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One-Shot Multiple Face Recognition for Real-Time Attendance Monitoring

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ABSTRACT: Attendance Tracking of all associations is crucial. Over a short period of time, the attendance management system has changed significantly from the handbooks to intelligent hi-tech monitoring systems such as the usage of RFID and fingerprint identification. These methods are, however, queue-based that may take longer time. Face recognition is an easy, safe and less time-consuming tool which can also be used in numerous applications, such as door control, video surveillance, safety networks and human computer interactions. We propose a One-Shot Multiple Face Recognition for Real-Time Attendance in this chapter. With the help of a database of student information, you can keep track of what's going on. In this we capture the class image through CCTV in real time and identify multiple students faces and record the attendance automatically. The goal of this chapter is to evaluate and compare various face detection and recognition methods or Neural Networks like HOG, CNN, MTCNN, YOLOV3, YoloV4 to achieve the maximum possible accuracy and response rate along with recognition of individuals faces. The proposal faces many challenges in real time environment to recognize persons such as poor lighting, low picture resolution and sub-optimal viewing, face size and location. Detecting and then recognize small number of faces may feel easier but when there are many human faces together it is challenging. In addition, keeping a database with a large number of student records adds to the complexity of this system. This article also provides the literature review as well as supports conversation and proposal for future work.

KEYWORDS: Face Recognition, HOG, CNN, MTCNN, YOLO

I. INTRODUCTION

The regularity of attendance presently concerns organizations (educational or otherwise). Employees/students' total performance is largely affected by their knowledge and presence at their premises. For instance, applications like biometric authentication and recognition, face mask detection (especially during the COVID-20 pandemic) are crucial and crucial in the implementation and management of the e-attendance system with the continuous research and development in the field of pattern recognition and the computer vision.

Face Recognition is one of the simplest methods for determining each other's individual identities. Face recognition in humans is divided into two phases: face detection and face recognition. Face detection occurs relatively quickly in humans, unless in rare circumstances. where the object is located at a short distance away, the next is the introduction, which recognize a face as individuals. Face detection has many advantages like, capturing the movement of the face, size, orientation, illumination etc. Also, to recognize as it also requires the face to be detected correctly.

This paper highlights the comparative analysis of different algorithms/networks for face detection and recognition. With this, the system can recognize face and record attendance from that individual so that attendance taking is more efficient and faster. High precision image classification can also be made possible with progress in convolutional networks. Small scale level information is vital, which different types of face detection methods cannot provide. This system provides a hassle-free environment, feasible access to every student and teacher in their Attendance Sheet.

The paper's organizing is done as follows: Section 2 discusses the currently present techniques, analysis of previous research associated with our proposed methodology. The associated research is defined as a base for our approach. Section 3 presents models of computation and theoretical tools we adopted to take attendance in Real-Time. Experimental results and also the comparative analysis of varied algorithms is shown in Section 4. Section 5 has Conclusions of the outcomes obtained by using our work.

II. RELATED WORK

Many existing methods of Face Recognition construct robust features that are, at the same time distinctive, and as robust as possible to describe a person in a variety of settings, some extensive survey and research s have been developed since then. we briefly introduce some research in the context of the proposed model done in field of Face recognition and Attendance monitoring.

Shubham Kadam and Sagar Khedkar published a review paper on [1] Contactless Attendance System based on Face Recognition at International Research Journal of Engineering and Technology. In this paper they have reviewed over 16 different research papers related to face detection, recognition and its applications. Starting from Euclidean distances calculated by three face recognition procedures, PCA algorithms, LBPH algorithm, DRLBP algorithm to Convolution Neural Networks (CNN). The results show that Haar Cascade is more preferable in all papers concentrated as it gives higher detection rate whereas LBPH overcomes different algorithms with a great recognition rate.

Eze Peter U., Joe-Uzuegbu C. K. A, Laz Uzoechi and Opara F.K wrote a research paper on Biometric-based Attendance System with Remote Real-time Monitoring[2] for Tertiary Institutions in Developing Countries. This paper was published in 2013 IEEE International Conference on Emerging & Sustainable Technologies for Power & ICT in a Developing Society (NIGERCON). In this paper the authors have used a real time monitoring system for detection and recognition of an individual for user authentication. But the cost of the proposed system was too high.

Mayank Srivastava, Amit Kumar, Aditya Dixit and Aman Kumar have researched on Real Time Attendance System Using Face Recognition Technique[3]. The proposed system uses the OpenCV algorithm and the Haar Cascades Algorithm[4] . This system consists of 5 stages i.e.

- i. Connect with the installed camera and start playing.
- ii. Load the Haar Classifier Cascade files for frontal face.
- iii. Initiate the Paul-Viola Face extracting Frame work.
- iv. Start the Haar Cascade Algorithm.
- v. It compares the input face with the trained faces.

This system achieved around 90% accuracy. But totally fails to detect and recognize side angle faces and multiple faces in real time.

Sarker Y., Fahim S. R, Sarker S. K., Badal F. R., Das S. K., & Mondal M. N. I. have published a paper at the 2019 IEEE International Conference on Robotics, Automation, Artificial-Intelligence and Internet-of-Things (RAAICON) and the name of the paper was “A Multidimensional Pixel-wise Convolutional Neural Network for Hyperspectral Image Classification”[5]. This paper has proposed a multidimensional pixel-wise convolutional neural network (MPCNN) to extract spatial and spectral-spatial information from the hyperspectral image(HSI). The positives from the proposed MPCNN is measured by the recognition of the objects as spatial or spectral-spatial and it is compared with different traditional CNN methods. The conclusion says that the proposed MPCNN algorithm is highly accurate with the highest accuracy around 99.09%, whereas the MS-CLBP method is 91.51% accurate.

III. METHODOLOGY

The proposed methodology focuses on developing an efficient system to Recognize the person in office or college to take attendance in Real-Time as shown in Figure 1. System takes video as the input and extracts frames to detect multiple people in the environment. By applying Various Deep learning Architecture like HOG, MTCNN and YOLO, systems extract features from faces. Then, it compares facial features with known faces in the database and create the attendance report automatically.

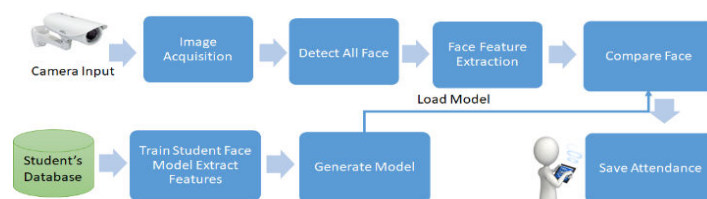


Figure 1: System Design

We have compared the working of three deep learning methods based on various parameters such as performance measure, accuracy, processing time, speed, side face detection and illumination conditions in Real-Time environment, which are as follows:

Method-1 Histogram of Oriented Gradient(HOG):

A HOG is a type of feature descriptor program which is usually used for object detection. We have given some sample faces to the algorithm, which is basically HOG itself.

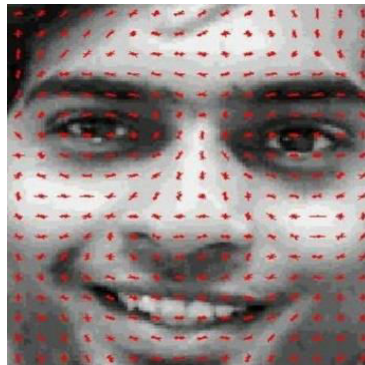


Figure.2HOGFeaturesampleface

The descriptors are a form of vectors which are gradient in nature generated per pixel of the image as shown in figure 2.We have implemented the Hog algorithm in our recent study which helped us to detect faces of different students.This algorithm helped us to accurately detect our faces without any errors.This algorithm restates on the property of objects within a picture to possess the distribution process of an intensity gradient. Gradients are basically calculated in the form of image per block as shown in figure 3.

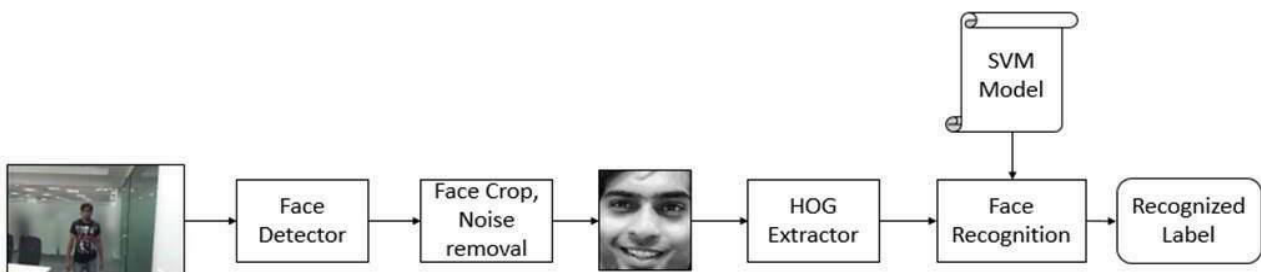


Figure.3 Block diagram of the face recognition process

Method-2 Multi-task Cascaded Convolutional Neural Networks (MTCNN):

MTCNN which is also known as the best algorithm to work with , is an algorithm consisting of three stages. Each stage has the capacity to improve the detection of the results by passing the inputs through CNN, which returns the bounding boxes with their points, which is then followed by non max suppression. In stage 1, the input image size is reduced multiple times to create a single picture pyramid and every scaled version of the image is skilled CNN.In stage 2 and 3, the bounding boxes are resized and forwarded to CNN.MTCNN is one among the foremost popular and most accurate face detection tools today.

Method-3 You Only Look Once (YOLOv4)

YOLOv4 is an object recognition system that recognises numerous items and faces in a single image in real time.YOLO recognizes objects very accurately and faster than other recognition systems available. This real-time recognition system i.e., YOLOv4 will recognize multiple objects from a picture and also make a boundary box round the object.It is often easily trained and deployed during a production system.One Convolutional Neural Network underpins YOLO (CNN). The CNN splits an image into many parts before concurrently predicting the border boxes and probabilities for each area.It predicts multiple bounding boxes and the values for those classes. During training and testing, YOLO observes the image and records contextual information about the lessons.YOLOV4 Working is shown in Figure 4.

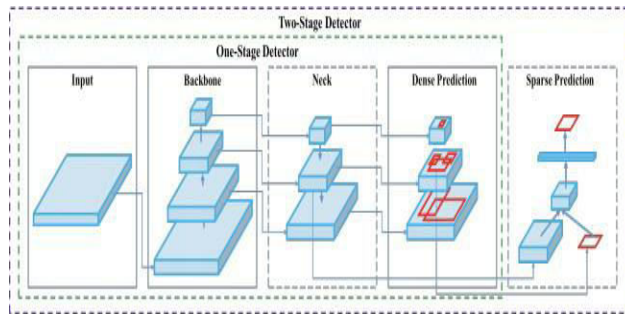


Figure.4 The Anatomy of an Object Detector

YoloV4 is a important improvement of YoloV3, the implementation of a replacement architecture within the Backbone and therefore the modifications within the Neck have improved the mAP(mean Average Precision) by 10% and the number of FPS by 12%.

IV. EXPERIMENTAL RESULTS

The proposed methodology was implemented on a system that had an Intel i3 processor running with 4GB RAM.



Figure.5 Person Re-identification in HOG

Results of HOG method is shown in Figure.5, which we took dataset of 30 to 40 human faces. In this implementation, we detected as well as recognized the human face and the recognized face attendance along with the time gets stored in the Excel sheet. But this technique was not able to detect more than two faces, Side angle faces were not detected in this method. Not applicable for large dataset. Some faces were detected but the identification was done wrong. The next method tested to detect multiple faces was YOLOv4. The YOLOV4 model was prepared on TensorFlow with conda environment. The following images were taken during faculty photoshoot and normal live lecture. Proposed methodology detect faces in special cases like invariant head-pose, under dim light or face covered by objects like eye-glasses, illumination, and lightening changes and Occlusion where the partial face is covered by hands. The results of YOLOv4 are shown in Figure 6,7,8 and 9.



Figure.6: Detected 19 faces



Figure.7: Detected 25 faces



Figure.8: Detected 41 faces



Figure.9 Detected all faces

These were the outputs in which we detected multiple faces using YOLOv4 which provide the accuracy of 94.667%. The challenges faced by the YOLOv4 model in Real-Time is, as the faces at the back were small, tiny and blurry. Our model was not able to detect that, only front faces are detected. As shown in figure.9 out of 100 faces, 41 faces were detected.

V. CONCLUSION

The project's computational models were chosen after much research, and the good testing results demonstrate that the selections were sound. Because of the large number of faces utilised in the transformation, the system with automated face recognition has a recognition accuracy of above 95%. In this experimental research, the system was tested in a range of scenarios, and real-world performance is likely to be far more accurate. The fully automatic front view face detection system displayed accuracy which was expected in our results. There is still need for more research in this discipline because it is such a broad subject. To make the procedure faster and easier, a variety of algorithms may be utilized. This will in turn, help to improve the accuracy of the detection system.

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