Face Recognition using Feature Descriptors and Classifiers

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Abstract

Feature extraction is becoming popular in face recognition method. Face recognition is the interesting and growing area in real time applications. In last decades many of face recognitions methods has been developed. Feature extraction is the one of the emerging technique in the face recognition methods. In this method an attempt to show best faces recognition method. Here used different descriptors combination like LBP and SIFT, LBP and HOG for feature extraction. Using a single descriptor is difficult to address all variations so combining multiple features in common. Find LBP and SIFT features separately from the images and fuse them with a canonical correlation analysis and same procedure also done using LBP and HOG. The SIFT features have some limitations they don't work well with lighting changes, quite slow, and mathematically complicated and computationally heavy. The combinations of HOG and LBP features make the system robust against some variations like illumination and expressions. Also, face recognition technique used a different classifier to extract the useful information from images to solve the problems. This paper is organized into four sections. Introduction in the first section. The second section describes feature descriptors and the third section describes proposed methods, final sections describes experiments result and conclusion phase.

Keywords: Face Recognition, Face Detection, Feature Extraction, Feature Descriptors, Multi Scale Vector, Classifiers

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I. INTRODUCTION

Image matching is considered as a standout amongst the most dynamic tasks of research in numerous application of computer vision field for example, face detection [1], object recognition [2], texture recognition [3], tracking [4] etc. The main focus for image matching is to find best matches between two images, when applying distinctive changes to the picture (illumination, pressure, brightness) by utilizing the feature descriptors. Many methodologies have been proposed to find the particular feature in an image such as SIFT [5], LBP [6], and HOG [7].

In this paper, find the best recognition criteria using the combination of different descriptors. Here used the combination of LBP+SIFT then using the combination of LBP+HOG for feature extraction. For the purpose of feature extraction takes 5 images with different subjects. First developed a training data set for the training process and from that dataset choose one of the images and that can be divided into four blocks and identifying the particular features. This process can be done in all images in the dataset. In this process find the SIFT feature and then find other feature LBP from the each block and then the features can be fused with CCA method same procedure is done with using LBP and HOG. Combination of two descriptors are used because of difficult to address all variation using single descriptor. Propose a new classification method for further classification. The basic procedure is shown in figure 1.

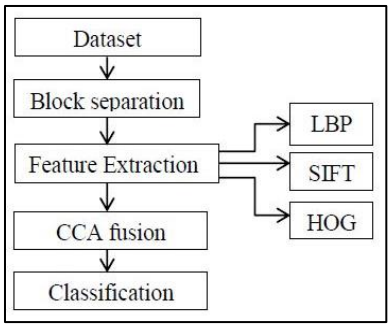

Fig. 1: Basic face recognition method

A. Paper Organization

The following paper discuss about feature extraction methods in section II, section III discuss about proposed face recognition methods and the results explained in section IV; Section V is a conclusion phase

II. FEATURE EXTRACTION

In machine learning, pattern recognition and in image processing, feature extraction begins from an underlying arrangement of measured information and assembles inferred values (features) proposed to be informative and non-excess, encouraging the ensuing learning and generalization steps, and at times prompting better human translations. Feature extraction is identified with dimensionality decrease. For the purpose of feature extraction different descriptors are used.

A. SIFT Descriptor

SIFT is proposed by Lowe keeping in order to separate the most stable interesting points of a picture by utilizing the Difference of Gaussian (DoG) And make a vector descriptor. This algorithm is described as follows:

- Scale-Space Extreme Detection: Search over multiple scales and image locations
- Key point localization: A number of interesting points are found from the initial step. To enhance the strength of the IP's, this progression includes disposing of the IPs with the low difference or poor restriction along edges.
- Orientation assignment: Compute the best orientation for each key point region
- Key point description: To create a set of histograms over a window of 16-by-16 pixels around an IP and orientation histograms aligned in a 4x4 grid. Each histogram has 8 orientations so that it gives 128 elements feature vector [8] as illustrates in Figure 2.

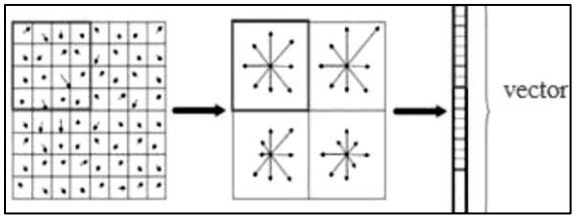

Fig. 2: SIFT descriptor extraction

B. LBP descriptor

The LBP operator is proposed by Ojala and al. [9]. It is intended for extraction surface component. This operator is robust against light changes and quick to compute. The LBP operator has been broadly utilized as a part of image recovery, object recognition and acknowledge great execution in face recognition [10], [11]. The LBP histogram figured over an area is for the most part utilized for the surface descriptor. This administrator portrays for each pixel a parallel code. Figure 3 illustrate the estimation of the LBP code. Decisively, the dim level of every pixel (focal) is tried with its 8 neighbourhood (measure 3×3). In the event that the estimation of the neighbourhood is greater than the estimation of the focal pixel, the result is set to one, generally to zero.

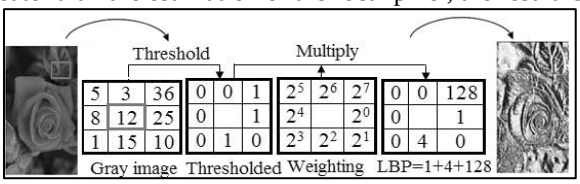

Fig. 3: Calculation of the LBP code

The LBP feature vector, in its simplest form, is created in the following manner:

- Divide the analysed window into cells (e.g. 16x16 pixels for every cell).
- For every pixel in a cell, contrast the pixel with each of its 8 neighbours (to its left side top, left-centre, left-base, right-beat, and so on.). Take after the pixels along a circle, i.e. clockwise or counter-clockwise.
- Where the middle pixel's esteem is more noteworthy than the neighbour's esteem, express "0". Something else, express "1". This gives 8-digit twofold number (which is normally changed over to decimal for comfort).
- Compute the histogram, over the cell, of the frequency of each "number" occurring (i.e., each combination of which pixels are smaller and which are greater than the centre).Then the histogram can be viewed as 256-dimensional feature vector.
- Optionally standardize the histogram.
- Concatenate (standardized) histograms of all cells. This gives an element vector for the whole window.

The feature vector can now be prepared to utilize the Support vector machine or some other machine-learning calculation to characterize pictures. Such classifiers can be utilized for face recognition.

C. HOG Descriptor

Histogram of oriented gradients (HOG) is a feature descriptor used to identify object in PC vision and image processing. The HOG descriptor strategy includes occurrences of gradient orientation in localized portions of an image - detection window, or region of interest (ROI). Figure 4 shows the HO algorithm execution.

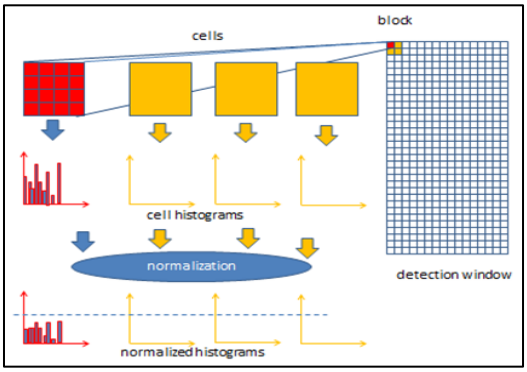

Fig. 4: Algorithm implementation of HOG

- Step1: Divide the image into small regions
- Step 2: Discretize each cell into angular bins
- Step 3: Each cells pixel provide weighted gradient
- Step 4: Groups of adjacent cells are considered as block
- Step 5: Group of histograms represents the block histogram
- Step 6: Set of these block histograms represents the descriptor.

III. METHOD FRAMEWORK

A. Database

To evaluate our descriptor, use randomly some images of the AR databases.. They are created at the CVC Computer Vision Center in by Aleix Martnez and Robert Benavente. It contains more than 4,000 color images relating to 126 individuals' faces (70 men and 56 women). Pictures feature frontal view faces with various outward appearances, light conditions, and impediments (sun glasses and scarf). The image was taken at the CVC under entirely controlled conditions. No limitations on wear (garments, glasses, and so forth.), make-up, hair style, and so forth were forced to members. Every individual took an interest in two sessions, isolated by two weeks (14 days) time. Similar pictures were taken in both sessions.

B. Block separation

Training set consists of five different images. Each images can be further divided into four blocks and each block is identified by two features named as LBP and HOG or LBP and SIFT.

C. Feature extraction

Feature extraction consist different feature descriptors. Find the combination of two different descriptors to find the best face matching method.

1) Face recognition using SIFT and HOG

Training data set consist five images of different persons. Each image in the training dataset can be divided into four blocks and find the SIFT feature of each block then find another feature HOG. Combining these features using a CCA method. This feature combination does not give better recognition rate or occurred errors in data matching because of the SIFT feature have some disadvantages that generally don't work well with lighting changes and blur and mathematically complicated and computationally heavy.

2) Face recognition using LBP ad HOG

The limitations of SIFT descriptor introduce another descriptor HOG. The same technique used in above technique repeated in this work also. The use of HOG feature makes the system robust against illumination variations. This method gives better recognition rate and increased the data matching performance.

D. CCA Fusion

Canonical correlation analysis (CCA) is a method for measuring the straight relationship between two multidimensional factors. It discovers two bases, one for every variable, that is ideal regarding connections and, in the meantime, it finds the corresponding correlation. At the end of the day, it finds the two bases in which the connection grid between the factors is diagonalized and the relationships on the diagonalized are boosted. The dimensionality of these new bases is equivalent to or less than the littlest dimensionality of the two factors.

E. Classification

Classification is the important process in face recognition criteria. Use a multi-SVM [12] classifier for the classification process. This method models a given training set with a corresponding group vector and classifiers a given test set using an SVM classifies according to a one versus all relation.

IV. RESULT

The major contribution of this paper is to show the better recognition criteria for image matching. The implementation of the combination of two descriptors and recognition accuracy obtained from the experimental analysis. Both combinations were tested on different database with different condition like illumination, the presence of sunglass, expression. The combination of SIFT and LBP occurred an error in data matching but the combination of HOG and LBP give better recognition performance.

Table – 1
Result for comparison of combination of two features

Dataset	*AR dataset*	
Methods	*SIFT+HOG*	*LBP+HOG*
Accuracy	*90%*	*98%*

The table 1 shows corresponding result in order to make a good combination of two descriptor. The result shows the better method for face recognition without any matching error.

V. CONCLUSION

This paper has attempted to review a number of papers to cover the current improvement in the field of face recognition. Here also presents a comparative study of face recognition. In this paper presented new descriptor used to improve the matching of the image by merging different descriptors SIFT, LBP, and HOG. The final result shows the better performance of our method compared to other recognition methods. The combination of LBP and HOG method avoid problems occurred in image matching due to illumination and expression variation in an image.

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