Automatic Detection and Localization of Relatively Permanent Pigmented or Vascular Skin Marks

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April 22, 2016

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DETTA KOMMER ATT TAS BORT NÄR VÄL RAPPORTEN ÄR KLAR. KAN DOCK VARA AV INTRESSE UNDER TIDENS GÅNG

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0.1	April 22, 2016			

Abstract

Keywords: facial marks,

1 Introduction

1.1 Motivation

The amount of technical tools available for forensic analysis in law enforcement increases rapidly and today there exist millions of devises capable of taking colour images. Video surveillance cameras, security cameras and cellphone cameras can all be used to catch perpetrators in the act. The videos and still images can be used as evidence for identification during trails which means that forensic technicians need tools to evaluate if the suspect is the same person as the one caught on camera.

The most intuitive method of evaluating whether the perpetrator and the suspect are the same person is to compare facial features such as eyes, nose, mouth, scars, and other facial marks. This is nowadays done manually [1] by the forensic examiners and in order to give a objective and comparable conclusion value a likelihood ratio [2] is calculated. The likelihood ratio express how strong the evidences against the suspect are and it is calculated by the Bayes factor.

To calculate the Bayes factor it is required to have enough observations of facial features and these are acquired manually by experts since facial recognition processes have not been found to be reliable enough [3]. To record all these observations manually is time consuming and there exist a interest in doing this automatically [4].

This master thesis was motivated by the need of large amount of data from facial marks. The National Forensic Centre (NFC) in Sweden is supporting this work by providing guidance and practical help.

1.2 Aim

The aim of this master thesis is to examine the possibilities of automatically detecting and locating facial marks and classifying them as permanent or non-permanent marks. The frequency, location and size of the permanent marks are stored such that it can be used to calculate the likelihood ratio. By automatically creating a large data base with face images and their features, the accuracy and speed in face recognition cases can be increased.

1.3 Problem specification

This master thesis is going to answers the following questions:

Is it possible to implement a program which can automatically detect RPPVSM?

How can the RPPVSM be given a location and size within a face?

With which accuracy can the program detect and localize RPPVSM?

1.4 Boundary

In general, when working with image, the quality of the images are crucial for the results. Low resolution and badly illuminated images taken from different angles can cause analytical difficulties. Therefore, this thesis will us images which are high resolute, well illuminated, taken en face and in RGB-colours.

2 Related work/Background

The work of systematically recording physical measurements for law enforcement was introduced by Alphonse Bertillon as early as in the 19th century. He developed the Bertillonage system since he believed that each person could be uniquely identified by a set of measurements [5]. This system was however outdated quickly thanks to the explosion of technology.

Resent research by Srinivas et al. [3] have resulted in an automatic and semi-automatic facial recognition processes. It uses a multiscale automatic facial mark detector for the automatic detector and receive a equal error rate of 15.48%. This result was improved by introducing human knowledge in the semi-automatic detector.

When distinguishing identical twins it is useful to look at facial marks which has been examined in an other article by Srinivas et al. [6]. The study concluded that the facial marks can be uses as features for distinguishing between identical twins even if there seems to exist a correlations between the twins set of marks.

Nurhudatiana et al. [7] describes in their article the distribution of Relatively Permanent Pigmented or Vascular Skin Marks (RPPVSM) in Caucasians, Asians, and Latinos. They conclude that if the number of RPPVSM are few they are randomly distributed which can be used for personal identification in law enforcement.

Anil and Park found during their research [8] that facial mark can be used to increase the recall and precision for a state-of-the-art face matcher (FaceVACS). The facial mark detector used the 3x3 LoG-operator as blob detector. Adding these features to the algorithm improved the face matcher from 92.96% to 93.90% on the Facial Recognition Technology (FERET) database and from 91.88% to 93.14% on a Mugshot face database.

2.1 Facial marks

The skin in the face does not have a homogeneous colour and contains regions with different coloured facial marks. The most common facial marks are moles, pockmarks, freckles, scars, and acne. Some of these marks are not permanent, e.g. acne usually heals without leaving any marks, while scares and moles remain the whole life [3]. Skin marks which can be used for identification are called RPPVSM and they have to be relatively permanent, common and also be observable without any special equipment. [7]

3 Method

4 Result

5 Discussion

6 Conclusion

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