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FACE RECOGNITION AND OPTIMIZATION WITH FEATURE EXTRACTION TECHNIQUE

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ABSTRACT

The research paper I have used as the base paper for my thesis work is based on the comparison of the 2D-3D face recognition using the CCA algorithm, the detection of facial curve from 3D mesh surface. In my experimental work I have use the concept of CCA and LDA, though it is only for the initial stage, I am comparing and detecting the face among the different objects, also I am detecting the other features of the face like nose, mouth and eyes. I have been comparing the same images by analyzing each component of an image individually, I have compared different component of the image individually (Red component, Green component and Blue component) also I have analyzed them using their gray scale image and also I have plotted their histogram curve and histograph images. I have taken 12 training set images and the accuracy for face detection is 99.99%, for nose Detection it is 99.99% and for mouth and eyes at single instance it is 90%.

KEYWORDS: CCA-canonical correlation analysis. Feature Extraction, Multiview Learning LDA, MATLAB Tool- Computer vision and Image processing.

1. INTRODUCTION

Human beings are predominantly visual creatures we heavily want to focus on our vision to make sense of the world around us. We do not prefer to look at things to identify and classify them, but we can scan for deference, and obtain an overall a rough idea for a scene with a quick glance. Humans have evolved very precise visual skills we can identify a face in an instant. We can differentiate colors; we can process a large amount of visual information very quickly. However, the

world is in constant motion stare at something for long enough and it will change in some way. Even a large solid structure, like a building or a mountain, will change its appearance depending on the time of day and night as amount of sunlight (clear or cloudy), or various shadows falling upon it. We are concerned with single images snapshots, if we like, of a visual scene. Although image processing can deal with changing scenes. For our purposes, an image is a single picture which represents something. As the human face plays an important role in our social interaction, conveying people's identity. Two dimensional image-based methods are inherently limited by variability in imaging factors such as illumination and pose. Such observations are relatively invariant to illumination and pose, although they do vary with facial expressions. As the technology for measuring facial surfaces becomes simpler and cheaper, the uses of 3D facial scans are expected to become more common. Because the shape of faces is independent on the illumination and pose, 3D face recognition has the potential to improve performance under the uncontrolled conditions. Automatic face detection is a complex problem in image processing. Many methods exist to solve this problem such as template matching, Fisher Linear Discriminant, Neural Networks, SVM, and MRC.

2. PROBLEM DEFINTION AND REQUIREMENT ANALYSIS

According the first research paper I observed color is a useful parameter of information in computer vision especially for skin detection. Then i approach for skin segmentation and facial feature extraction. The basic aim of skin detection is to group pixels to form possible face candidate regions and then use connected components analysis for pixels grouping. In order to detect the facial feature in scale invariant, the possible face candidate regions will be normalized, and then texture information in these regions will be segmented by means of mean and variance of face region. Edge will be detected using the method based on multi-scale morphological. Eye will be located by the PCA edge direction. The others feature, such as nose and mouth, also located using the geometrical shape information. As all these techniques are simple and efficient, the proposed method is computational effective and suitable for practical applications. In our experiments, the proposed method has been successfully evaluated using two

different test datasets. The detection accuracy of this method is around 98%, and the average run time is approxes 0.1-0.3 sec per frame [2].

The research paper which I used as a base research paper compare the 2D-3D face recognition method using the CCA approach , which is based upon the detection of facial curves from 3D mesh surface. This research paper proposed the principle of the detection facial curves from 3D range images. It introduced a powerful technique for 2D-3D face recognition, and that technique is CCA method. According to this technique 2D- 3D face matching method is used the CCA to learn mapping between the 3D image and 2D-3D face images which are using the facial curves. This method allows matching the 3D facial image with competitive 2D face image. The 2D-3D face recognition results for individual cases and different number of subjects in the test set are shown in the corresponding table as below. When the objects are used as a Test 2D-3D face match results gave recognition on 115 objects is approximately 98%. [3]

If we use another technique for the optimization and extraction, we are able to construct two types of nonlinear feature spaces, where to extract the nonlinear features linear feature extraction algorithms are applicable. We get the knowledge about that how and what is the relationship between the two kernel methods that are LDA, PCA and CCA when they are applied for feature extraction algorithms analysis. Through the theoretical knowledge based analysis it is cleared that they are similar in different scaling test for different feature extraction. As in present scenario face recognition is an important parameter but it also have some problem the main problem is lower accuracy, if we compared it with previous methods as finger print recognition etc., and the relative ease with which many systems can be defeated. But there are many other factors which affect the performance of an image detection and complexity. If it is required that the appeared image should be correct and accurate it is necessary that all these basic problems must be disappear, if it is not done then capture image have some errors. Inadequate constraint or handling of such variability inevitably leads to failures in recognition. It may include the following problems in different features as:

• Acquisition geometry changes: Scale changes, location and in front of the camera as well as rotation in depth.

• Physical changes: Change in face expression, with change in age, due to make-up, glasses, facial hair, and hairstyle.

• Imaging changes: lighting variation, camera variations, and channel characteristics like broadcast or compression in image.

Table 1: Comparison of different methods

S. No.	Features	LDA	PCA	CCA
1.	Face	98%	97.3%	98%
2.	Nose	98%	98%	98%
3.	Eyes	85%	83%	86%
4.	Mouth	75%	80%	80%

2.1 FACE RECOGNITION SYSTEM

One of the most challenging problems that face recognition must deal with is the appropriate separation of data that belongs to the same class. In face recognition, a class represents all the data of the same subject (data of all the images of the same person).There are different methods for face recognition.

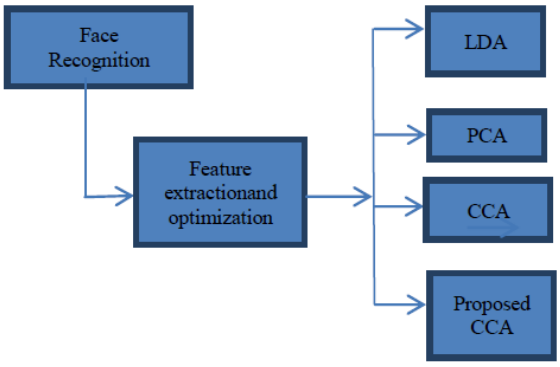


Figure 1: Methods of face recognition system

The procedure for any face recognition system is given as above. The first step is the features of images are extracted. Second, the classifier is trained on a training set of images and models for various classes are generated. Finally, these classification models are used to predict test images. [4]

3. OVERVIEW of LDA, PCA and CCA with PROPOSED METHODOLOGY

PCA is a method or technique for reduction of dimension of image and can apply to a broad class of computer vision problem, and also include the feature selection, and object selection and face recognition.

CCA is another method for face recognition. It is a suitable and dominant technique which can be used for showing

the relationships among multiple dependent and independent variables [5]. So that, a powerful feature projection approach for facial images which is based on CCA recognizes and measures the relationship between two sets of variables. Compared to other recognition approaches like PCA and LDA, CCA can concurrently deal with two sets of data. For two sets of multivariate data, x and y, CCA finds two sets of basic vectors, w_x and w_y, so that the correlation is maximized between the projections of variables onto these vectors. CCA maximizes the following function -

$$\rho = \frac{E w_x^T C_{xy} w_x}{\sqrt{w_x^T C_{xx} w_x w_y^T C_{yy} w_y}} \quad (1)$$

Where E[f(x,y)] is the empirical expectation of the function f(x,y), and C_{xx} and C_{yy} are the within-set covariance matrices of x and y, respectively.

By solving the following Eigen value equations, the canonical correlations between x and y can be given as -

$$C_{xx}^{-1} C_{xy} C_{yy}^{-1} C_{yx} w_x = \rho^2 w_x \quad (2)$$

$$C_{yy}^{-1} C_{yx} C_{xx}^{-1} C_{xy} w_y = \rho^2 w_y \quad (3)$$

Where the Eigen values ρ2 are the squared canonical correlations and the eigenvectors w_x and w_y are the normalized canonical correlation basis vectors.[6]

I worked with computer vision tool Computer vision based people detection should be a basic ability to include in any Vision Based Interface Several approaches have been developed in the past for people detection attending to different elements of the human body: face, head and the entire body as well as the human skin. Among those body parts, for human communication face plays an important role. There are different static and dynamic features that we use to successfully interact with other people and to identify them. I was given seven training images along with the corresponding ground truth data to develop and train my algorithms on. The end result for my work was an algorithm capable of finding over 99% of the faces in all but one image in approximately30 seconds. In addition, I am able to successfully locate one of the females in two test images.

4. RESULTS

I worked with proposed methodology of CCA that is the advanced and improved form of LDA and PCA. As table 1 shows the accuracy of different methods which

applied on different subjects or images. Previous CCA is applicable only for Face detection but in improved form it is applicable on other parts of face or body. As i used the more and more images for analysis and get the output .I generated the histogram and histograph of colored and gray images .In some images output is not 100% but it is 99.89% which is more than to previous. As my results I detected Face, Nose, Eyes and Mouth with gray and colored images with RGB component.

4.1 GRAY IMAGES

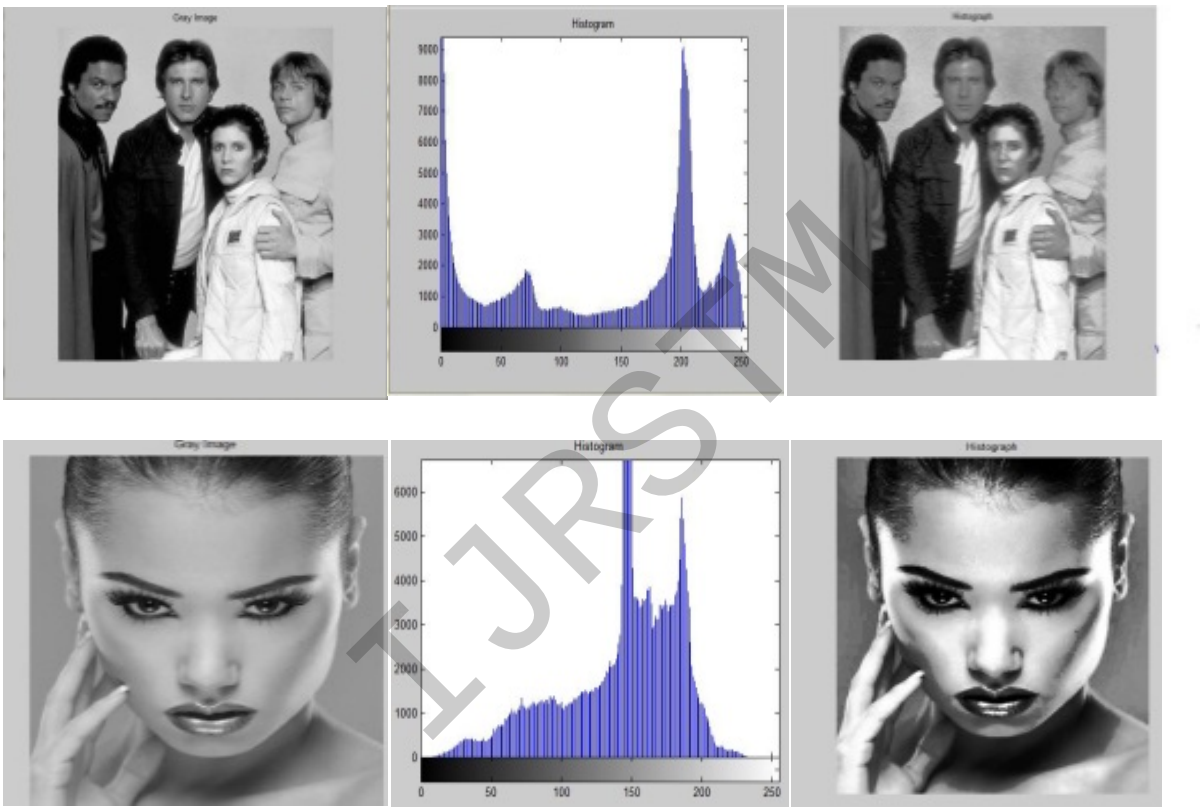
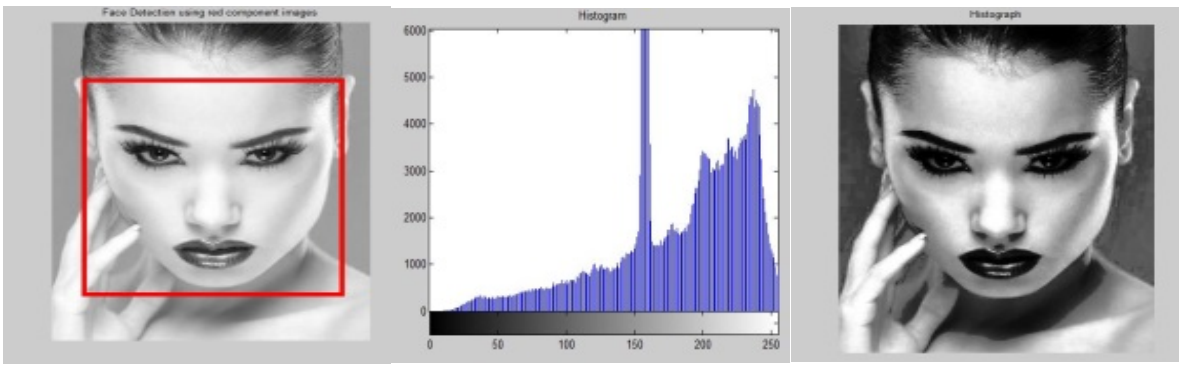


Figure 2: Test gray images with their histogram and histograph

4.2 ANALYSIS OF RGB COMPONENTS



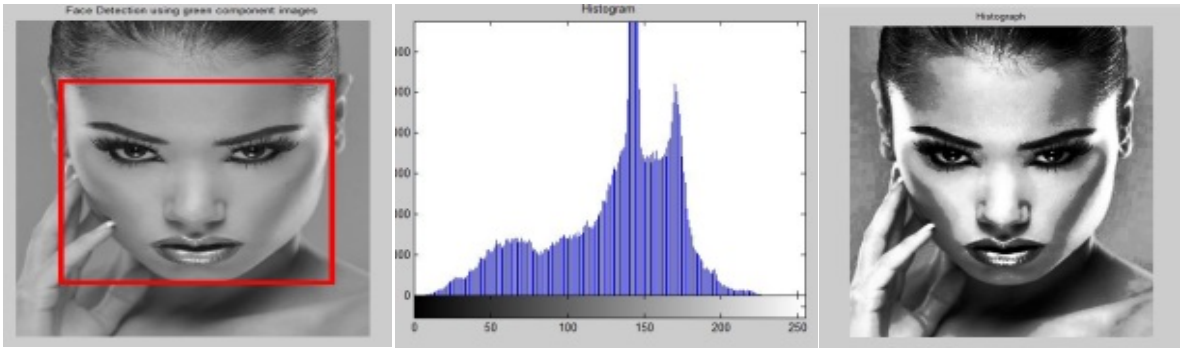


Figure 3: Face Detection with RGB Component with histogram and histograph

As the above results show the analysis of face detection with gray images and RGB components similarly 12test images are also analyzed for detection. My next task to analyze the other feature of face like nose, eyes and mouth that will be shown as below. I just show here colored image data analysis.

Figure 4: Other test results of Face Detection with histogram and histograph

Figure 5: Nose Detection of colored image with RGB Component

Figure 6: Eyes and Mouth Detection with RGB component

These all are my analysis which is appeared on my experiments. In my experiments, I used 12 test images and accuracy results is shown as below in table 2.

Table 2: My results with Improved CCA

Features	4 Images	8 Images	12 Images
Face	99.99%	99.99%	99.99%
Nose	99.99%	99%	99%
Eyes	90%	90%	90%
Mouth	90%	90%	90%

5. CONCLUSION

My aim was to detect the face and its feature; I have achieved that, from my experimental work i can draw the conclusion that analyzing the image on single components individually generates the better chance of detecting the face, nose, mouth, and eyes more accurately compared to the RGB images. In my work have used red component images, green component images and blue component images for the detection , also i have shown the gray scale images and their histogram images as well as histograph. For future enhancement it is

very useful for criminal cases as in the present scenario criminal case has been increases rapidly so to reduce the percentage this is most appropriate method by this if criminal have changes on his image by any type of changes.

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