pose and illumination variations; and iv) robust user identification.

The four main challenges above had to be dealt with, while guaranteeing that the typical requirements imposed on biometric systems, like universality, uniqueness, permanence, collectability, performance or acceptability were also met. This ensured that the developed identification system was a successful one.

To address the identified challenges, this project proposed to develop a multimodal biometric identification system, based on gait and eye biometrics, to operate in application scenarios where the user cooperation is kept very low, and the sense of intrusion into the user's privacy is also very low. One such application could be the user approaching a door/gate to a secure area (e.g., walking along a corridor) and a camera would be able to capture the way a user walks without an explicit cooperation (the user just needs to walk freely along the corridor), and when wanting the door/gate to open the user would just need to look forward at some point, allowing the capture of the region around his/her eyes, again without an explicit cooperation, and in both cases in a totally contactless manner.

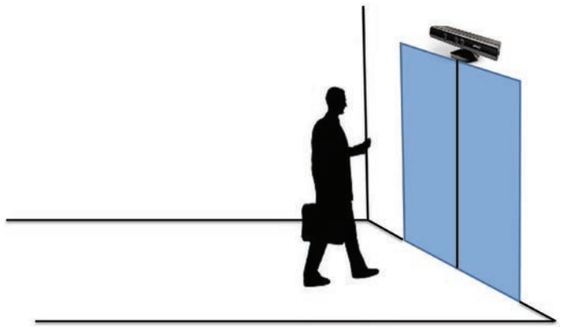

Fig.1 *Considered application scenario.*

URL
http://www.it.pt/project_detail_p.asp?ID=1529

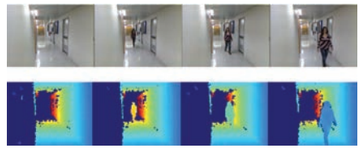

Fig.2 *Examples of video frames (RGB and depth frames) captured with the proposed system.*

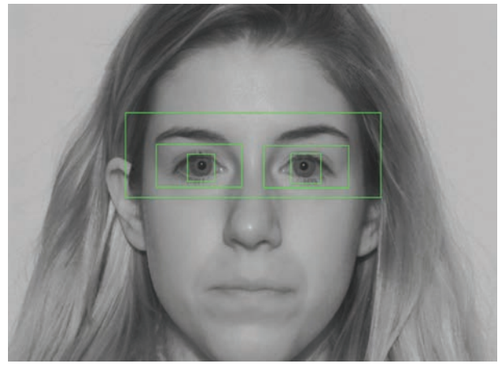

Fig.3 *Examples of eye regions captured with the proposed system.*

ACHIEVEMENTS

In the present project, state-of-the-art methods have been extended by considering a biometric identification system based on the fusion of gait and eye biometric data, to enhance the identification rates with respect to traditional biometric systems without increasing the sense of intrusion into the user's privacy. The additional consideration of multimodal biometrics, in addition to help increasing the recognition rates, also has the advantage that if for some reason a given biometric trait cannot be acquired, or is not performing as expected, the recognition system is still left with the option of operating based on a single biometric trait.Using a soft migration strategy from MATLAB to hardware and taking advantage of Xilinx's System Generator tool and Intellectual Property (IP) cores, we have demonstrated an FPGA implementation for time- and frequency-domain chromatic dispersion equalization and also for nonlinear equalization based on the Split-Step Fourier (SSF) method and on a simplified VSNE. Those algorithms have been tested in a laboratorial environment, providing valuable information about the hardware implementation issues.

We have also implemented a real-time digital coherent transmitter/receiver for access and metro networks, suitable to be used in WDM-PONs with QPSK modulation formats and Nyquist pulse shaping for very high spectral efficiency. Both transmitters/receivers are based on FPGA technology and use a simple 8-bit DSP architecture.

PROJECT TEAM		
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INDICATORS	
FUNDING	36 K€
CONFERENCE PAPERS	2
CONCLUDED MSC	2

PUBLICATIONS

- C. Padole, H. Proença, "Periocular Recognition: Analysis of Performance Degradation Factors", Proc. of the Fifth IAPR/IEEE International Conference on Biometrics (ICB 2012), New Delhi, India, March 30-April 1, 2012.
- A. Nambiar, P. L. Correia, L. D. Soares, "Frontal Gait Recognition Combining 2D and 3D Data", Proc. of the ACM Workshop on Multimedia and Security (MMSec), Conventry, United Kingdom, September, 2012.