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Face Recognition using Line Edge Map

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Abstract

As technology is advancing, the demand of face recognition is increasing day by day. In past years, many researchers had introduced different techniques and different algorithms for accurate and reliable face recognition. But so far no system / technique exists which has shown satisfactory results in all circumstances. There are some conditions where more chances of error occurs, like varying pose, different light conditions and different facial expressions. So to improve the results in these conditions, a proposed concept of an improved Line Edge Map (LEM) using Matlab has introduced and compared the results with famous recognition technique "eigenface" and with the earlier results of LEM using different algorithm. As stated above we are proposing this technique with using Matlab software, because of the ease of editing and understanding the programming of Matlab the applications of this technique is more. And as the name stated of this technique, it totally works on lines, so its processing is very fast and it also take very less memory to store databases.

Keywords: *Face recognition, Techniques, Algorithm, Conditions, Line edge map, Matlab software, Applications, Fast,lessmemory*

1. Introduction

Positive identification of individuals is a very basic societal requirement. In small tribes and villages, everyone knew and recognized everyone else. You could easily detect a stranger or identify a potential breach of security. In today's larger, more complex society, it isn't that simple. In fact, as more interactions take place electronically, it becomes even more important to have an electronic verification of a person's identity. Until recently, electronics verification took one of two forms. It was based on something the person had in their possession, like a magnetic swipe card, or something they knew, like a password (Rabia Jafri et. al, 2009). The problem is, these forms of electronic identification aren't very secure, because they can be given away, taken away, or lost and motivated people have found ways to forge or circumvent these credentials. The ultimate form of electronics verification of a person's identity is biometrics; using a physical attribute of the person to make a positive identification. Despite the fact that other methods of identification (such as fingerprints, or iris scans) can be more accurate, face recognition has always remains a major focus of research because of its non-invasive nature and because it is people's primary method of person identification (A.S Tolba et. al, 2006). This technology has a wide groups of technologies which all work with face but different scanning techniques. In many applications, like the surveillance and monitoring of a public place, the traditional biometric techniques will fail as for obvious reasons we cannot ask everyone to come and put his/her thumb on a slide or something similar. So we need a system which is similar to the human eye in some sense to identify a person. To cater this need and using the observations of human psychophysics, face recognition as a field emerged. Different approaches have been tried by several groups, working world wide, to solve this problem. Many commercial products have also found their way into the market using one or the other technique. But so far no system / technique exists which has shown satisfactory results in all circumstances.

2. Line Edge Map

Edge information is a useful representation feature that is insensitive changes to certain extent. Though the edge map is used in various pattern recognition fields (Praveen kumar et al, 2013). A suitable face feature representation, Line Edge Map (LEM), was proposed by (Gao and Leung, 2002), which extracts as features line segments from a face edge map. In which the faces were encoded into binary edge map using sobel edge detection algorithm. A line edge map approach extracts lines from a face edge map as features. This can be considered as a combination

of template matching and geometrical feature matching (Ho-chul Shin et al, 2007). LEM integrates the structural information with spatial information of a face image by grouping pixels of face edge map to line segments. After thinning the face edge map, a polygonal line fitting process known as the dynamic two strip algorithm (Leung and Yang, 1990) is applied to generate the LEM of a face.

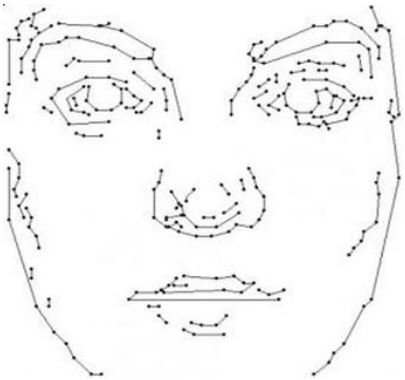

Fig.1 Line Edge Map

They also introduced the primary line segment Hausdorff distance (HpLHD) and the complete version of line segment Hausdoff distance (LHD), which they used to measure the similarity of face LEMs (M. Kirby and L. Sirovich (1990). Example of LEM is shown in fig.1. In mathematical terms, The LEM representation which records only the end points of line segments on curves, further reduces the storage requirement. Efficient coding of faces is a very important aspect in a face recognition system. LEM is also expected to be less sensitive to illumination changes due to the fact that it is an intermediate-level image representation derived from low level edge map representation. The basic unit of LEM is the line segment grouped from pixels of edge map.

3. Proposed Method

After studying the introductory LEM we have concluded that to make a LEM as shown in fig .1 we have to define more and more points to join straight line. It makes our program tuff and length and more chances of errors occurs. With the help of block diagram as shown in fig.2 we have tried to explain the proposed concept.

Firstly at the input we will give a RGB image then convert that RGB image into a grey scale image then grey scale image will be converted into binary image then using sobel edge detection convert binary image into edge detected image then invert that edge detected image and apply improved LEM algorithm on it and we will get LEM image of the input image then compare that LEM image with data base and we will get the appropriate match if available.

A thorough investigation on the proposed concept is conducted which covers all aspects on human face recognition, i.e., face recognition, under 1) varying lighting condition, 2) varying facial expression, and 3) varying pose. It is a very encouraging finding that the proposed face recognition technique has performed superior to the eigenface method in most of the comparison experiments.

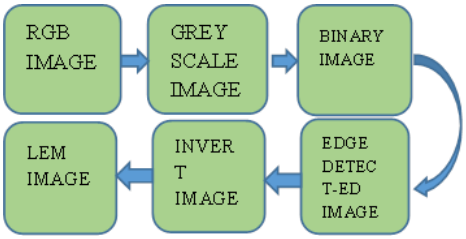

Fig.2 Block Diagram of LEM

Fig.3. RGB images

The main advantage of this algorithm is that, this algorithm is in Matlab software. So because of its understandable programming language anybody who is familiar to this can easily understand and edit it as per user requirement. Line edge maps is the **low sensitiveness** to illumination changes, because it is an intermediate-level image representation derived from low-level edge map representation. The algorithm has another important improvement, it is the **low memory requirement** technique because the kind of data used.

Many different types of LEM algorithms are available but when we make LEM from any image using those algorithms then many times it has found that, that algorithms also makes LEM of background objects and unnecessary features like hair also. So during matching

with database it takes more time and more chances of error occurs. And it also takes more memory to store databases also. So to remove these limitation also, we have introduced an improved LEM algorithm in which it will make LEM of only facial features (eyes, nose, lips and outer boundary of face) and not make any unnecessary line. It will also help in fast processing because when we have very less lines to match with data base then it will take very less time to process. And if lines will be less then chances of errors will also be less. So for advancing technology these two features plays very important role and helps to give accurate and less time consuming results as required.

Here are some examples of self-created RGB database in different light conditions and different poses are shown in fig 3 and in fig 4 there are proposed LEM images of respective RGB images.

This technique has some more pros like we do not need to resize image before recognizing any image. So we can take an arbitrary image and we can process it without resizing it. It can automatically detect facial features from the whole image. It also saves time and reducing calculations of resizing.

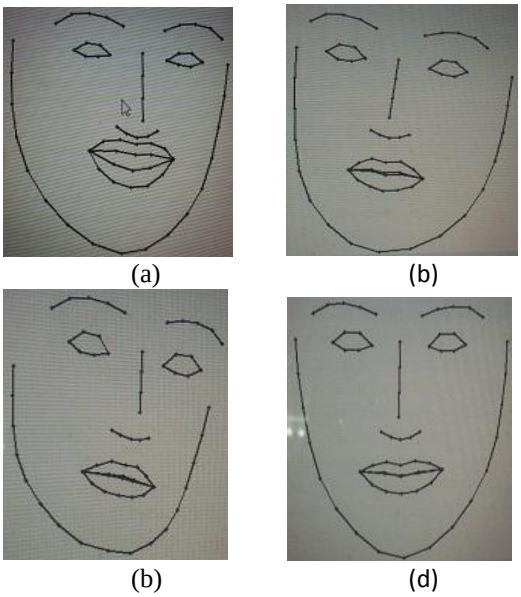

Fig.4. LEM images

It is also free of errors of poses variations and facial expressions. As shown in fig.3 some images at different poses and different facial expressions but the LEM of these images as shown in fig.4 is accurate and no line of facial feature is missing and no unnecessary line has formed by this algorithm

4. Result

We compared result of this technique with famous face recognition eigenvector technique and earlier LEM using different algorithm and we have analyzed that the result of this technique and algorithm is much better than other techniques. As shown in table.1 that algorithm is achieving higher accuracy. These results are taken on our self-created database on different images at different light conditions, varying pose and size.

Table.1 Face recognition result of eigenvector, LEM [1], proposed LEM

S.NO.	Methods	Recognition Rate (%)
1.	Eigenvector	85%
2.	LEM	89%
3.	Proposed LEM	96%

The RGB and LEM images are using in this paper is from self-created database and of size of 175x200 (width-175, height-200). But in this algorithm we can take image of any size. This algorithm is free from image size issues.

Conclusion

From the above proposed technique we have conclude that it is much better as compared to others techniques in error occurring conditions like lighting conditions, pose variations, facial expression. Our proposed LEM is exact in every conditions and achieving 96% accuracy is much higher than other techniques. And this is a less time consuming, less memory occupy and faster technique. So overall at all aspects is gives satisfactory results. And we have also concluded that, due to its less memory occupation we can use this in embedded system also like mobile banking in phone. We can use face recognition system for access instead of different password on every stage.

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