Face Detection Using Python

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- **Abstract**:

The objective of the project is to detect human face in an image using python. This helps in detecting human faces in a virtual or a digital image. Our main objective is to detect human face in an image using methods like coordinates of the face in the image, depending on different areas covered by the number of the coordinates, and number faces that will be computed. Here our aim is to get the number faces in the image and not their features. The program begins with importing all the required libraries such as OpenCV which is mostly use for image processing, facial recognition and detection, then we import Dlib library which is used for detecting the coordinates of the facial structure of the face, and we also import Numpy library for a in the it's a huge high-performance multidimensional array object and tools for working with these arrays. To count faces we capture frames continuously. We then use an iterator to get the coordinates of the facial structure in the frame and then each time a face is detected a box is being plotted around the face along with it's face count.

Keywords:
Words;Random;Time;clues
Hangman;Kinter.

I.INTRODUCTION

Face detection, also called facial detection, is an artificial intelligence (AI)-based computer technology used to find and identify human faces in digital images and video. Face detection technology is often used for surveillance and tracking of people in real time. It is used in various fields including security, biometrics, law enforcement, entertainment and social media.

Face detection uses machine learning (ML) and artificial neural network (ANN) technology, and plays an important role in face tracking, face analysis and facial recognition. In face analysis, face detection uses facial expressions to identify which parts of an image or video should be focused on to determine age, gender and emotions. In a facial recognition system, face detection data is required to generate a faceprint and match it with other stored faceprints. The detection of human faces is a difficult computer vision problem. Mainly because the human face is a dynamic object and has a high degree of variability in its appearance. In recent years, facial recognition techniques have achieved significant progress. However, high-performance face detection remains a challenging problem, especially when there are many tiny faces

II. LITERATURE REVIEW

This section gives an overview on the major human face recognition techniques that apply mostly to frontal faces, advantages and disadvantages of each method are also given. The methods considered are eigenfaces (eigenfeatures), neural networks, dynamic link architecture, hidden Markov model, geometrical feature matching, and template matching. The approaches are analyzed in terms of the facial representations they used.

A. Eigenfaces Eigenface is one of the most thoroughly investigated approaches to face recognition. It is also known as Karhunen-Loève expansion, eigenpicture, eigenvector, and principal component. References [26,27] used principal component analysis to efficiently represent pictures of faces. They argued that any face images could be approximately reconstructed by a small collection of weights for each face and a standard face picture (eigenpicture). The weights describing each face are obtained by projecting the face image onto the eigenpicture. Reference [28] used eigenfaces, which was motivated by the technique of Kirby and Sirovich, for face detection and identification. In mathematical terms, eigenfaces are the principal components of the distribution of faces, or the eigenvectors of the covariance matrix of the set of face images. The eigenvectors are ordered to represent different amounts of the variation, respectively, among the faces. Each face can be represented exactly by a linear combination of the eigenfaces. It can also be approximated using only the "best" eigenvectors with the largest eigenvalues. The best M eigenfaces construct an M dimensional space, i.e., the "face space". The authors reported 96 percent, 85 percent, and 64 percent correct classifications averaged over lighting, orientation, and size variations, respectively. Their database contained 2,500 images of 16 individuals. As the images include a large quantity of background area, the above results are influenced by background. The authors explained the robust performance of the system under different lighting conditions by significant correlation between images with changes in illumination. However, [29] showed that the correlation between images of the whole faces is not efficient for satisfactory recognition performance. Illumination normalization [27] is usually necessary for the eigenfaces approach. Reference [30] proposed a new method to compute the covariance matrix using three images each was taken in different lighting conditions to account for arbitrary illumination effects, if the object is Lambertian. Reference [31] extended their early work on eigenface to eigenfeatures corresponding to face components, such as eyes, nose, and mouth. They used a modular eigenspace which was composed of the above eigenfeatures (i.e., eigeneyes, eigennose, and eigenmouth). This method would be less sensitive to appearance changes than the standard eigenface method. The system achieved a recognition rate of 95 percent on the FERET database of 7,562 images of approximately 3,000 individuals. In summary, eigenface appears as a fast, simple, and practical method. However, in general, it does not provide invariance over changes in scale and lighting conditions. Recently, in [32] experiments with ear and face recognition, using the standard principal component analysis approach , showed that the recognition performance is essentially identical using ear images or face images and combining the two for multimodal recognition results in a statistically significant performance improvement. For example, the difference in the rank-one recognition rate for the day variation experiment using the 197-image training sets is International Journal.

III. PROBLEM STATEMENT

Facial detection systems can be impacted by poor lighting or low image quality. The data may not match up with the person's nodal points because of camera angles being obscured; this creates an error when matching faceprints cannot be verified in the database.

IV. METHODOLOGY

Face detection software uses several different methods, each with advantages and disadvantages:

Viola-Jones algorithm. This method is based on training a model to understand what is and isn't a face. Although the framework is still popular for recognizing faces in real-time applications, it has problems identifying faces that are covered or not properly oriented.

Knowledge- or rule-based. These approaches describe a face based on rules. Establishing well-defined, knowledge-based rules can be a challenge, however.

Feature-based or feature-invariant. These methods use features such as a person's eyes or nose to detect a face. They can be negatively affected by noise and light.

Template matching. This method is based on comparing images with previously stored standard face patterns or features and correlating the two to detect a face. However, this approach struggles to address variations in pose, scale and shape.

Appearance-based. This method uses statistical analysis and ML to find the relevant characteristics of face images. The appearance-based method can struggle with changes in lighting and orientation.

Convolutional neural network-based. A convolutional neural network (CNN) is a type of deep learning ANN used in image recognition and processing that's designed to process pixel data. A region-based CNN, also called an R-CNN, generates proposals on a CNN framework that
localizes and classifies objects in images. These proposals focus on areas, or regions, in a photo that are similar to other areas, such as the pixelated region of an eye. If this region of the eye matches up with other regions of the eye, then the R-CNN knows it has found a match. However, CNNs can become so complex that they "overfit," which means they match regions of noise in the training data and not the intended patterns of facial features.

Single shot detector (SSD). While region proposal network-based approaches such as R-CNN need two camera shots -- one for generating region proposals and one for detecting the object of each proposal -- SSDs only require one shot to detect multiple objects within the image. Therefore, SSDs are faster than R-CNN. However, SSDs have difficulty detecting small faces or faces farther away from the camera.
Some techniques used in face detection applications include the following:

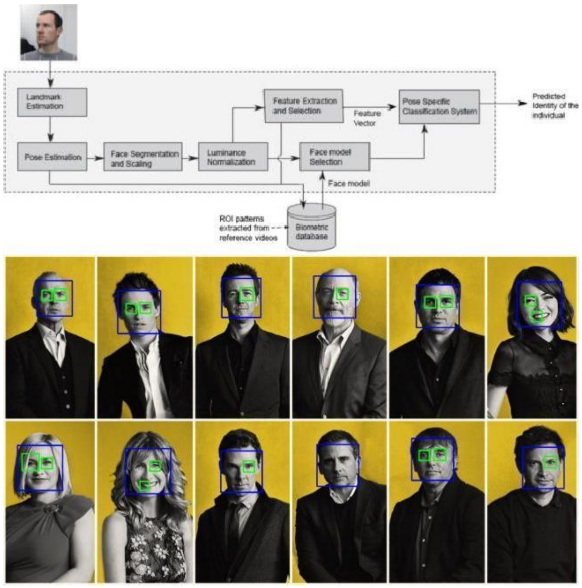
Background removal. If an image has a plain, mono-color background or a predefined, static one, removing the background can reveal the face boundaries.
Skin color. In color images, skin color can sometimes be used to find faces; however, this might not work with all complexions.
Motion. Using motion to find faces is another option. In real-time video, a face is almost always moving, so users of this method must calculate the moving area. One drawback of this approach is the risk of confusion with other objects moving in the background.
A combination of these strategies can provide a comprehensive face detection method.

V. EXPERIMENTAL RESULTS

Most of the presented researches have accuracies over 90% on public available datasets, but different challenges are still acknowledged regarding real-world facial recognition, training the algorithms toreplicate human behavior and large scale adoption in the industry. Different approaches are presented in References [15,16], where fuzzy algorithms perform a rotation invariant face recognition based on symmetrical facial characteristics. The main advantage is that the algorithms can be used on smart TVs (Television sets) with low processing power to recognize the viewer and offer proper content and services accordingly. ...

... The main advantage is that the algorithms can be used on smart TVs (Television sets) with low processing power to recognize the viewer and offer proper content and services accordingly. The algorithm presented in Reference [16] is an enhanced version of the one in Reference [15], with an increase in accuracy. The presence of cosmetics and contact lenses adds challenges to face detection for biometric purposes.

ARCHITECTURE



VI. CONCLUSION

In conclusion, now the world becomes more and more better because of the advance in science and technology, so face recognition isslowly recognized by people, and we also began to use it in different fields. Face recognition is the use of human facial featuresto complete identification.

VII. FUTURE WORK

Facial detection solutions are expected to be present in 1.3 billion devices by 2024. Powered by AI, facialrecognition software in mobile phones is already being used by companies like iProov and Mastercard to authenticate payments and other high-end authentication tasks. Such uses will increase as we move into 2022 and beyond.

Around the home, security systems are also turning tofacial detection n to both improve security in and around the home and also to improve access and create a more seamless experience. Especially when deployed in smart home or building developments.

Companies like Netatmo, Netgear, Honeywell and Ooma have home security systems with facial detection on incorporated, helping to identify people when they arrive at your home as well as detecting potential intruders when you are away from the home.

Honeywell has partnered with Amazon’s Alexa to offer a great solution for those looking to create a smarter home.

Taking things one step further, Google Nest Cam IQwatches over your property 24/7 and can detect people from a distance of 50m away. The system can recognise familiar faces and you can pre-set actions for those visitors such as opening a gate or front door.

While facial detection is undoubtedly changing the world in which we live, that world is also changing the way facial detection is being deployed around theworld.

VIII. REFERENCES

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