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Facial Feature Extraction For Face Recognition

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Abstract:
System of face recognition techniques plays a crucial role in life, and Face recognition is one among the biometric techniques used for identification of humans. among which it's utilized in security protection and protection systems (electronic door through the face) and in advertisements, the foremost famous of which is Facebook, which uses face recognition technology in terms of garments and hairstyle this technique has advantages that are easy to use, accurate and unnecessary to the human factor. this technique has been programmed through algorithms and high algorithms to research the position of the top and therefore the background image, and a few define some areas of the face consistent with the programmed algorithms .and the most idea of our work is to extract the features from the face by using some techniques like (HOG, LBP,PCA,SURF,HAARIS) Then, the KNN algorithm is applied to seek out the similarity ratio between the training image that stored within the system and testing image. Our dataset contained about 100 images (60 training images, 40 testing image) of various people and when applying the techniques, we embraced that the hog algorithm is that the most effective compared to other algorithms with a hit rate of quite 85%.

KEYWORDS: Facial Recognition, Handcraft Features, Classification

1. INTRODUCTION

Since the last century, biometrics have been used to identify humans. Faces are one of the many forms of biometrics used to identify and verify individuals. Face recognition refers to the automated method of checking for correspondence between two human faces. Extraction feature is extremely an important step in face recognition. There is no 100% match between photos of the same face even if they are from the same person. and, the fundamental human behavior that is essential for effective communications and interactions among people. a proper method of classifying faces was first proposed in [1] The author proposed collecting facial profiles as curves, i.e. leading to a vector of independent measures that would be compared with other. vectors during a database progress has advanced to the purpose that face recognition systems are being

demonstrated in real-world settings [2] The rapid development of face recognition is thanks to a mixture of factors: active development of algorithms, the supply of an outsized databases of facial images, and a way for evaluating the performance of face recognition algorithms. during this study, analyzing face recognition systems using four different techniques to extract face recognition features using local binary patterns (LBP) describing the feel and shape of the digital image, we use face detection using haaris and Histogram of Gradient (HOG). From discovering the thing. this system computes gradient direction duplicates in localized parts of a picture, and that we use accelerated robust features (SURF): SURF descriptors are wont to locate objects, people or faces to trace and recognize objects and extract points of interest.

2. RELATED WORK

There are several researches have been conducted on face recognition problem. One of these based of face properties, considering that every face has several distinct features, represented in several curves on the faces, and therefore the technique of distinguishing faces depends on these features as a contract. Each face has about 80 nodes, and therefore the most famous of those nodes which will be measured using programs are [3] the space the depth of the attention, the form of the cheekbones, and finally the length of the jaw line.

Within the 1960s, Bledsoe created a system that could organize faces" photos by hand using the RAND tablet. The tablet may be a device people could use to enter vertical and horizontal coordinates on a grid with the assistance of a stylus that released electromagnetic pulses. People used that system to manually record the coordinate areas of countenance like eyes, nose, mouth, and hairline. The manually recorded metrics might be later saved within a database. And when the new photograph of a private was entered into the system , get the most closely resembled image via database during this era , face recognition was untouched by technology and computer processing power the primary and foremost step taken by Bledsoe to prove that face recognition was a practical biometric.

In this section, we introduced the face recognition, and applications of this technology. An incredible number of researches and energy from many major company and universities and been dedicated to the present field. Earlier face recognition technology was considered as a thought of fantasy. But within the past decade, face recognition technology has not only become real but it"s widespread. Today, people can easily read articles and news stories about face recognition everywhere. Here is that the history of face recognition technology.

and a few ideas about its bright future. Nowadays even retailers are using AI-based face recognition technology to stop violence and crime. Airports are becoming better-secured environment, mobile

acers are using face recognition to bring the biometric security feature within the devices.

Face recognition method in our search first extraction of (LBP) features LBP has been considered as among the powerful texture features extraction technique. the LBP for texture features extraction. the essential assumption was that texture has locally two complementary aspects: the pattern and strength [4]. Generally, the essential idea of LBPs is to summaries" the local structure in a picture by comparing each pixel with its neighborhood. If the intensity of the canter pixel is bigger or equal with its neighbor, then it's assigned as 1 and 0 if not. the primary basic LBP operator in [5] is employed as a hard and fast 3×3 neighborhoods.

For more, there's another algorithm it's second histogram of gradients (HOG) may be a feature descriptor uses overlapping local contrast normalization for improved accuracy .and The presented technique utilizes a histogram of gradients (HOG) for fetching of countenance followed by the feed forward back propagation neural network classifier. A window approach is performed for the detection of an image. The window of detection features a hard and fast size 150x150. The window detects prominent image pixels from the whole face image. The analysis is split into two phases First, the descriptor value is calculated for every window of detection via the HOG feature method [6].

And the histogram of gradients (HOG) feature execution works as follows: The extracted face image is partitioned into small associated pixels values called cells. The HOG edge direction of the pixels during a cell is calculated, Each cell is separated in an angular bin in accordance with the sting of the gradient, The pixels of each cell contribute to the weighted gradient of the corresponding angular bin., Neighboring group cells considers spatial areas referred to as blocks Grouping cells during a block is that the basis of normalizing histograms .And The normalized histogram group represents the histogram of the block. the gathering of those blocking histograms optimizes the HOG feature of a picture.

Another feature is speeder up robust feature (SURF) algorithm [7][8][9] mainly includes three steps: an interest point detection, interest point descriptor, and interest point matching. The definition of the interest point within the SURF algorithm means the points which special location in images, for instance, corner point, spot and T-junction. the foremost valuable performance of the interest point detection is repeatability which represents the detector can find the reliability of the interest points in several viewpoints. Interest Point Matching in SURF interest point matching is predicated on distance between vectors and calculates the space of the interest points among the template images and therefore the searching images.

For more improvement, SURF features are developed to gain more informative information. SURF depends an excessive amount of on the local orientation value which can cause gain incorrect orientation then latter the features extraction and matching believe the local orientation. So even a touch bias will cause unsuccessful matching, descriptor vector generation. when SURF gets the descriptor vector, it only makes use of 3/8 information round the interest points, meaning three of eight sub-blocks round the points, this directly affects the describing performance, and eventually Interest points matching. the first method in SURF must calculate the space between any two points within the template image and searching image. It increased an excessive of consuming time

HAAR features is introduced in 2001, still has been used widely within the face detection algorithms. during this method, Firstly, the worth of all pixels in grey scale images which are in black accumulated. Then, they subtracted from the entire of white boxes. Finally, the result is going to be compared to the defined threshold and if the standards is met, the feature considers successful. generally, for every computation in Haar feature may have to get each single pixel within the areas of features and this step are often bypassed by applying integral images that the

worth of every pixel is adequate to the summation of gray values above and left within the image [10]. Therefore, it only calculates the pixel value for four pixels lookups from the integral image.

Another feature which will be used is deep face recognition. In 2014, Deep Face [11] achieved the very best accuracy on the famous standard LFW(Labeled Faces in the Wild) scale [12], approaching human performance within the unrestricted state for the primary time, by training a 9-layer model on 4 million face

images. Since then, research that specialize in the French language has become deep learning curricula. More powerful loss functions are explored to find out deep discriminatory features and are categorized into Euclidean distance loss, Angular cosine-based loss also as maximum soft loss and its differences. The loss supported the Euclidean distance reduces internal contrast and expands the variance between supported the Euclidean distance. Face Net used the triple loss function which aims to separate the positive pair from the negative pair by the space margin and achieve an honest performance (99.63%) on the LFW.

3- CLASSIFICATION

The final stage of the Facial Features feature extracted is used to perform face recognition to recognize who is his face or classification to determining some facial properties, for example, glasses / without glasses, etc. The k-nearest neighbors (KNN) algorithm may be a simple, easy-to-implement supervised machine learning algorithm which will be wont to solve both classification and regression problems. In other words, similar things are almost one another The KNN algorithm Load the info, Initialize K to your chosen number of neighbors (here 1), for every example within the data. it's Calculate the space between the input image and therefore the training images and Add the space to the matrix to an ordered collection and eventually Sort the ordered collection

4-SUGGESTED METHODS

In program use five features (HOG,LBP ,PCA,SURF,HAARIS) and therefore the Face Dataset in figure(1) contains 100 images of 10 subjects There are 10 images per person, one for each of the subsequent facial expressions or configurations: happy, normal. The database is split into two groups: Training image: 60 images and Testing image:40 images [13]
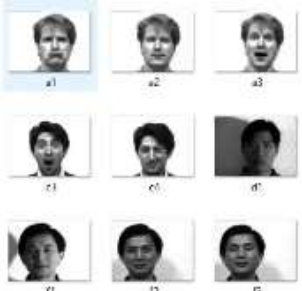
Training image	Testing image
Figure (1): examples of face date set left: the training instances. Right: test instances	

Tables 1-7 illustrate results of applying the algorithms and knn to the Image contain the results that we reached by applying all testing images to the varied techniques previously explained and as follows:

The numbers within the Results field represent the space between the image (the image on the far left) and therefore the set of images stored within the system In ascending order, because the first number is that the lowest distance, then the input image belongs to the same row because the image with rock bottom distance By applying our techniques, we concluded that HOG technology produces the simplest results compared to the remainder , with a minimal failure rate 0.15 it's worth noting that we are here, and that we explained the 4

Table (1) Result of Appling the HOG and knn algorithm to the images

Original Images	Knn Result	Class number
	0.3345	1
	0.5496	5
	0.5632	3
	0.7768	8
	0.1984	1
	0.2570	1
	0.4378	1
	0.5818	2
	0.1693	6
	0.1693	6
	0.2025	6
	0.2307	6
	0.2930	10
	0.2999	10
	0.3463	10
	0.4873	10
	0.2642	8
	0.2926	8
	0.3004	8
	0.4390	8

least distances out of 60 previously calculated results it's worth noting the red values indicate classification was wrong

Original image	hog	lbp	Hog & lbp	pcs	haaris	Surf
	0.1833	0.0144	0.1839	0.0383	1.0062 e+03	0.5019

Table (2): results of applying features extraction

Table (3): Result of Appling the HOG & LBP and knn algorithm to the images		
Original images	**Knn Result**	**Class number**
	0.1169	5
	0.1855	5
	0.2144	5
	0.4693	2
	0.4426	1
	0.4803	2
	0.5427	2
	0.5516	2
	0.2108	3
	0.2511	3
	0.3688	3
	0.4817	7
	0.1122	10
	0.1466	10
	0.1467	10
	0.2025	10
	0.2055	1
	0.3171	1
	0.4567	1
	0.5842	2

Table (4) Result of Appling the PCA and knn algorithm to the images		
Original images	**Knn Result**	**Class number**
	0.0335	8
	0.0341	5
	0.0406	8
	0.0452	2
	0.0241	1
	0.0257	9
	0.0276	9
	0.0320	3
	0.0276	4
	0.0300	8
	0.0369	1
	0.0390	2
	0.0361	6
	0.0361	6
	0.0400	2
	0.0412	10
	0.0225	3
	0.0311	7
	0.0314	3
	0.0316	9

Table (5): Result of Appling the SURF and knn algorithm to the images		
Original image	**knn Result**	**Class number**

Original image		0.0456	2
		0.0456	2
		0.0521	2
		0.0543	2
		0.0465	3
		0.0522	10
		0.0527	6
		0.0556	10
		0.0456	5
		0.0506	1
		0.0546	4
		0.0552	6
		0.0446	7
		0.0481	2
		0.0505	10
		0.0513	10
		0.0639	3
		0.0677	10
		0.0679	10
		0.0713	10

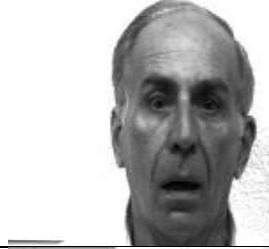**Table (6): Result of Appling the HAARIS and knn algorithm to the images**

Original image	Knn Result	Class number
	66.2900	7
	66.7471	7
	70.5472	3
	71.1709	3
	41.2203	4
	59.8064	4
	67.9009	3
	80.7470	4
	92.6191	10
	106.5871	1
	108.2326	1
	109.0022	9
	78.7452	5
	86.3292	5
	91.2397	1
	92.0062	9
	39.9925	2
	39.9925	2
	47.3705	7
	51.6270	7

Figure(2) : showing how the hog works(a.Input image on left b. result on right)

Figure(3) : showing how the lbp works(a.Input image on left b. result on right)

Figure(4):showing how the lbp &hog work(a.input image on left b.result on right)

Figure(5) : showing how the pca works(a.Input image on left b. result on right)
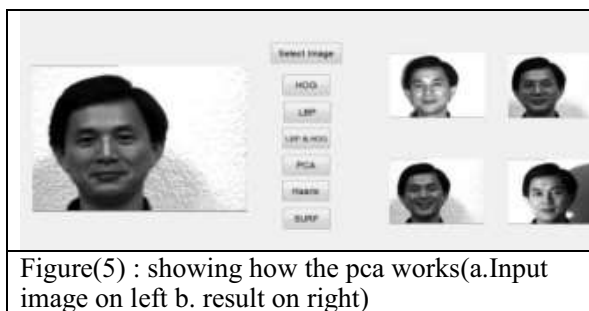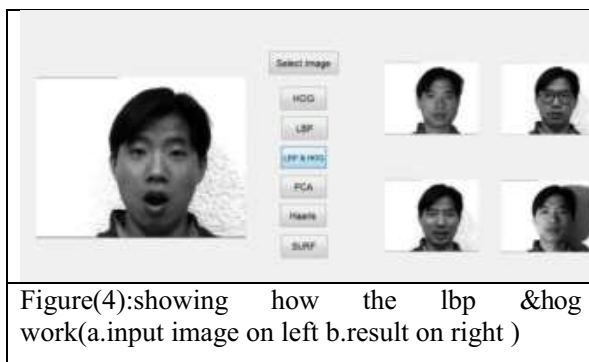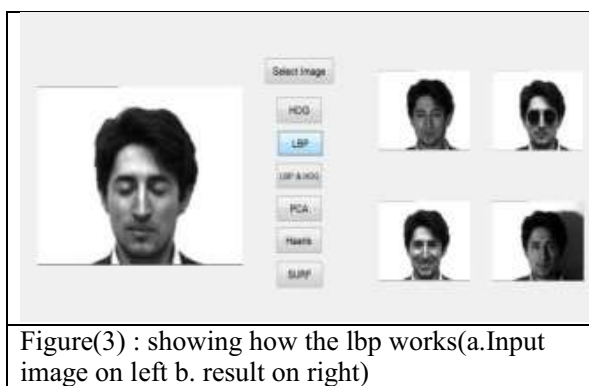
Table(7): Result of Appling the LBP and knn algorithm to the images

Original Images	Knn Result	Class number
	0.014	1
	0.0186	1
	0.0226	5
	0.0238	9
	0.024	2
	0.024	2
	0.0296	2
	0.0385	2
	0.0099	3
	0.011	3
	0.0114	3
	0.0233	7
	0.0172	1
	0.0185	1
	0.025	5
	0.027	9
	0.1032	8
	0.1654	3
	0.2244	5
	0.2456	1

Figure(6) : showing how the Haaris works(a.Input

image on left b. result on right)
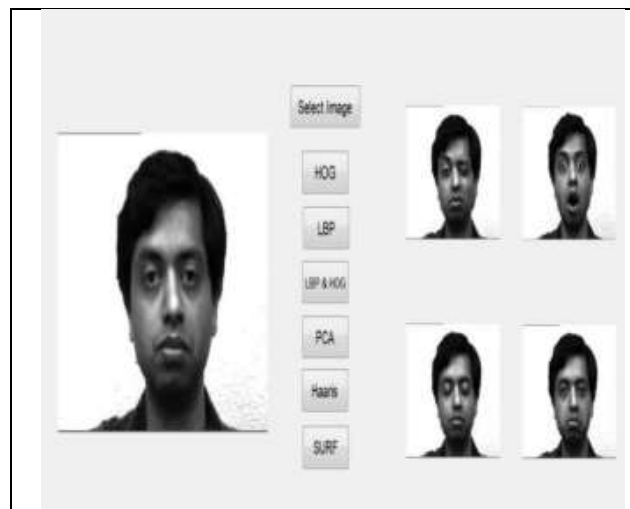
Figure(7) : showing how the surf works(a.Input
image on left b. result on right)

5- Practical experiments

These figures below illustrate the results obtained from applying the various algorithms to the images entered (far left)

Where the results should be (far right)

The same person is show in input image (same class)

Table (8) Results of Method

Methods	Correct Images	Error Image	Percentage
HOG	34	6	0.85
LBP	33	7	0.825
HOG & LBP	33	7	0.825
Harris	31	9	0.775
Surf	22	18	0.55
PCA	29	11	0.725

In Table 8 the results of the algorithms to the test image where the fields contain the output of the knn algorithm (classification), where they represent the lowest distance measured with respect to the trained images It is worth noting that the red values indicate that the classification was wrong.

6.CONCLUSION

We suggested building a high-performance, scalable, graceful and low-cost face recognition system. First, we studied more advantages of face (Image Face) by using some feature extraction techniques like (HOG,LBP,HOG&LBP,PCA,SURIF,HAARIS) Then, the KNN algorithm is applied to seek out the similarity ratio between the training image that stored within the system and testing image. Our dataset contained about 100 images (60 training images, 40 testing image) of various people and when applying the techniques, we embraced that the hog algorithm is that the most effective compared to other algorithms with a hit rate of quite 85%

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