

A Comparative Analysis of Various Face Detection Algorithms

Abhinav Hans

Assistant Professor

School of Computer Science and Engineering

Lovely Professional University, Phagwara

Abhinav.21477@lpu.co.in

Prithve Kumar P, Yeshwanth

Konka

School of Computer Science and

Engineering

Lovely Professional University, Phagwara

Abstract: Over a long period of time or so, face recognition has got to be a prevalent area of study in artificial intelligence and one of the foremost fruitful applications of image analysis and understanding. [1] It is because of the nature of the issue, even the computer science analysts and neuroscientists are fascinated by it. [2] It is the common conclusion that propels the computer vision research will give valuable experiences to neuroscientists and clinicians into how human brain works etc. In order to perform this work, we need to have a set of basic rules. All the rules are put together to form algorithms. These algorithms vary from each other by various factors like complexity, time taken to execute, performance, accuracy, etc. Through this paper, we will be discussing various Algorithms and their comparative analysis used in face detection.

Introduction

This topic is one of those basic procedures that empowers such common computer-person communication is face detection. Face detection and acknowledgment moreover gets a tremendous consideration in the restorative field and research communities counting biometric, design acknowledgment and computer vision communities.[3] The field of biometrics and its innovation utilizes location and acknowledgment strategy including human body parts such as unique finger impression, palm, retina (eyes) and face. Biometrics ID strategy is not only verifies but moreover confirms the character of an individual, which is comparing to the authorized access. Face discovery is the stepping stone to the complete facial investigation calculations, counting face alignment, face modelling, face acknowledgment, head posture, face confirmation, face verification,

facial expression recognition, and more. [4] Face detection determines the existence and location of a face in an image, by separating the face from all other things present in the image. This requires

appropriate face detection algorithms.

Face detection algorithms

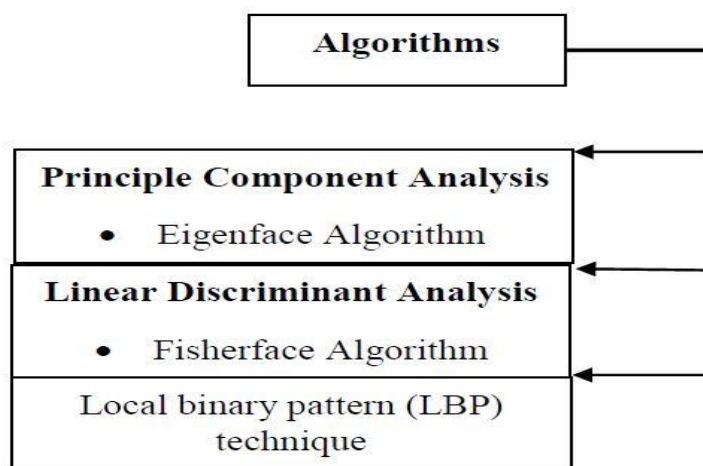


Fig: 1

This paper will contain the comparative analysis of Eigenface Algorithm, Fisherface Algorithm, and The local binary pattern (LBP) technique.

Eigenface Algorithm

The task of face prediction is segregating image data into classes of people. [4] The images are exceedingly difficult to analyse because of varying lighting conditions, the expressions, the posture etc. However the input picture is not fully arbitrary and in spite of their contrasts, there are designs which repeat in all the images. Such designs, can be watched in all images might be - within the facial confession- the nearness of few face features like eye brows, ears, and eyes in any face and their distance between them and those are called as Eigen-Faces. They can be extricated out of unique picture data by any means like numerical method called PCA. The method is

given below.

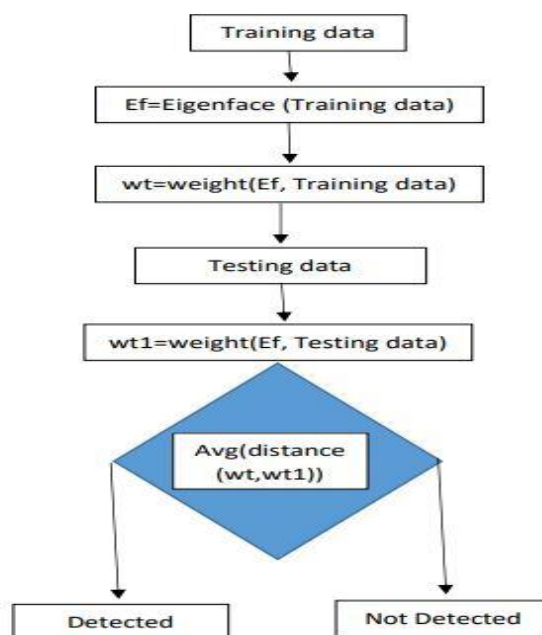


Fig: 2

[5]Advantages:

- **Acknowledgment**
is simple and productive compared to other coordinating approaches
- Raw information (images) are utilized directly to the algorithm for recognition without any data preparations like converting into Grey-scale etc.
- No information of geometry and cogitative of faces is required.

Disadvantages:

- This strategy is exceptionally sensitive to scale, hence, a low-level pre-processing is still essential for normalization
- The recognition rate diminishes for recognition beneath changing posture and brightening.

This facial feature can be extracted by employing a numerical techniques called PCA. By utilizing it, a new unique picture can be made by using the EigenFaces from the training set.

Fisherface Algorithm

In 1991, Cheng et al. presented the Straight Discriminant Examination (LDA) strategy for face recognition. This strategy tries to discover a direct subspace that maximizes the partition of two design classes according to Fisher Basis JF. This will be obtained by reducing the distance of the within class distribution matrix. Belheumeur presented the fisherface strategy for face recognition. [6] This strategy is a combination of PCA and LDA strategies. The PCA strategy is used to solve solitary issues by reducing the measurements before being utilized to perform the LDA process. The Fisherface approach is additionally one of the foremost broadly applied policies for take out the face in face pictures. This way attempts to discover the projection track wherein, pictures fit in to distinctive groups are isolated at maximum.



Fig: 3

Advantages:

- It utilizes linear projection of the images into face space, in which take the common highlights of face and find an appropriate orthogonal basis for the projection
- This algorithm is comparable to Eigenface but with development in way better in grouping of distinctive pictures.

- By using Linear Discriminant Analysis, we may classify the preparation dataset to make agreement with distinctive individuals and diverse face expressions.
- By using Fisherface get a higher accuracy in facial expression when compared to others.

Disadvantages:

- Fisherface is more complicated than Eigenface
- Need a lot of processing time.

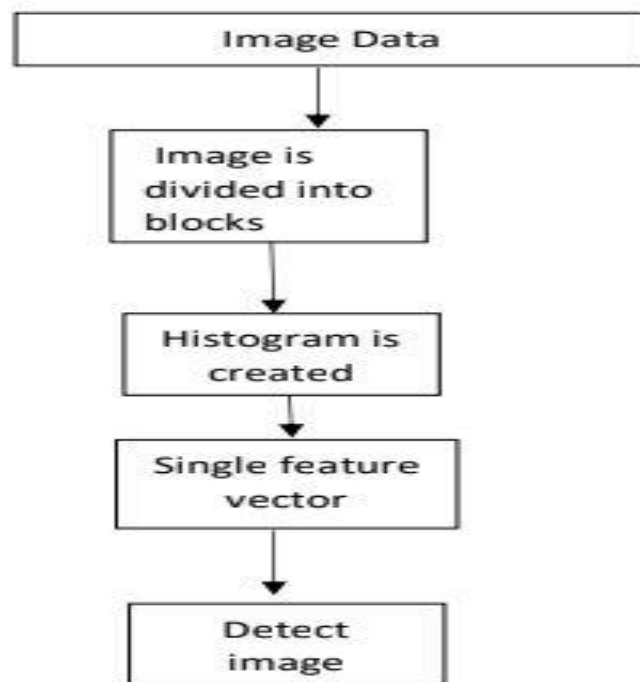
Local binary pattern (LBP)

By using LBP, the input face has to be converted into the grey scale picture and the pattern is found out by comparing the middle pixel with the neighbouring pixels. If the neighbouring pixel is less prominent than that of the middle pixel, at that point it is indicated as 0 and the reverse is true. This should be done for each and each pixel so that we are going get a pattern in binary form. [8]The local pattern is applied within the input picture in order to get the critical features of a picture .The main motive is to find the nearest pattern for each pixels of the input picture. At last, the histogram is defined to determine the likenesses of a given image.

[10]The LBP strategy is exceptionally viable to portray the picture surface features. LBP has few advantages such as high-speed computation and steady rotation, which encourages the wide utilization within the areas of picture recovery, texture examination, face acknowledgment, picture division, etc. As of late, LBP was effectively connected to the discovery of moving objects by means of background subtraction. In LBP, each pixel is allotted a surface value, which can be joined with target for tracking monotone videos. The major LBP designs are used to identify the key focuses within the target locale and after that frame a cover for joint Color-texture.

Key Points:

- Description of pixels neighbourhood
- Binary brief code to depict neighbourhood
- Works by taking contrast of middle pixel with neighbouring pixels.

Process:**Fig: 4****Advantages:**

- This method is effective to describe image texture Feature.
- Used in Texture analysis, face recognition and Image subdivision.
- Helps in detecting the moving object via Background Removal.
- It is one of the simplest methods in face detection.
- Resistance against the monotonic light changes and computational effortlessness

Disadvantages:

- Not delicate to little changes within the Face Localization.
- The LBP is using bigger neighbourhood regions which increments the errors.
- This method is not exact.
- Only utilized for binary and grey pictures

Efficiency and Accuracy of the algorithms

BASIS	EIGEN FACE	FISHER FACE	LBPH
Based on	PCA	LDA	histogram
Confidentiality	2,000	200	4
Efficiently	Low	Medium	High
Extra features in background	High	Medium	Low
Threshold	4,000	400	7

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