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Face Identification and Liveness Detection using CNN for Automated Attendance System

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ABSTRACT

A real time automated attendance system is designed using the method of live face detection and recognition. The system supports multi-user attendance and face liveness detection at the same time. The system can automatically collect face data, that will be saved in the specified dataset folder of each individual person obtained during the registration process. The face detection part of the system is based on Haar Cascade Classifier, and the face recognition part is based on Local Binary Pattern Histogram algorithm. The algorithm implementation is based on Keras and TensorFlow framework, and the face liveness detection part is based on CNN that creates a 3D model of face detected to differentiate between real and fake images. The attendance system is written in Python language, and the user interface is designed by pywebview library. The experimental results show that the system achieves a good performance in real-time face recognition.

Keywords: *- Liveness detection, Face Recognition, Haar Cascade Classifier, LBPH, Keras, CNN, Automated Attendance*

1. INTRODUCTION

This paper presents a study on automating attendance process using face biometric along with liveness detection to check whether the obtained face is real or fake. A facial recognition system is a biometric technology capable of matching a human face from a digital image or a video frame against a database of faces. It works by pinpointing and measuring facial features from a given image. Face recognition is typically employed to authenticate users through ID verification services. Among all biometrics available in the modern world, face is becoming more popular because of the low cost contactless authentication process. The paper-based method of marking attendance is time-consuming and its complexity increases with the increase of overall strength. This case is nullified in the automated version as it saves time and an additional bonus comes with security as it also helps to prevent proxy of attendance. Considering these facts, the automation in attendance system is implemented using face recognition technique as it is completely contactless and cost efficient. Many face based attendance systems has been developed in the recent years, but among them most of the systems are reliable to spoofing attacks which makes the system less secure.

The objective of our proposed system is to create a face recognition based attendance system with liveness detection using Convolutional Neural Network (CNN) to check whether the faces obtained from the camera is real or spoofed.

Face based attendance systems are implemented using various face detection and face recognition methods. The speed and accuracy of the system depends on the algorithm used. The major algorithms for face recognition include Eigen faces, LBPH and Fisher faces. Among these algorithms, LBPH is considered to be the fastest and lightest. Thus, the system uses Haar Cascade Classifier for face detection because of their robustness and LBPH algorithm for face recognition. It is robust against monotonic grayscale transformations.

2. ALGORITHMS USED

2.1 Face Detection

Face detection is a computer technology being used in a variety of applications that identifies human faces in digital images. The system uses Haar Cascade Classifier for face detection. Haar Cascade is a machine learning object detection algorithm proposed by Paul Viola and Michael Jones in their paper "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. OpenCV offers pre-trained Haar cascade algorithms, organized into categories, depending on the images they have been trained on.

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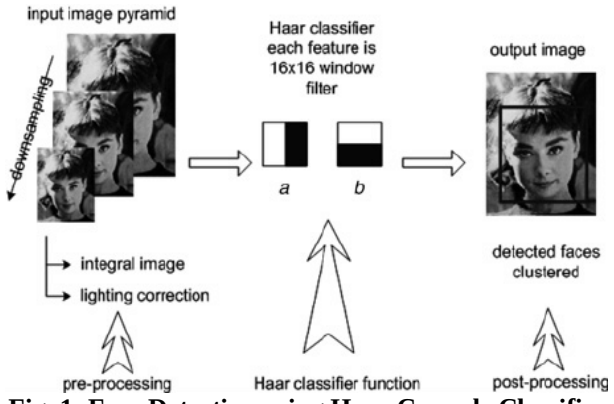

Fig. 1: Face Detection using Haar Cascade Classifier

2.2 Face Recognition

After detecting a face from the camera, the obtained face is compared with all other faces in the dataset to find a closest match using a suitable face recognition algorithm. The system uses Local Binary Pattern Histogram (LBPH) algorithm for face recognition. LBPH is a simple yet very efficient texture operator that labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number.

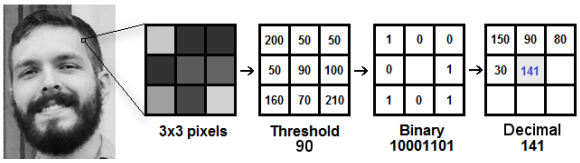

Fig. 2: Pixel Matrix to Binary Pattern using LBPH

2.3 Liveness Detection using CNN

Liveness detection is the ability of a system to detect whether the obtained biometrics is real or fake. Liveness check uses algorithms that analyze data after they are collected from biometric scanners and readers to verify if the source is coming from a fake representation. In essence, a liveness detection mechanism is a security feature developed to mitigate the vulnerability of biometric systems to spoofing attacks. There are a number of approaches for liveness detection.

The system uses convolutional neural network (CNN) to check the liveness of a person. A CNN is a type of artificial neural network used in image recognition and processing that is specifically designed to process pixel data. CNNs are powerful image processing, artificial intelligence (AI) that use deep learning to perform both generative and descriptive tasks.

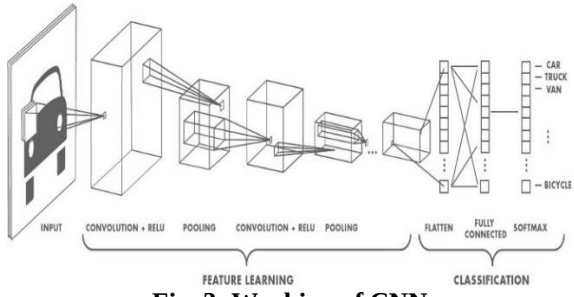

Fig. 3: Working of CNN

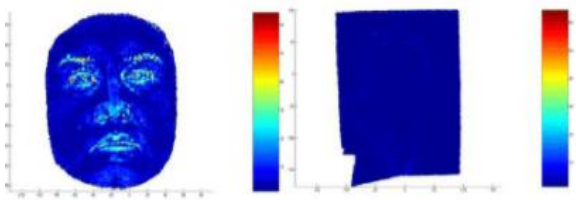

Fig. 4: Real Face (3D) vs. Spoofed Face (2D)

The aim of the proposed system is to determine if an impostor is employing a 2D image of a genuine user to fool a face recognition system. The proposed method computes the 3D features of the captured face data to determine whether the human face obtained is real or fake. Figure-4 represents the comparison between the 3D data acquired from a photograph and a real 3D face. The color codes represents the values of curvature. Blue represents low curvature values and red represents high curvature values.

The value of the curvature at p is computed as: $C = ((p-b)*v)/d^2$ where, v is the eigenvector corresponding to the smallest eigenvalue of the decomposition, b is the baricenter of the Cartesian coordinates of the points within Ωr, and d is the mean distance of all points within Ωr. As the radius r controls the degree of smoothness of the curvature along the 3D surface, the localization accuracy can be varied by changing the value of r. The mean curvature of the 3D points lying on the face surface is computed as the arithmetic average of the curvature values of all the points. The mean curvature value computed from the frame obtained using the camera is compared with the threshold value. The large difference between the two curvature values clearly indicates that the obtained face is not real.

3. PROPOSED SYSTEM

The system aims at recording the attendance of each individual person using face recognition along with liveness detection.

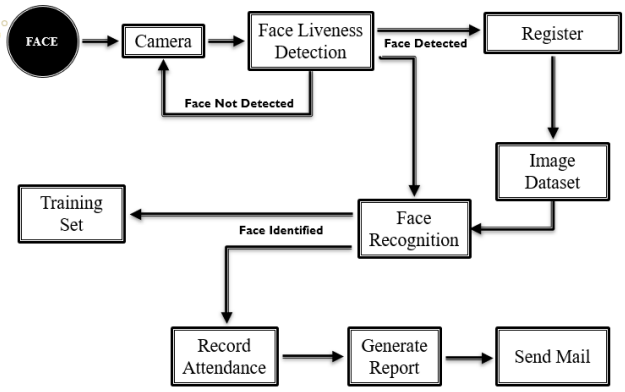

Fig. 5: Architectural Design of the system

Initially, the system captures the faces of each individual person in the attendance list and stores them in a dataset folder created with their unique IDs. During registration process, multiple images of the same person is captured and stored in the dataset folder that can be used to improve the accuracy of the system. The dataset folder is then trained using LBPH algorithm and the output is stored as a .npy file.

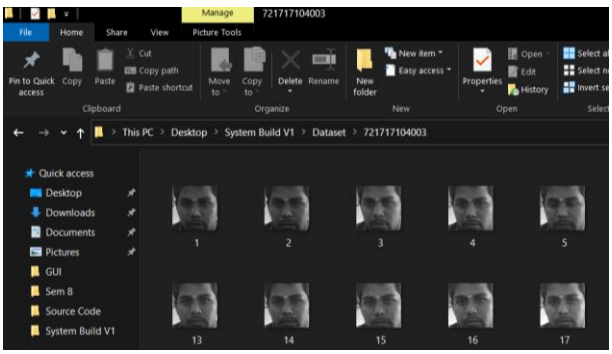

Fig. 6: Dataset

Figure-6 represents the set of images of a same person captured and stored in the folder created with their unique university

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register number during the registration process. Once the system is started to record the attendance, it checks liveness in each frame obtained from the camera. Only after the confirmation of liveness from this module, the face recognition algorithm starts to match the obtained face with all other faces in the dataset to identify a closest match.

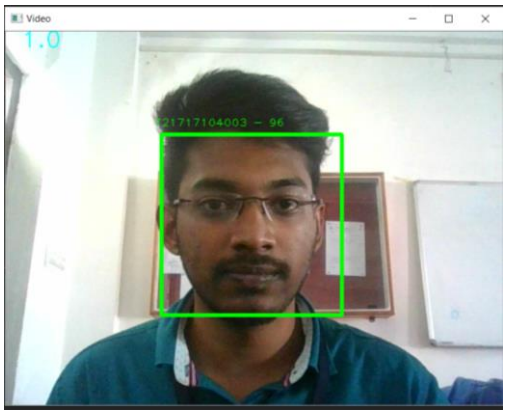

Fig. 7: System detecting a real face

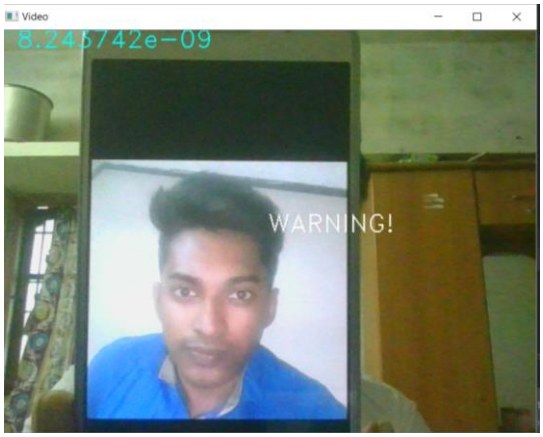

Fig. 8: System detecting a fake face

During liveness detection, the curvature value used to determine real and fake faces are displayed in the top of the screen. A value greater than or equal to the threshold value represents a real face whereas the value less than threshold represents a fake face. Figure-7 and figure-8 represents the real and fake faces identified by the system respectively. The system provides a warning if the face detected is not real.

If the face found is real and if there is no warning, the system starts recognizing the face obtained and records the attendance in a Microsoft Excel Sheet.

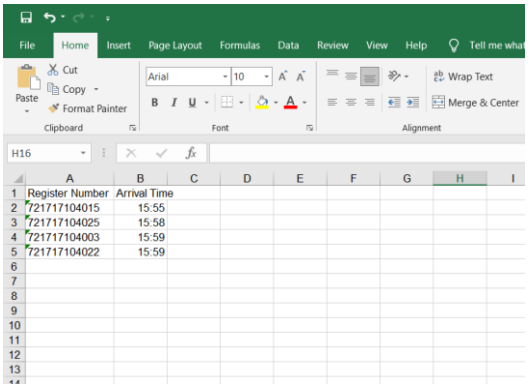

Fig. 9: Attendance Report

4. CONCLUSION

Developing technologies must ensure security and reliability. Automating attendance using biometric technology is a huge advancement in recent years. But they must be resistant to hacks and spoof attacks. Our system provides a way to detect 2D spoofing attempts using CNN thereby making the biometric attendance secure and reliable.

5. REFERENCES

[1] Bharath Tej Chinimilli; Anjali T, Akhil Kotturi, Vihas Reddy Kaipu, Jathin Varma Mandapati (June 2020.) "Face Recognition based Attendance System using Haar Cascade and Local Binary Pattern Histogram Algorithm" in ICOEI.

[2] Smitha, Pavithra S Hegde, Afshin (May 2020) "Face Recognition based Attendance Management System" in IJERT.

[3] Shreyak Sawhney, Karan Kacker, Samyak Jain, Shailendra Narayan Singh, and Rakesh Garg, (July 2019) "Real-Time Smart Attendance System using Face Recognition Techniques" in 9th International Conference on Cloud Computing, Data Science & Engineering (Confluence).

[4] Arjun Raj. A, Mahammed Shoheb, Arvind. K and Chethan K S, (June 2020) "Face Recognition Based Smart Attendance System" in International Conference on Intelligent Engineering and Management (ICIEM).

[5] Shizhen Huang and Haonan Luo (July 2020) "Attendance System Based on Dynamic Face Recognition" in CISCE.

[6] Tanya Srivastava, Vanshika Vaish, Puneet Sharma, Pooja Khanna, (March 2019), "Implementing Machine Learning for Face Recognition based Attendance Monitoring System" in International Conference on Computing for Sustainable Global Development (INDIACom).

[7] A. Ahmed, J. Guo, F. Ali, F. Deeba, and A. Ahmed (2018), "LBPH based improved face recognition at low resolution," in International Conference on Artificial Intelligence and Big Data (ICAIBD).

[8] R. Samet and M. Tanriverdi, (2017)" Face Recognition-Based Mobile Automatic Classroom Attendance Management System"

[9] A. O¨ zdil and M. M. O¨ zbilen, (2014) "A survey on comparison of face recognition algorithms," 8th International Conference on Application of Information and Communication Technologies (AICT).

[10] Jomon Joseph1, K. P. Zacharia (2013) "Automatic Attendance Management System Using Face Recognition", International Journal of Science and Research (IJSR).

[11] Ononiwu G. Chiagozie, Okorafor G. Nwaji (2012), "Radio-frequency identification (RFID)based Attendance System with Automatic Door Unit", Academic Research International.

[12] O. Shoewu, PhD, O.A. Idowu, B.Sc. (2012), "Development of Attendance Management System using Biometrics.", The Pacific Journal of Science and Technology.

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