Maestría en Ingeniería en Sistemas y Cómputo Inteligente

Title

Spline wavelet transform for face recognition

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1. Introduction

Computer graphics is involved in computer science where produce synthetic visual images. The computer graphic is divided in three areas; 3D animation in real time (it use in video games), special effects edition (by TV and movies), edition of image and modeling (it is implement in engineering and medical objectives) [Hernan C et al (2004)].

Actually, computer graphic is a tool that allow three-dimensional graphics creation, these are used in virtual reality. The avatar in virtual reality is three-dimensional visual representation of user in a synthetic space. The contribution of three-dimensional graphics has created new forms of education are implemented therapy systems that allow an improved quality of life for special people [Van Dam et al. (2014)].

For this reason, this work aims to develop an avatar which will connect to Kinect sensor for incorporation into a system of motor rehabilitation for down Syndrome children.

2. General objective

To implement a system for motor rehabilitation for Down Syndrome children.

Specific objectives

- To design and implement an avatar with human morphology for incorporation into Kinect. (100%)
- To implement motor rehabilitation routines for upper body. (10%)
- To integrate Interface, Kinect technology, avatar and motor rehabilitation routines. (50%)

3. Method

Face recognition is a system that basing on the characteristic of an individual have to verify or recognize his/her identity. A face recognition system generally consist of four modules as shown in Figure 1: *face detection, alignment, feature extraction and matching*. *Face detection* segments the face areas from de background. *Alignment* is aimed at achieving more accurate localization and at normalizing faces. *Feature extraction* is responsible for provide effective information to distinguishing between faces of different persons. For *matching* the extracted features of the input face is matched against the faces of the database, achievement or not identify.

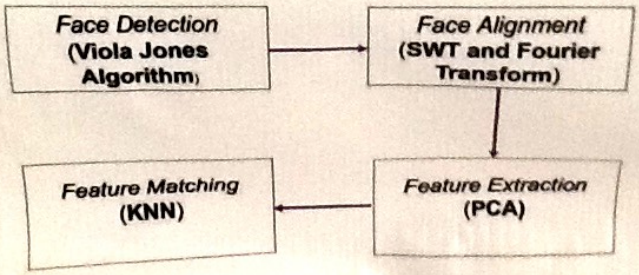

Figure 1. *Process to perform a face recognition system.*

3.1. Algorithm description

The algorithm can be described in detail as follows and shown in figure 2:

- The first step is normalize the training set or database, this means, all the face images.
- *The spline wavelet transform* is applied over the training set to decomposing the face images into suitable levels, getting four images, one of approximation and three of details. For this work will only keep the approximation image.
- Then *2D Fourier transform* is performed with the purpose to reduce lighting problems.
- Once made the preprocessing, *PCA* is executed on the face images to extract its features. Those last three points are known as training phase.
- In the stage of recognition, input face images need to go through the four steps, to finally match those features with the *KNN* algorithm.

Spline Wavelet Transform

Fourier Transform

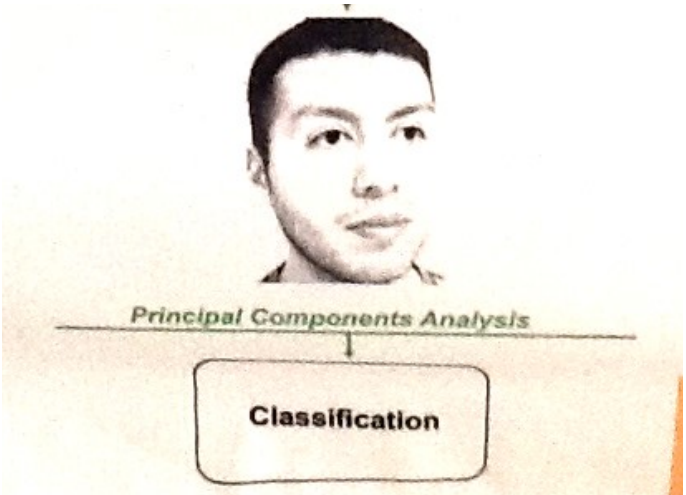

Figure 2. Overall procedure of the algorithm proposed

4. Results

The implementation of this face recognition system was performed using the *QT* platform and the *OpenCV* library as shown in figure 3. For this paper we use as training set, the database of faces *ORL*, which contains 40 faces of different people, 10 images per person, making a total of 400 images.

For the experimentation, the training set was divided in three sets. The first set represents the features obtained from 10 principal components , the second set form 80 principal components and the third set form all the principal components. To evaluate the results all the experiments was used *10 cross-validation*. The results shown in figure4.

Figure 3. Prototype interface (QT, OpenCV).

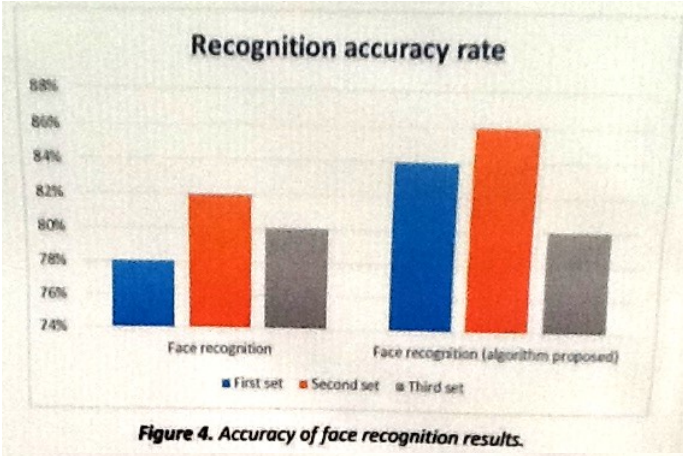

Figure 4. Accuracy of face recognition results.

5. Conclusion

The performance of face recognition system depend highly of features that are extracted to represent the face pattern, but preprocessing are the basis for an extracting effective features, becoming to the *spline wavelet transform* in a good and useful tool to decompose an image at suitable levels getting a better face recognition rate.

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