Face Detection and Recognition Using OpenCV

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Abstract**—Face detection and picture or video recognition is a popular subject of research on biometrics. Face recognition in a real-time setting has an exciting area and a rapidly growing challenge. Framework for the use of face recognition application authentication. This proposes the PCA (Principal Component Analysis) facial recognition system. The key component analysis (PCA) is a statistical method under the broad heading of factor analysis. The aim of the PCA is to reduce the large amount of data storage to the size of the feature space that is required to represent the data economically. The wide 1-D pixel vector made of the 2-D face picture in compact main elements of the space function is designed for facial recognition by the PCA. This is called a projection of self-space. The proper space is determined with the identification of the covariance matrix's own vectors, which are centered on a collection of fingerprint images. I build a camera-based real-time face recognition system and set an algorithm by developing programming on OpenCV, Haar Cascade, Eigenface, Fisher Face, LBPH, and Python**.

Keywords—- ***Face detection, Face recognition, PCA, Eigenspace, Haar cascade, Fisher face, LBPH, OpenCV***

I. INTRODUCTION

A face recognition program is a software application for verifying a person and identifying him or her with a video or picture from a source. For psychology at least the 1950s and the 1960's, the earlier work on facial recognition can be traced back to engineering literature. Some of the earliest findings include experiments on Darwin's feelings for face expression. With the open source platform Intel called OpenCV, (Media, 2008)[1] (Media, 2008) facial recognition can be done quickly and reliably. One way from a face and an image database are the preferred facial features. It is generally compared to biometrics like fingerprints and eye reconnaissance systems, and is used in security systems, thumb recognition systems. The key element analysis using Fisher face algorithms, the Markov model, multilinear subspace learning using tensor representations and the nervously driven dynamic reference matching, etc, were also common recognition algorithms. The Computer-View library for Intel's open-source makes programming easy to use. This provides advanced capabilities such as facial detection, face tracking, facial recognition and a range of ready-to-use methods for artificial intelligence (AI). It has the advantages of being a multi-platform framework; this supports Windows and Macos, as well as Mac OS X recently.

II. FACE ALGORITHIMS

The currently available algorithms are:

A. Haarcascade_frontalface_default.xml
B. Eigenfaces see **createEigenFaceRecognizer()**
C. Fisher(Placeholder3)faces see **createFisherFaceRecognizer()**
D. Local Binary Patterns Histograms (see **createLBPHFaceRecognizer()**

A. Face Detection using Haar Cascade

A hair cascade is defined as: a sequence of "square shaped" functions which together form a family of wavelets or a base. It is also focused on "Haar Wavelets," which organize pixels on the picture into squares, based on a hair wavelet approach which was suggested in the 2001 "rapid object detection using an enhanced cascade of simple features" paper by Paul Viola and Michael Jones (P.Viola, 20010[11]. It is a learning approach based on computers, where many positive and negative representations are used to construct a cascade function. This is then used to detect objects Using "integral image" principles in order to compute "features" identified by the hair cascades.

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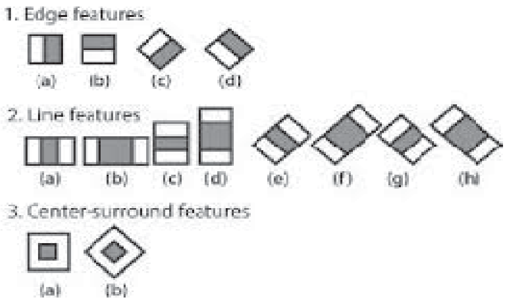


Fig 1-Extraction features in Haar-like features.

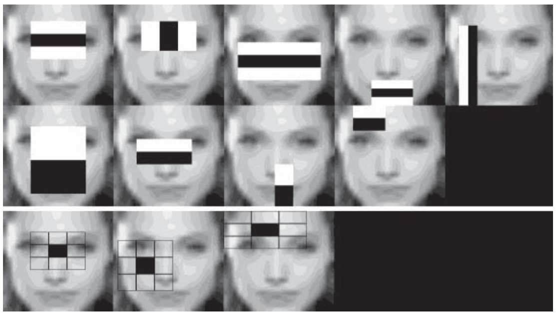


Fig2-Haar cascade classifier view

The cascade is measured by 1.25 and different sized faces are re-iterated in order to find it. Large amount of computing power and time consumed by Running an image on cascade.

B- FACE RECOGNITION USING EIGEN FACES: Following the following steps:

Step 1: normalize

Step 2: Project on Eigen space

Step 3: defined as

Step 4:

Step5: if, < face l recognized from training set.

Then the distance in the face spaces is also referred to as length.

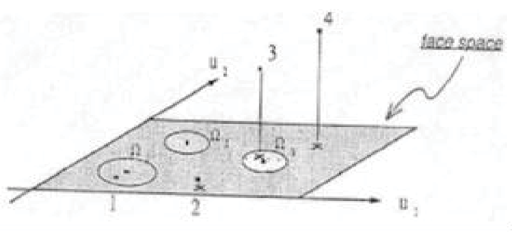


Fig3-Face Detection Using Eigen Faces

B.1-MAIN IDEA BEHIND EIGEN FACES:

Suppose G is an *1*vector, corresponding to an NN face image (I)

The purpose is to constitute mean face into a low-dimensional space: *mean* = (K<<N^2).(AlexPentLand, 1991)[3].The features are images that can be added to the average face tocreate new face pictures. We can write this mathematically as,

$$F = F_m + \sum_{i=1}^{n} \alpha_i F_i$$

F= a new frontal face.
F_m = the average frontal face,
F_i = an EigenFace,
α_i = are scalar multipliers we can choose to create new faces. They can be negative or positive.

The classification of the main components of the facial image database is determined. It is used for facial recognition and facial landmark detection applications. (Alex Pentland, 1991)[3]

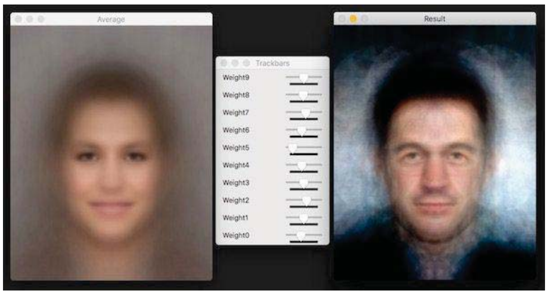


Fig4-The mean image (Left). A new face eigenface (Rights) with different weights (Center**).**

C- Face Recognition Using Fisherfase: The most commonly known DAs, which can originate from an RA concept, is the Linear Discriminant Analysis (LDA). In 1936, Fisher. If LDAs are used to locate a subspace image of a set of face images, they use the Eigenface method to describe the space is known as Fisher's Linear Discriminant Analyzes (FLDA or LDA)

D-Face Recognition Using LBP

Local Binary Pattern *(LBP)* Is an easy, but very strong user of texture who marks the image's pixels with each pixel's proximity, and views the outcome as binary numbers.

It was first defined in 1994 (LBP) and is a powerful component for the classification of texture since then. In addition, LBP has been calculated to increase significantly the detection efficiency on certain datasets when coupled with histograms of oriented gradients (HOG) descriptor. By using LBP combined with histogram, face pictures with a simple data vector can be described.

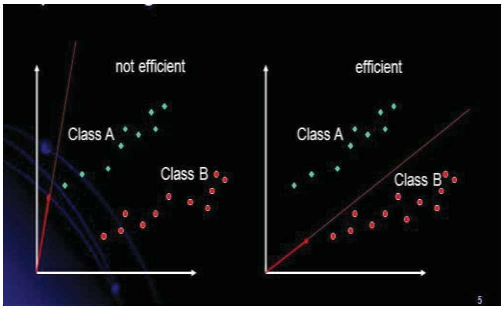


Fig5-PCA seeks directions that are efficient for representing the data.

Local Binary Patterns, or LBPs for short,the work popular of Ojala et al as texture descriptor in its 2002 paper, Multiresolution Grayscale and Rotation Invariant Texture Classification with Local Binary Patterns (the definition of LBPs was implemented at the beginning of 1993). It computes a global representation of texture based on the Gray Level Co-occurrence Matrix, unlike Haralick. LBPs compute a regional texture representation. The binary image is built by comparing every pixel with the pixel surrounding area.For example, look at the original 3 x 3-pixel neighborhood LBP descriptoroperarted just same this:

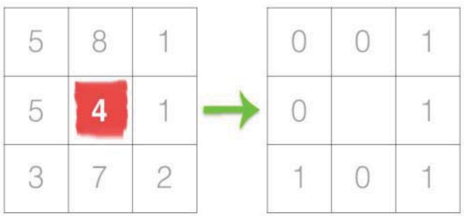
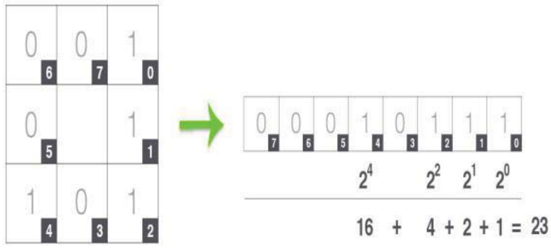


Fig6- Binary Pattern

A middle pixel and an 8-binary numbers cap is the first step in creating an LBP for the 8 Pixels neighborhood. In the figure above, we choose the center pixel and set it against its 8pixel neighborhood. If the pixel center is more than the following line, set the value to l; set the value to 0, otherwise. A total combination of 2 ^8= 256 possible LBP codes with eight pixels will be achieved.Thanks to a neighborhood of 3x3, we have 8 neighbors on which we have to check binarily.This binary search results were stored in an 8-bit array and converted into decimal.



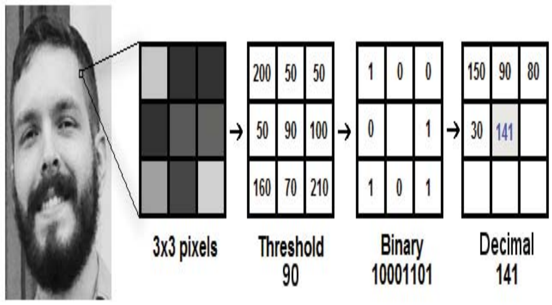


Fig7-- Face Recognition of LBPH Algorithm

III. Detection Algorithm

Principal Component Analysis (PCA):

Karhunen-Loeve is also the most effective technique for the identification, detection and compression of an image, the principal component analysis (PCA). PCA is the factor analysis name statistics. The space of the data is reduced by the large dimension (observed variables) to the smaller intrinsic dimension of the characteristic space (independent variables). In this case, there is a strong correlation between the variables observed.

PCA is used for calculating, reducing duplication, extracting functions, compression performance, etc. Because PCA is also a traditional linear domain technique, the method is suited to linear models. There are several Applications for Face Recognition. It can be classified as sex identity, verification of face expression, registration or declaration of gender.The most useful applications are: cluster monitoring, video content indexing, personal identification, matching headshots, entry security. The software most important. The PCA definition is to depict the large 1-D vector of pixels formed out of the two-dimensional face picture in the main components of the feature space. This is known as self-space projection.Superfacial space is determined by defining a number of facial images with the ownvectors of the covariance matrix.[4](Kyungnam)

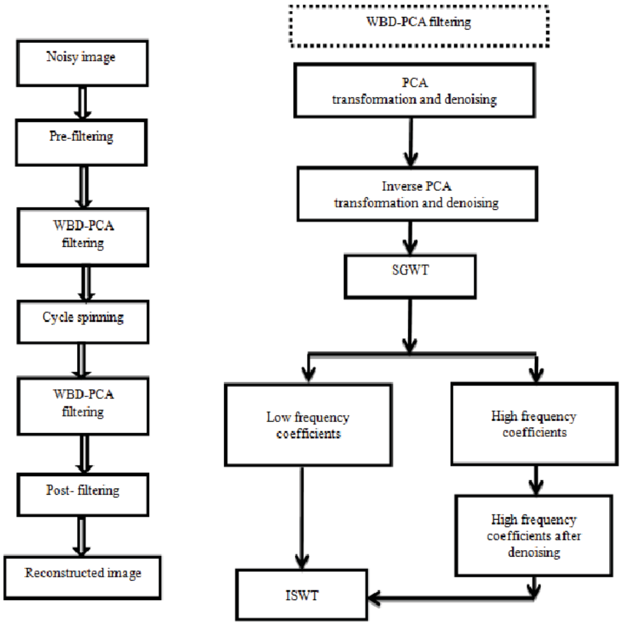


Fig8-. Block diagram of PCA(Principal Component Analysis)

IV. OPENCV STRUCTURE AND CONTENT

OpenCV is organized loosely into five main elements, four of which are outlined in Figure. The CV portion includes the main picture processing and lower computer vision algorithms.

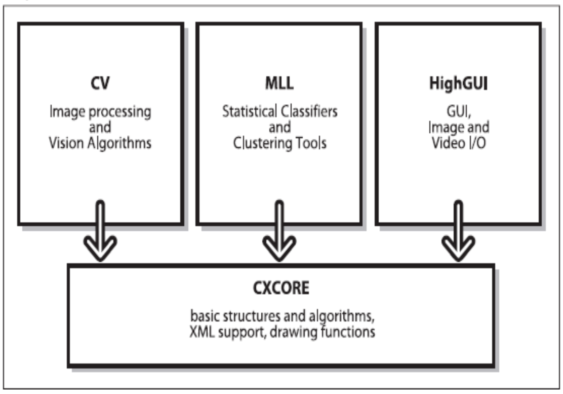


Fig9-. OPENCV Structure and content

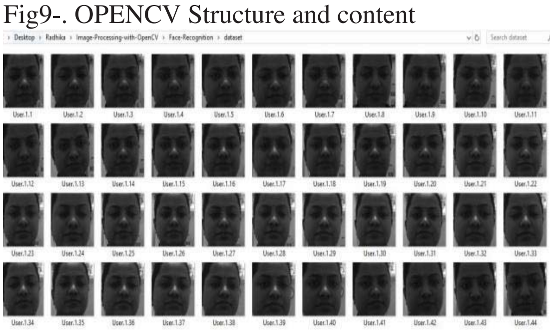


Fig10-Facial Recognition using OpenCV

V. CONCLUSION

In the last 20 years, facial recognition technology has come a long way. Today can check identity information automatically with regard to safe transactions, tracking, security purposes and buildings access control. Such systems normally work in controlled environments and algorithms of recognition may manipulate environmental constraints to achieve high accuracy of recognition. Yet face-recognition technologies of next generation will be commonly used in smart settings where computers and machines are more like supportive helpers.

FUTURE WORK

In the field of face recognition, there are several important problems. One challenge is to plan the picture before use of the tool. Of example, it is one of the abilityto identify if the image is a man or a woman, so that an image can be identified by one or two classifiers and trained with such an individual. It may be possible to obtain consistency in classification when multiple spaces are spectrum-scale individuals in one section. This turns out to be a collection of peculiarity for men and one for women (gender with space, so to speak). Lisema,Waldoestl and Nicolay did the same job, but it would be better. The new classification network is yet another piece of work by developing it in future. Instead of the resulting image projection into face space, you can create your network from the data as an output. Perhaps by learning face projection, it improves the accuracy of the neural network classifier.

References

[1] Learning OpenCV –Computer Vision with the OpenCV Library O'Reilly Publication.

[2] Learning OpenCV: Computer Vision with OpenCV Library, Kindle Edition.Gary Bradsk1 and AndrianKehlar

[3] M.A. Turk and A.P. Pentland, "Face Recognition Using Eigenfaces", IEEE Conf. on Computer Vision and Pattern Recognition, pp. 586-591, 1991.

[4] "KyungnamKim" Face Recognition using Principle Component Analysis"

[5] Codacus: https://youtu.be/1Jz24sVsLE4

[6] G B Huang, H Lee, E L. Miller, "Learning hierarchical representation for Face verification with convolution deep belief networks[C]",Proceedings of International Conference on Computer Vision and Pattern Recognition,pp.223-226,2012.

[7] Computer Vision Papers, http://www.cvpapers.com

[8] Learning OpenCV: Computer Vision with the OpenCV Library 1st Edition, Kindle Edition

[9] OpenCV Homepage http://opencv.willowgarage.com

[10] Recognition Homepage http://www.face-rec.org/algorithms.

[11] Paul Viola, Matthew Jones Conference paper- IEEE Computer Society Conference on Computer Vision and Pattern Recognition."Rapid object detection using a boosted cascade of simple features."