PRNU Variance Analysis for Morphed Face Image Detection

Luca Debiasi*, Christian Rathgeb†, Ulrich Scherhag‡, Andreas Uhl*, Christoph Busch‡

WAVELAB - The Multimedia Signal Processing and Security Lab, Universität Salzburg, Austria
† da/sec – Biometrics and Internet Security Research Group, Hochschule Darmstadt, Germany
*ideiasi,uhl)@cs.sbg.ac.at, (ulrich.scherhag, christian.rathgeb, christoph.busch)@h-da.de

Abstract

We propose a method to detect morphed face images based on Photo Response Non-Uniformity (PRNU). More specifically, the variance of PRNU-based features across image cells is estimated to distinguish bona fide from morphed and potentially post-processed morphed face images. The proposed morph detector is shown to be robust against post-processing techniques, which are likely to be applied to conceal the morphing process. Tested on a database of 961 bona fide and 2,414 automatically morphed images, an overall detection equal error rate (D-EER) of 10.5% is obtained, including unaltered unaltered images and various post-processing techniques.

Main Results

- Morphed face images pose a serious risk to Automated Border Control (ABC).
- PRNU shows non-uniformities across image regions after morphing procedures.
- We proposed a variance analysis based approach of PRNU features for morphed face image detection.
- Improved performance (D-EER of 10.5%) and robustness against post-processings of morphed images compared to previous work (D-EER of 15.7%).
- High robustness expected for other datasets and morphing techniques.

What is face morphing?

Morphing - Creation of an artificial target image which resembles information of two (or more) source images.

What is PRNU?

The PRNU is an intrinsic property of all digital imaging sensors, which is characterised by slight variations among individual pixels in their ability to convert photons to electrons. This noise-like pattern is cast onto every image it captures.

Morphing Detection

Face has been selected as primary biometric trait for electronic Machine Readable Travel Documents (eMRTD) in 2002. In 2014 Ferrara et al. [1] presented “The Magic Passport”:

Motivation for Face Morph Detection

Face detection is one of the most important areas in biometrics. In the last few years, face detection has been extensively studied and various algorithms have been proposed.

Experimental Results

Table 1: D-EER performance comparison of proposed PRNU variance analysis-based detector with baseline proposed in [3]. The column ALL reports the D-EER including all attacks (Morph to SHRP).

References