Computer vision is a subdomain under artificial intelligence(AI) that enables computers to observes images and infer useful information out of it.
It is very similar to human vision except the fact that humans can easily distinguish between images/ objects whereas computers need to fed algorithm,lots of data and camera to make a decision
However with the amount of data being fed not only makes it more efficient but also processes thousands of images per minute making it far more suitable than human vision
CV works on technology of deep learning and CNN which is a special type of ML , which groups together similar types of images

PREPROCESSING STEPS:
preprocessing means cleaning of data to extract useful information out of it and increase the accuracy of output and remove inconsistency
Preprocessing steps in face recognition involves rejecting an acceptable amount of non-facial windows
1]GMT(Gamma intensity correction) - It corrects the overall brightness of a face image thus the effect of varying lighting is weakened. It changes the difference between dark and light areas by changing the luminance value. The overall tone of an image can be lightened or darkened depending on the gamma value used, while maintaining the dynamic range of the image.

2]Difference of Gaussian (dog) filtering - Difference of Gaussians is a grayscale image enhancement algorithm that involves the subtraction of one blurred version of an original grayscale image from another, less blurred version of the original . As an image enhancement algorithm, the Difference of Gaussian (DOG) can be utilized to increase the visibility of edges and other detail present in a digital image. It is well suitable for processing images with a high degree of noise.

3]Histograms Equalization - It is a method in image processing of contrast adjustment using the image’s histogram. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values.

Techniques /Algorithms used for classification:
1]SVM(Support Vector Machine) :
It is a supervised learning algorithm which is used for classification as well as regression problems.
Here the types of images are separated by a hyperplane or a decision boundary .There could be multiple hyperplanes but SVM chooses the one that separates the image more effectively
Parallel lines are drawn to the hyperplane called as margins from the support vectors

The goal of the SVM algorithm is to create the best line or decision boundary that can segregate n-dimensional space into classes so that we can easily put the new data point in the correct category in the future.

2]PCA(Principal Component Analysis) :
Principal Component Analysis is an unsupervised learning algorithm used upon large number of variables for dimensionality reduction
It is used to solve the problem of overfitting. Large datasets are increasingly common and are often difficult to interpret. Principal component analysis (PCA) is a technique for reducing the dimensionality of such datasets, increasing interpretability but at the same time minimizing information loss.
Here the variables are orthogonal i.e not correlated to each other.

3]LBPH(Local Binary Pattern Histogram) :
LBPH is a face recognition algorithm which is able to recognize the face of a person from both front face and side face
All images are represented in the Matrix formats, as you can see here, which are composed of rows and columns. The basic component of an image is the pixel. An image is made up of a set of pixels. Each one of these is small squares. By placing them side by side, we can form the complete image. A single pixel is considered to be the least possible information in an image. For every image, the value of pixels ranges between 0 to 255.
This image here is 32 pixels wide and 32 pixels high.

And when we multiply 32 by 32, the result is 1024, which is the total number of pixels in the image. Each pixel is composed of Three values are R, G, and B, which are the basic colors red, green, and blue

It works on the mathematical expression of:

$$\sum_{n=0}^{7} s(i_n - i_c)2^n$$

Where i(n) is the neighbor pixel value and i(c) is the central pixel value

$$s(z) = \begin{cases} 1, & z \geq 0 \\ 0, & z < 0. \end{cases}$$

Where z =(i(n) - i(c))2*n

In this way the entire matrix then consists of 0's and 1's and then the comparison takes place

4]Eigenfaces :

This algorithm is based on the technique of PCA. Here firstly a training set of N*N images are read. The dimensionality of images are reduced and the images are resized to the dimensions of N*1. A training set of N*M dimensions are selected where M is the number of sample images. Average face is found and then subtracted from the faces in the training set and a matrix A is created

$$\boldsymbol{\psi} = \frac{1}{M} \sum_{i=1}^{M} \boldsymbol{\Gamma_i}$$

where $\boldsymbol{\psi}$: average image, M: number of images, $\boldsymbol{\Gamma_i}$: image vector.

$$\boldsymbol{\phi_i} = \boldsymbol{\Gamma_i} - \boldsymbol{\psi}, \quad i = 1, 2, \ldots, M$$

where $\boldsymbol{\phi_i}$ is the difference between the image and the average image.

The matrix obtained by the subtraction operation (A) is multiplied by its transpose and thus covariance matrix C is formed:

Where A is :

$$A = [\phi_1, \phi_2, \ldots, \phi_M]$$

Covariance matrix:

$$C = A^T A$$

The dimensions of the matrix C is N*N. M images are used to form C. In practice, the dimensions of C is N*M. On the other hand, since the rank of A is M, only M out of N eigenvectors are nonzero. The eigenvalues of the covariance matrix is calculated. The distance between image and the eigenfaces is calculated and the output is selected whose euclidiean distance is minimum or the image is unrecognizable.

CONCLUSION :

The Eigenfaces, Fisherfaces and LBPH algorithms have several advantages over other face recognition ,they are easy to implement and most widely used , they demonstrate more stable performance on small dataset. However Eigenface had the lowest performance in terms of accuracy i.e just 86.6% whereas LBPH had the best performance in terms of accuracy. LBPH is one of the easiest face recognition algorithms. It can represent local features in the images. Hence LBPH is more suitable algorithm than the others for facial recognition