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IMAGE RECOGNITION AND IDENTIFICATION USING MACHINE LEARNING

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Abstract - Face recognition has been a rapidly growing and intriguing region progressively applications. A huge number of face recognition calculation have been produced in a long time ago. In this paper, for face detection we are using HOG (Histogram of oriented Gradient) based face detector which gives more accurate results rather than other machine learning algorithms like Haar Cascade. In recognition process we are using CLAHE (Contrast Limited Adaptive Histogram equalization) for pre-processing than we are using HOG which is a standard technique for features extraction. HOG features are extracted for the test image and also for the training images. And finally for classification we are using SVM (support vector machine). SVM will classify the HOG features. Pre-processing technique is use to remove the noise, contrast enhancement, and illumination equalization. The result of this paper show the liability and productiveness in better face recognition performance.

Key Words: Face detection, Face recognition, Machine Learning, Support Vector Machine, CLAHE.

I Introduction

Today's pandemic situation has transformed the way of educating a student. Education is undertaken remotely through online platforms. In addition to the way the online course contents and online teaching, it has also changed the way of assessments. In online education, monitoring the attendance of the students is very important as the presence of students is part of a good assessment for teaching and learning. Educational institutions have adopting online examination portals for the assessments of the students. These portals make use of face recognition techniques to monitor the activities of the students and identify the malpractice done by them. This is done by capturing the students' activities through a web camera and analysing their gestures and postures.

IMAGE face recognition is an important area of research in in computer vision. It is easy for humans to detect and recognize face in images, but not for machines. There are several techniques in machine learning to detect and recognize a face. Human face consists of multidimensional structure and required a quality computing technique for recognition. To identify a faces in images, there are several things to look as a pattern, such as height, color of the faces, width of other parts of the face like lips, nose,

eyes, etc. Clearly, there is a pattern, different faces have different dimensions, and similar faces have similar dimensions.

Face recognition has become a popular topic of research recently due to increases in demand for security as well as the rapid development of mobile devices. There are many applications which face recognition can be applied to such as access control, identity verification, security systems, surveillance systems, and social media networks.

The improvement of e-learning and online evaluation frameworks is increasing rapidly. The Main Goal is to develop a model which is intended to distinguish the ordinary examples for activities of concern, for example, conversations during a test or the pivoting, processes more exactness and computes more accuracy. Certain presumptions about normal behaviour with regards to delegating tests are made. In the existing system, it takes more computational power and speed is less.

II Machine Learning

In the real world, we are surrounded by humans who can learn everything from their experiences with their learning capability, and we have computers or machines which work on our instructions. But can a machine also learn from experiences or past data like a human does? So here comes the role of Machine Learning.

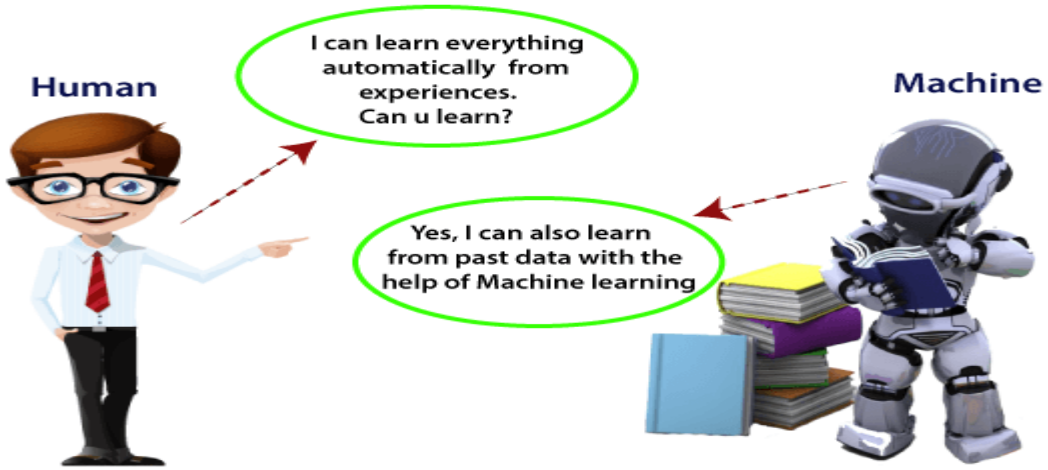


Figure 1: Machine Learning

2.1 Block Diagram of Machine Learning

A machine learning system builds prediction models, learns from previous data, and predicts the output of new data whenever it receives it. The amount of data helps to build a better model that accurately predicts the output, which in turn affects the accuracy of the predicted output.

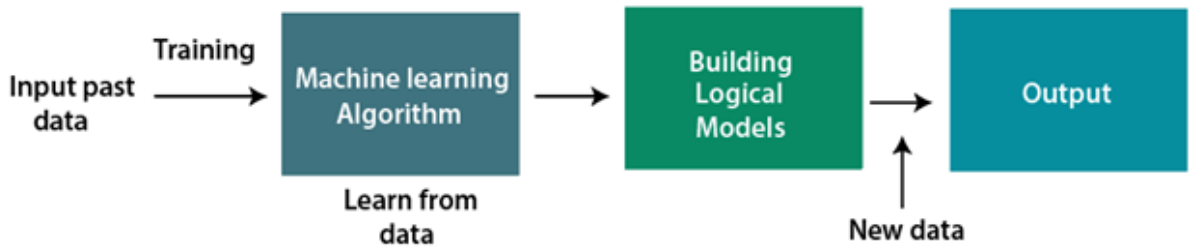


Figure 2 : Block Diagram of Machine Learning

III Face Recognition

Face recognition is a rapidly growing field in machine learning, and it has a wide range of applications in various industries. From security and surveillance to entertainment and social media, face recognition technology can revolutionize how we interact with technology. Face recognition is an identification method that uses the individual's face's distinctive features to identify them. The majority of facial recognition systems operate by matching the face print to a database of recognizable faces.

The technology has become increasingly popular in a wide variety of applications such as unlocking a smartphone, unlocking doors, passport authentication, security systems, medical applications, and so on. There are even models that can detect emotions from facial expressions.

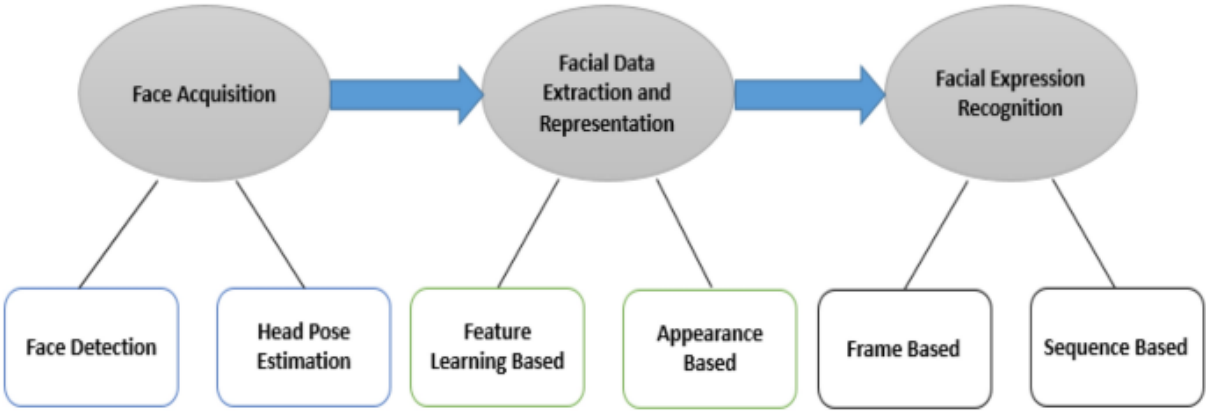


Figure 3: Process of Face Recognition

3.1 Face Recognition Operations

The technology system may vary when it comes to facial recognition. Different software applies different methods and means to achieve face recognition. The stepwise method is as follows:

- ***Face Detection:*** To begin with, the camera will detect and recognize a face. The face can be best detected when the person is looking directly at the camera as it makes it easy for facial recognition.

With the advancements in technology, this is improved where the face can be detected with slight variation in their posture of face facing the camera.

- ***Face Analysis:*** Then the photo of the face is captured and analyzed. Most facial recognition relies on 2D images rather than 3D because it is more convenient to match to the database. Facial recognition software will analyze the distance between your eyes or the shape of your cheekbones.
- ***Image to Data Conversion:*** Now it is converted to a mathematical formula and these facial features become numbers. This numerical code is known as a face print. The way every person has a unique fingerprint, in the same way, they have unique face prints.
- ***Match Finding:*** Then the code is compared against a database of other face prints. This database has photos with identification that can be compared. The technology then identifies a match for your exact features in the provided database. It returns with the match and attached information such as name and address or it depends on the information saved in the database of an individual.

3.2 Face Detection

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.

3.2.1 Face Detection Methods

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.

IV Research Method

4.1 Face Recognition

Face detection is the process of recognizing the shape of facial images in humans through matching existing faces such as curvature textures with digital images stored in a database. Face recognition is a computer vision technology in the field of biometrics that is used to recognize a person from a digital image or video. Facial recognition is a more versatile biometric technology than other options, which can be used in cases involving multiple people at once, such as in the case of a missing persons.

4.2 Machine Learning

Machine learning is artificial intelligence that is implanted in the system with a focus on development to be able to learn automatically without having to be programmed by humans. Machine learning consists of algorithms and statistical models that computer systems use to perform specific tasks by relying on patterns built from mathematical models based on data or samples from the training process. Several important terms need to be known in learning machine learning, namely dataset, training, validation, and testing. A dataset is a collection of samples used to create and evaluate machine learning models. Training is a term for a data set used for training a model. Validation is a collection of data that can be used to optimize the model while the training process is being carried out. Testing is a term for a set of data used to test a trained model.

4.3 Support Vector Machine

SVM was developed by Boser, Guyon, and Vapnik in 1992 and is a machine learning data classification technique that is guided through a training process called supervised learning. This algorithm compares the candidate set of a standard parameter of discrete values. SVM defines the boundary between two classes with the maximum distance from the closest data. SVM is usually used to solve prediction cases, both classification, and regression cases. SVM consists of a training and testing process to test how accurate the learning process and the resulting model.

V PROPOSED SYSTEM

The facial recognition system can be built using two steps. The first step is a process through which the facial features are picked up or extracted, and the second step is pattern classification. The fig.5.1. Represents our face recognition system which shows all process and steps involved.

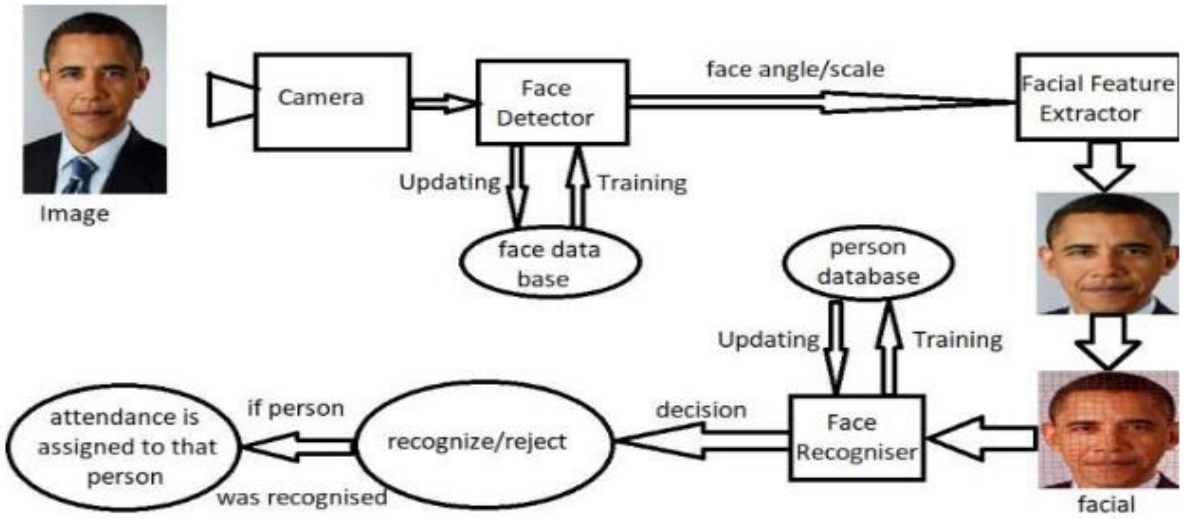
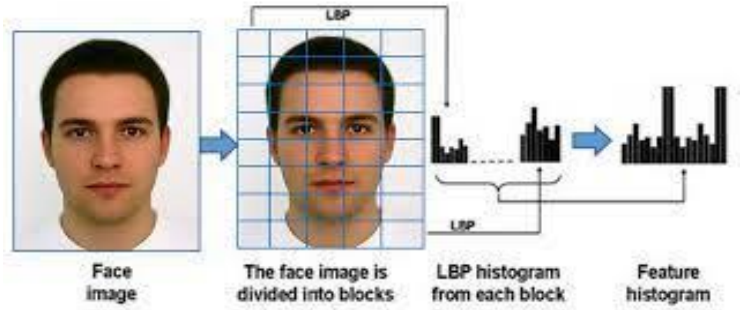


Figure 5 : System Architecture

5.1 Local Binary Pattern Histogram

For the input image given, this algorithm generates a replacement histogram and compares it with other generated histograms. Fig2.2 shows working of LBPH. For the histogram faces recognize, a 3X3 window move it one image, at each move of each local part of an image, the center pixel will compare with its neighbor pixels. 1 is denoted as the neighbor pixels intensity value is less than or equal to center pixel and 0 is denoted for others. Then, in the 3X3 window, read values 0 or 1 in clockwise sequence to produce a binary pattern, such as 11000011, which is local to a specific part of the image. We will have



an inventory of local binary patterns after performing the recognized on whole image.

Figure 5.1: Local Binary Histogram

5.2 Convolutional Layer

This layer is the first layer that is used to extract the various features from the input images. In this layer, the mathematical operation of convolution is performed between the input image and a filter of a particular size MxM. By sliding the filter over the input image, the dot product is taken between the filter and the parts of the input image with respect to the size of the filter (MxM).

The output is termed as the Feature map which gives us information about the image such as the corners and edges. Later, this feature map is fed to other layers to learn several other features of the input image.

The convolution layer in CNN passes the result to the next layer once applying the convolution operation in the input. Convolutional layers in CNN benefit a lot as they ensure the spatial relationship between the pixels is intact.

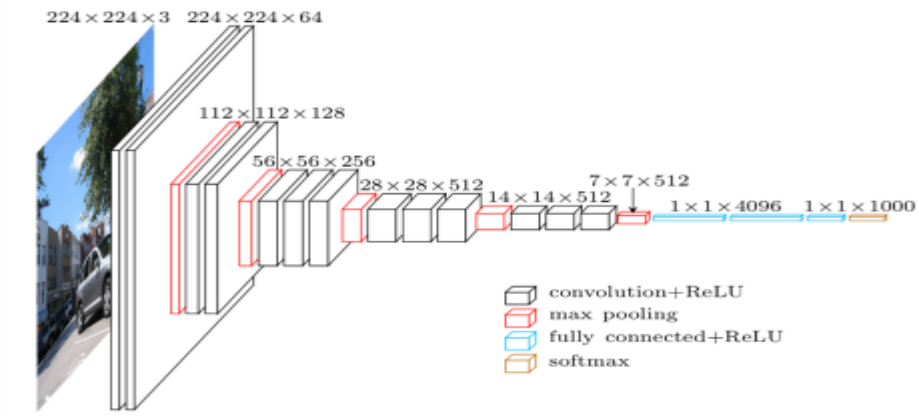


Figure 5.2 .: Convolutional Neutral Network Layer

5.3 Registration User Interface

The users can register with the system using a graphical user interface shown in Fig-5.3. Here users will have to feed in required details such as Student name, password. The students are supposed to enter all the required details in the GUI interface manually. After registering student can mark their attendance in and out.

Fig 5.3 . System GUI

5.4 Add Photos

After clicking on add photos button as shown in Fig 4.2, the web cam opens automatically and window pops up and starts detecting the faces in the frame. The faces are detected by a green color box which outlines the face.

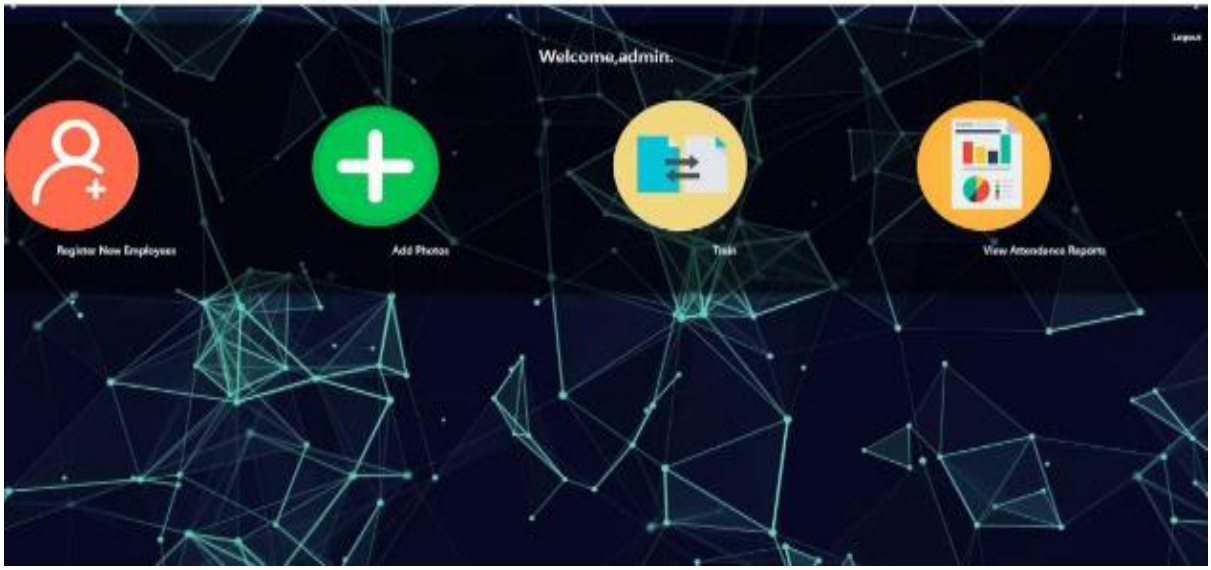


Figure 5.4: Add photos (screen pops up and starts detecting the faces

5.5 Result

The face recognition window will be shown where registered students are recognized by showing their Name in case they were not registered it would have shown ‘unknown’. By pressing CTRL+Q, the window will be closed and attendance will be updated in the excel sheet.

6. Conclusion

In this paper, a new deep learning based face recognition attendance system is proposed. the whole procedure of developing a face recognition component by combining state- of-the-art methods and advances in deep learning is described. it's determined that with the smaller number of face images together with the proposed method of augmentation high accuracy are often achieved, 95.02% in overall.

These results are enabling further research for the aim of obtaining even higher accuracy on smaller datasets, which is crucial for creating this solution production-ready. the long run work could involve exploring new augmentation processes and exploiting newly gathered images in runtime for automatic retraining of the embedding CNN. one in all the unexplored areas of this research is that the analysis of additional solutions for classifying face embedding vectors. Developing a specialized classifying solution for this task could potentially result in achieving higher accuracy on a smaller dataset. This deep learning based solution doesn't rely upon GPU in runtime. Thus, it may be applicable in many

other systems as a main or a side component that would run on a less expensive and low-capacity hardware, at the same time as a general-purpose Internet of things (IoT) device.

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