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Kinship Verification using algorithms in terms of appearance

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Abstract

In recent decades, face verification and recognition issues have received considerable attention and are motivated by psychological results; several scientists have studied the ability of human assessors or the perception to recognize kinship from human facial images. In addition, the biological relationships and similarities between the traits found in the same family prompt us to exploit this fact to develop a computer system that will be able to recognize kinship by proposition an algorithm that determines whether a pair of facial images belonging to a class is " kin " or " non. Our approach is based on the processing which ensures the preparation of the presentation of an image of the analysis. The latter is based on a step of extracting information in the important areas of the face of parents and children which are then compared between them between father and son, between father and daughter, between mother and son or between a mother and daughter this applies different algorithms in terms of type of appearance on the Kinfacew-II database. In the end, we tried logically to compare these methodologies one of them can provide the most accurate results for our hypothesis, so we found that the PCA algorithm gave the best estimate of 71, 05%. This result is encouraging and promising, as recent studies have concluded in this regard.

Keywords: Face Recognition, kinship, Biometrics, verification, appearance, PCA, LPP

1. Introduction

Recent advances in psychology and cognitive science have revealed that the human face is an important index for measuring the similarity of family ties, with children generally more like their parents than other adults, because their children and their parents overlap.

Facial recognition is one of the best biometric methods for applications related to the identification or authentication of people. Indeed, this is the modality used by humans. It is non-intrusive and socially accepted. The question of identifying a person from their face is an easy task for humans. Is it the same for a machine?

The last few years have been marked by significant progress in this area, thanks to advances in modelling and face analysis techniques. Systems have been developed for detecting and tracking faces, but reliable face recognition remains a major challenge for researchers in computer vision and pattern recognition.

Kinship is a genetic relationship between two family members, including parent-child, brother-sister-brother and sister, grandfather-grandchild; it is the application of kinship in computer vision up to 'now. Therefore, in automatic kinship recognition using computer vision techniques, the machine is able to distinguish parents from unrelated persons and determine the degree of kinship based on an inspection of their face images. [1]

The automatic kinship check aims to recognize the degree of kinship of two individuals from their facial images and it has possible applications in image recovery and annotation, forensic medicine, search for missing children, historical studies and exploration of social media. It is a recent and difficult problem which faces different degrees of kinship and variations in age and gender. [2]

This work explores the computer identification of parent-child pairs using a combination of characteristics of different natures, based on appearance data, selection of functionalities and classifiers at the cutting edge of technology. [3] [4]

2.Our approach

In this section we propose an approach based on the treatment that ensures preparation for the presentation of a picture of the analysis. The latter is based on a step of extracting information in the important areas of the face of both parents and children that are then compared to each other between father and his son. Between father and his daughter. Between a mother and her son or between a mother and her daughter this applies different algorithms in terms of type appearance (also differs in principle on the Kinfacew-ii database that contains 1000 pairs of pictures of parents and children). In the end we tried in a logical way to compare these methodologies any of them can provide the most accurate results for our hypothesis.

2.1. The face database

To evaluate the proposed system, we use Kin Face in the Wild (KinFaceW-II) includes 2000 facial images which they collected from the internet. Consequently, facial images are captured in uncontrolled environments without constraints in terms of pose, lighting, background, expression, age, origin, glasses, ethnic beard and partial occlusion.

KinFaceW-II images are cropped and aligned. So the non-facial regions such as the bottom and the hair were removed and only the facial region was used for parentage verification. If these images in color, we have converted them into grayscale images. For each cropped image, histogram equalization has been applied to alleviate the illumination problem.

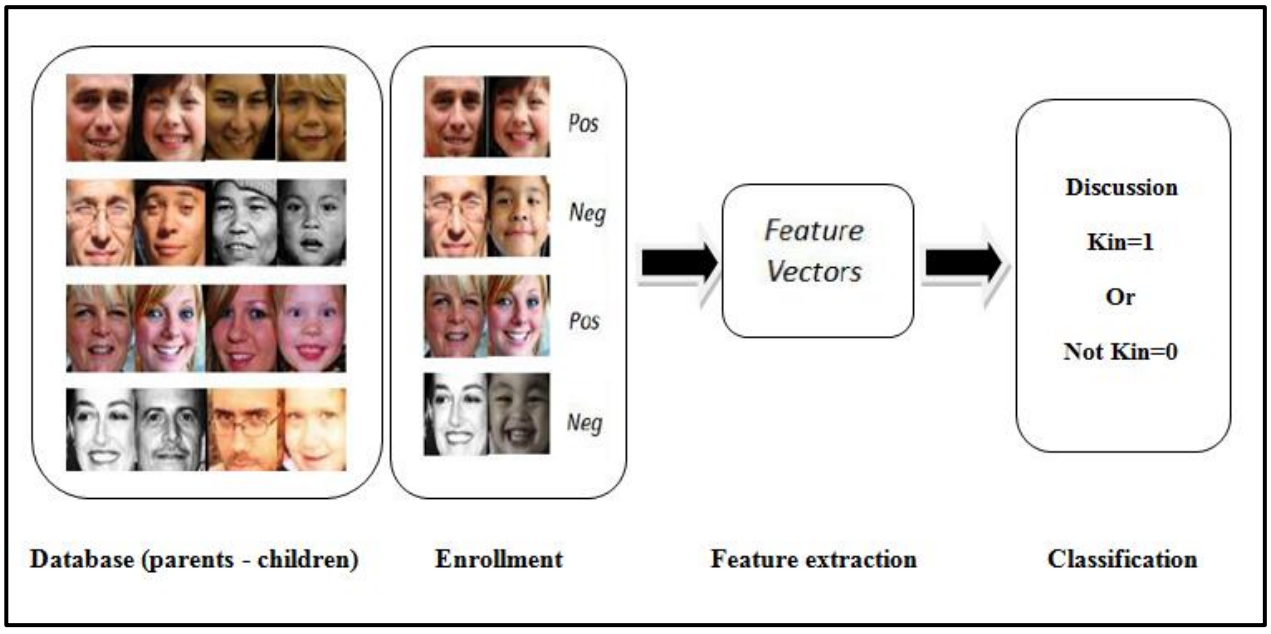
For the KinFaceW-II dataset, each relationship (Father-son, father-daughter, mother-son, and mother-daughter) contains 250 pairs of images. [5] [6]

Fig.1: KinFaceW-II images

3. Results and Discussion

The task of parentage verification from photos is seen as a binary class problem. It usually requires a pair of face images as input and provides relationships as output. Figure 2 shows the basic diagram for automatic parentage verification.

Fig. 2: Block diagram of the kinship verification system using facial images.



The kinship recognition system can be divided into the following three stages: enrollment, Characteristic extraction and classification stage.

Enrollment: We associate images with positive and negative examples. The positive samples are the real parent-child pairs, while the children are negative with parents chosen at random who not their real parents are. Typically, there are four types of relationships, namely, son-father, son-mother, father-daughter and daughter-mother.

Extraction of the characteristics (Feature extraction): for each image of the face, we extract the characteristic of the face, which concatenates and stores in a characteristic vector.

Classification: This module compares parent-child images to determine whether two people are from the same family or not.

3.1. Classification results

Appearance-based features

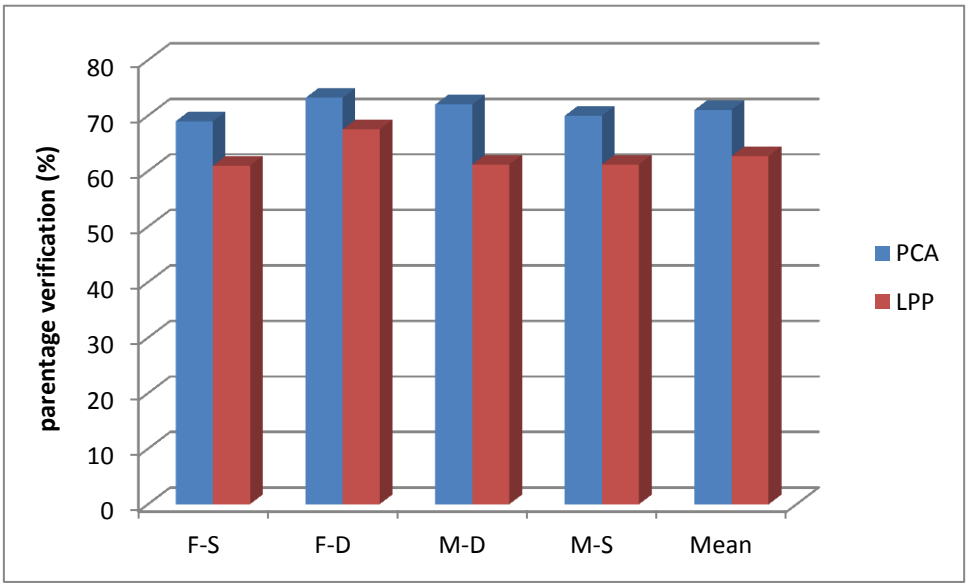
Objective of this approach is to find an appropriate representation of the entire image (all pixels are considered) and to capture both the texture of the face and the geometric information. [7] [8]

The performance of the system based on appearance is indicated in the following table:

Table 1. Accuracy (in %) of parentage verification using characteristics based on appearance.

Feature	F-S	F-D	M-D	M-S	Mean
PCA	69	73.2	72	70	71.05
LPP	61	67.5	61.2	61.2	62.72

Fig.3: Comparison histogram of accuracy (in %) of parentage verification using characteristics based on appearance.



Discussion

- The average accuracy of the overall characteristics based on appearance is between 62.72-71.05%.
- PCA achieve the best accuracy equal to 71.05% while the lowest is LPP.

4. Conclusion

In this paper, we tackled the problem of automatic parentage verification from facial images by considering four relationships: F - S, F - D, M - S and M - D, use the different characteristics, features based on appearance, which has given us good results.

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