Classification of Components of Face Using Texture Feature

Naveena M[1], G Hemantha Kumar[2]

[1] Scientific officer, Manasagangothri
University of Mysore, Mysore

[2] Professor and Vice Chancellor
University of Mysore, Mysore

Abstract:

The goal of this paper is to classify the component of texture feature of the face. The face image is a type of texture that can be represented using texture descriptors. This concept is used in changes of pose and different illuminations are used to detect components of face using Viola-Jones algorithm. A local region is represented by its center pixel, and center pixels represent the image in gray level then the gray level image is converted into binary code. In K- nearest neighbor classification the output belongs to the class. An object is classified by a majority vote of its neighbors, and the object is assigned to the most common among its k nearest neighbors.

1. INTRODUCTION

The face of humans conveys a lot of information like, identity, emotional expressions etc., and Face recognition is one of the interesting and difficult problems. It impacts important applications in many areas such as identification for law enforcement, authentication for banking and security system access, personal identification among others etc., In this work it mainly consists of three parts, namely face representation, feature extraction and classification. Face representation represents how to model a face and determines the successive algorithms of detection and recognition. The most useful thing is to measure similarities between images. Facial expression is one of the most powerful, natural and immediate means for human beings to communicate their emotions and intensions.

By using the components of face, in biometrics we can authenticate a person to access personal information. Biometrics is an important subject to secure our personal things with biological parts like eyes, face, palm and iris. Biometrics is a word which is derived from the term, Bio means body parts and metrics means measuring values. It compares the input image with the existing image which is stored in the database and identifies the particular person or verifies the person.

To identify or to verify a person from a digital image or from video source face recognition system is used. We do this by comparing selected facial features from the image and a facial database which we have taken. In previous algorithms they extract the features of major landmarks or features of other parts based on position, size and/ or shape of the Eyes, Nose, and Mouth with extracting these kinds of features we compare with images which is there in database to verify or identify the face which is matching with these extracted features. In other cases many algorithms shows the face by extracting texture of skin. By this texture analysis it gives unique lines, patterns and it finds the spots which is easy to recognize the face of a particular image.

Face detection has been regarded as the most complex and challenging problem in the field of computer vision, due to the large intra-class variations caused by the changes in facial appearance, lighting, and expression. Such variations result in the face distribution to be highly nonlinear and complex in any space which is linear to the original image space. Moreover, in the applications of real life surveillance and biometric, the camera limitations and pose variations make the distribution of human faces in feature space more dispersed and complicated than that of frontal faces.

It further complicates the problem of robust face detection. An important characteristics used for analysis of many types of images is texture feature. Most important property of the LBPV operator is better tolerance against illumination changes than most of the other texture methods we have. Another equally important property of LBPV is computational simplicity, which makes it possible to analyze images in challenging real- time settings.

In this project we will consider LBPV features as Examples to demonstrate the usefulness of texture-based approach in facial image. Local Binary Pattern (LBP) features have performed very well in various applications, including texture feature classification and segmentation, image retrieval and surface inspection. The original LBP operator takes the center pixel value and considering the result as a binary number. And then we convert this obtained Binary Number into corresponding Decimal values.

2. PROPOSED METHODOLOGY

Software design is one of the most important steps of software life-cycle, as it provides the process of transitioning the user requirements into the system's implementation. There are a series of methodologies that can be adopted, which highly depend on the type of project, user and available resources.

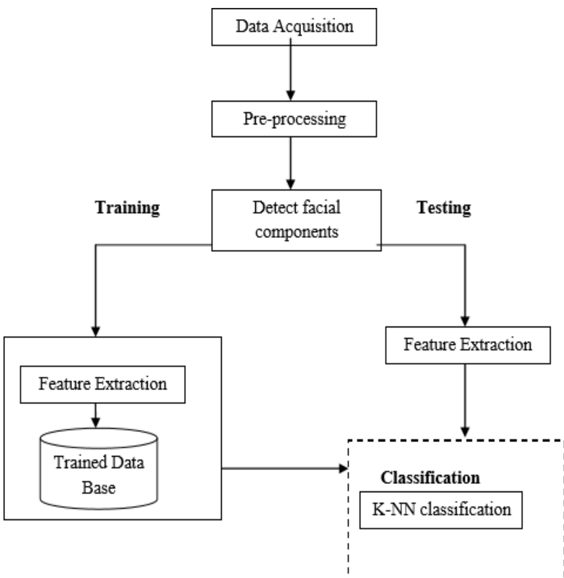


Fig1: proposed architecture

3. FACE DETECT

Face detection is a computer technology being used in a variety of applications that identifies human faces in digital images. Voila-Jones object detector are used to detect face and facial parts, Voila and Jones algorithms focus on the detection of frontal human faces. The Voila- Jones object detection framework is the first object detection framework to provide competitive object detection rates in real-time proposed in 2001 by Paul Viola and Michael Jones although it can be trained to detect a variety of object classes, it was motivated primarily by the problem of face detection.

The characteristics of Viola-Jones algorithm which make it good detection algorithms are:

- Robust-very high detection rate (true- positive rate) and very low false- positive rate always.
- Real time- For practical applications at least 2 frames per second must be processed.
- Face Detection only (not recognition). The goal is to distinguish faces from number of faces.

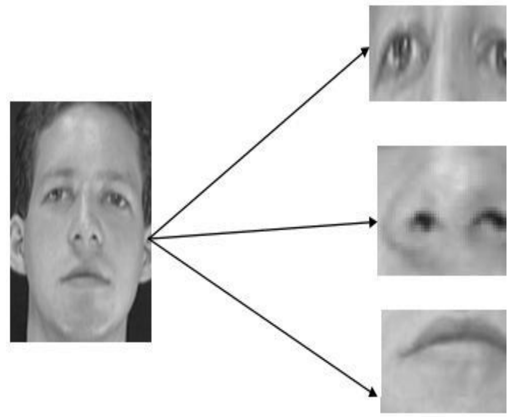


Fig2: detected face components

4. FEATURE EXTRACTION

Local Binary Patterns is a non-parametric descriptor whose aim is to efficiently summarize the local structures of images. Local Binary patterns summarize local structure of images efficiently by comparing with each pixel with its neighboring pixels.

Local Binary Patterns was originally proposed for texture analysis. It is powerful approach to describe local structures. It has been extensively used in many applications for instance, leaf image analysis, image retrieval, motion analysis.

$$S(X) = \begin{cases} 1, & if x \geq 0 \\ 0, & if x < 0 \end{cases}$$

The original LBP operator labels the pixels of an imaged with decimal numbers called Local Binary Patterns or LBP codes.

Monotonic illumination changes means illumination consistency increasing or decreasing in this LBP works better than the other algorithms. LBP was originally proposed for texture analysis and later it has improved that it is a simple and powerful approach to describe local structure.

It has been extensively exploited in many applications, for instance, face image analysis, image and video retrieval environment modeling visual inspection, motion analysis, Biometrical and image analysis and remote sensing.

Local Binary Pattern(LBP) Feature have performed very well in various applications, including texture classification and segmentation, image retrieval and surface inspection.

The original LBP operator labels the pixels of an image by Thresholding the 3-by-3 neighborhood of each pixel with the center pixel value and considering the result as a binary number.

And then we convert this obtained binary number into corresponding decimal value.

After sending the parameters like radius and size along with the image to the LBP function. Here is the expression to calculate the LBP factor for the given pixels where the notation(P,R) denotes a neighborhood of P sampling points on a circle of radius of R. formally, given a pixel at (Xc , Yc), the resulting LBP can be expressed in decimal form as follows:

$$LBP_{p,r}(X_c, Y_c) = ss\sum_{p=n}^{p-1} s(i_c - i_c)2^p$$

Where ic and ip are, respectively, gray-level values of the central pixel and P surrounding pixel in the circle neighborhood with a radius R, and function s(x) is defined as

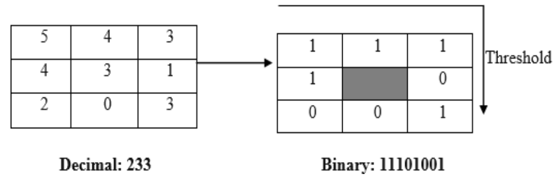
By this calculation we get a LBP factor for each Pixel

5. CLASSIFICATION

In pattern recognition, the K-nearest classifier algorithm is a non-parametric method used for classification and regression. In both cases, the input consists of the K closets training examples in the feature space. The output depends on whether K-NN is used for classification or regression.

In K-NN classification, the output is a class membership. An object is classified by a majority vote of its neighbors, with the object being assigned to the class most common among its K Nearest Neighbors (K is a positive integer, typically small). If K=1, then the object is simply assigned to the class of that single nearest neighbors. In K-NN regression, the output is the property value for that object. This value is the average of the values of its k nearest neighbors. K-NN is a type of instance-based learning, or lazy learning, where the function is only approximated locally and all computation is differed until classification.

The K-NN algorithm is among the simplest of all machine learning algorithms K-NN algorithm is one of the simplest classification algorithms. Even with such simplicity, it can give highly competitive results. K-NN algorithm can also be used for



regression problems. The Nearest Neighbor rule achieves consistently high performance without a priori assumptions about the distributions from which the training examples are drawn. It involves a training set of both positive and negative class. A new sample is classified by calculating the distance to the nearest training case. The sign of that point then determines the classification of the sample.

The K-NN classifier extends this idea by taking the K-Nearest points and assigning the majority value K-NN instance based classifier, classification using an instance- based classifier can be a simple matter of locating the nearest neighbor in instance space and labeling the unknown instance with the same class label as that of the known neighbor.

This approach is often referred to as a nearest neighbor classifier. To improving the performance and speed of a nearest neighbor classification many techniques are used. One of the simplest classifier, which we used in the K- Nearest Neighbor classifier. The term of nearest means that smallest Euclidean distance in dimensional feature space, K-NN is a type of instance-based learning, where the function is only approximated locally and computation is deferred until classification.

The K-NN algorithm is among the simplest of all machine learning. The K-NN classifier operates on the premises that classification of unknown instances can be done by relating the unknown to the known according to some similarity function. The K-Nearest Neighbor classifier labels unknown objects of the majority of K- Nearest Neighbors. A neighbor is viewed as nearest if it has the smallest distance within the various methods of supervised statistical pattern recognition.

The nearest neighbor rule achieves consistently high performance without a theoretical assumption from which the training examples are drawn. It involves a training set of both positive and negative cases.

A new sample is classified by calculating the distance to the nearest training case. The sign of that point then determines the classification of the sample.

The K-NN classifier extends this idea by taking the k-nearest points and assigning the leaf of the majority. It is common to select k small and large k values help to reduce the effects of noisy points within the training dataset. And the choice of k is often performed through cross validation.

The Euclidean distance can be defined as,

$$D = IIA - BII= IIAII2 + IIBII2 - 2 *A.B$$

6. EXPERIMENTAL RESULTS AND OBSERVATIONS

DATA SET: Data collection is the systematic approach to gather and measure information from a variety of sources to get a complete and accurate picture of the area of our interest. When following this method of data collecting, it is essential to distinguish between primary and secondary data. Primary data is also known as the raw data, primary data collection is quite expensive. The data can be collected through various methods like surveys, observations, case study etc., it takes long period to collect the data. Accuracy and reliability is more in primary data. Secondary data implies second-hand information which is already collected and recorded by any person other than the user for a purpose, secondary data offers several advantages as it is easily available and it saves time. So we have collected secondary data set. In this work classify the components on different expression, different angle and different pose. Here we classify the all datasets into different classes. Each class has individual person in different expressions and different angle. Similarly we have taken 5 classes each class has 10 samples which has shown in the below table.

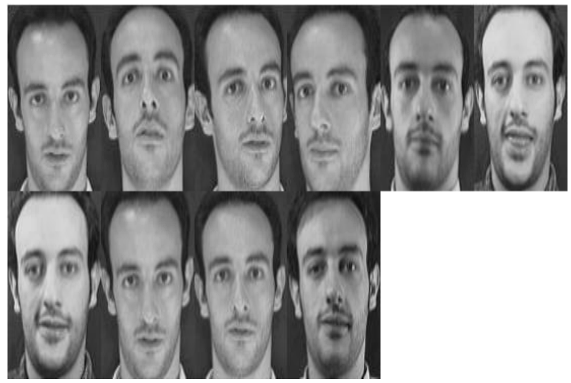
Sl.No	Class Name	No. Sample
1	Class 1	10
2	Class 2	10
3	Class 3	10
4	Class 4	10
5	Class 5	10
Total	5 Classes	50

Table1: Datasets

CLASS 1:

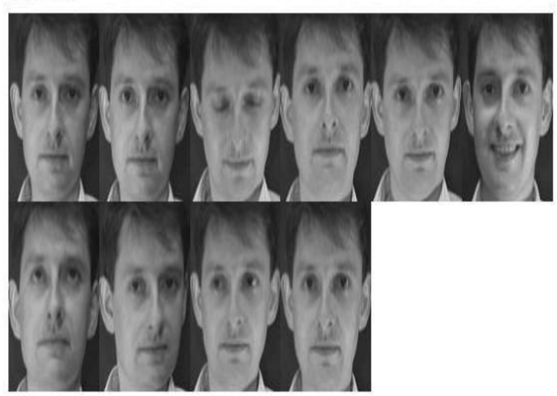
CLASS 2:

CLASS3:



CLASS 4:

CLASS 5:



IJCSI International Journal of Computer Science Issues, Volume 16, Issue 6, November 2019
ISSN (Print): 1694-0814 | ISSN (Online): 1694-0784
www.IJCSI.org https://doi.org/10.5281/zenodo.3987086

50x9 double

	1	2	3	4	5	6	7	8	9
1	96.6415	87.0193	2.9784e+06	118.3783	89.3742	3.3696e+06	117.9156	90.0700	2.0203e+06
2	94.3756	87.4997	2.8893e+06	119.6376	88.1265	3.1379e+06	121.3593	92.9507	2.2105e+06
3	108.0418	90.0905	4.6202e+06	118.9311	87.4909	2.5206e+06	121.9560	92.7285	2.7371e+06
4	97.6814	87.8665	3.2249e+06	124.2699	88.6245	3.9752e+06	121.3152	92.6007	2.3246e+06
5	95.1056	88.4084	3.1118e+06	124.2620	87.5471	3.4512e+06	121.5370	91.0273	2.7049e+06
6	106.2827	87.4485	3.7409e+06	114.1821	87.7317	3.5036e+06	121.6358	91.5072	1.9202e+06
7	95.8433	86.4793	3.3800e+06	120.7945	89.4818	3.1759e+06	122.0548	89.1795	2.3711e+06
8	95.3348	86.2837	2.8817e+06	127.1078	87.8339	2.8578e+06	124.6400	91.2726	2.0098e+06
9	102.8806	89.4793	3.8932e+06	128.7511	87.6408	2.8894e+06	126.8267	91.7181	2.1072e+06
10	93.5512	88.7199	3.5159e+06	122.5366	88.2179	3.5996e+06	120.3940	91.1006	1.9194e+06
11	97.7461	88.0812	4.7733e+06	120.4803	87.9292	4.5431e+06	115.2383	95.3734	1.9949e+06
12	97.9588	85.8738	3.8302e+06	110.7826	84.6123	1.9429e+06	116.7518	95.2129	2.2489e+06
13	98.1917	88.7990	4.4385e+06	115.5630	85.6465	3.6890e+06	111.1733	93.9677	2.4159e+06
14	103.0678	87.1760	3.9663e+06	139.7619	92.0283	5.6034e+06	119.0994	95.7699	2.4710e+06
15	103.7640	89.1035	3.8685e+06	114.3107	87.1463	2.7903e+06	117.8090	93.3880	2.0654e+06
16	95.2839	85.8361	4.0863e+06	111.3476	86.4428	2.5118e+06	112.6699	91.1984	3.9348e+06
17	97.9508	85.8188	4.1559e+06	108.6424	85.6848	2.7583e+06	120.1553	88.5060	3.6122e+06
18	95.0503	85.4238	4.4474e+06	108.6715	86.5724	3.7939e+06	102.4299	94.6960	2.1707e+06
19	106.1822	89.5798	3.8916e+06	114.2913	86.9511	2.2812e+06	114.1504	95.2638	2.0780e+06

Fig3: Feature matrix database

50x1 double

	1	2	3	4
1	1			
2	1			
3	1			
4	1			
5	1			
6	1			
7	1			
8	1			
9	1			
10	1			
11	2			
12	2			
13	2			
14	2			
15	2			
16	2			
17	2			
18	2			
19	2			
20	2			
21	3			
22	3			
23	3			
24	3			
25	3			
26	3			
27	3			
28	3			

Fig4: Label matrix database

7. DISCUSSION

Our Paper is to experiment along with the 5 peoples with 10 different angle pose variation dataset, here every person gave 10 different pose variations totally 5*10 it is 50 images. Therefore from each person we have collected 10 images among the total 50 images we take different values for training and different value for testing the images then we have got different accuracy.

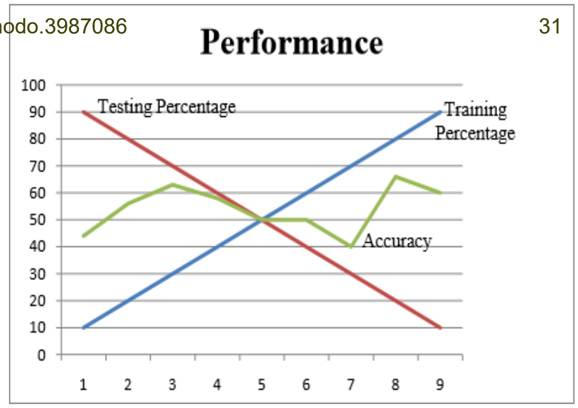


Fig5: Graphical representation of performance measurements

8. CONCLUSION

In this paper, a new methodology is defined to classify facial components. Here we store the components of face in database and extract the feature of that images using local binary pattern [LBP] feature, with mean, standard deviation and variance we get the feature matrix. Using these feature matrixes we compare actual input image values with the obtained feature values. At present we have used LBP feature for feature extraction, later process we can try with other feature extraction method in LBP itself like efficient LBP, extended LBP.

FUTURE WORK

Face detection has been a challenging task due to numbers of factors like poses, image condition and illumination. Most of the existing methods and algorithms are unable to provide solutions to these problems of variations. A considerable attention is required to develop efficient methods that can work with and overcome from such problems.

In future we can try with the other classifier and we can see by fusing the two classifier. For the further work we will try with more samples and more classes of faces. And with other invariant functions.

We can expect better results in future work by using other methods to extract the feature and fusing the classifiers. As this is the beginning work with the LBP, we just proposed a basic model by applying other feature extraction method with other classifiers.

REFERENCES

[1] William Robson Schwartz, "Face Identification Using FEATURE" sets, 2012

[2] S.Malini, R.Gayathri, "LBPV for Newborn Personal Recognition System", 2013

[3] K.Meena. Dr. A.Suruliandi, "Local binary patters and its variants for face recognition", 2011

[4] LadislavLenc and pavelKral, "Feature to feature Matching for LBP based face Recognition".

[5] Huang.D Shan, C.Ardvilian, M.Wang, Y.chen, "Local binary pattern and its application to facial analysis" 2011

[6] T.Ahonen, A.Hadid, M.Peitikainen, "Face recognition with local binary patterns", 2007

[7] Laura Sanchez Lopez, "Local Binary Pattern applied to face detection and recognition". 2010

[8] Md.ABDUR Rahim, Md.NajmulHassain, Tazilla Wahid & Md.ShafalAzam, "face recognition using local binary patterns" 2013

[9] Li Lju, Lingjhum Zhao, Yunil Long, GangyaoKuang, Paul Fieguth, "Extended local binary pattern for texture classification", 2012

[10] Sarbjith Singh, AmirtpalKaur, Taqdir, "A face Recognition System Technique using local binary pattern", 2015

[11] LadislavLenc, and Pavel Kr all, "Feature to feature Matching for LBP based Face Recognition"

[12] YannRodriguz, "Face Detection and Verification using Local Binary Patterns", 206

Di Haung, Caifengshan, Mohsen Ardebilian, Yunhog Wang, and liming Chen "local Binary patterns and its Application to Facial Image Analysis": A survey