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An Attendance System Based on Face Recognition and Detection Using CNN

1Vashvi Singh, 2Siddharth Singh, 3Akanksha Awasthi

1,2Reserch Scholar, 3Assistant Professor
1, 2, 3Department of Computer Science and Engineering,
1, 2, 3Goel Institute of Technology & Management, Lucknow, India.

Abstract - Face recognition is a biological tool that may be used to recognize people by their distinctive facial features. Numerous applications, including security, enforcement agencies, and consumer electronics, have made use of this technology. Face detection and recognition system works by analyzing a person's individual facial features to a database of recognized faces. The system can recognize the person if there is a match. We employ a variety of already trained models, such as those for image processing, pattern recognition, and artificial neural network method (ANN). The accuracy of facial recognition has been considerably improved by the advent of deep learning technologies. CNNs (Convolutional Neural Networks) with deep learning have significantly improved picture categorization. The Computer Vision and Machine Learning Group's deep learning model, DeepID, has achieved recognition rate of 98% on the ORL database for attendance systems.

***Key Words*:** Face Recognition, Biometric, Image processing, Pattern Recognition, Artificial Neural Network.

1.INTRODUCTION

Attendance is a critical component of daily classroom assessment. The instructor normally checks it at the start and the end of class, however it is possible that a teacher will miss someone or that certain pupils will respond many times. The challenge of identifying faces for collecting attendance is solved by employing facial recognition techniques based on high-definition monitor video and certain other information technologies [6].

The goal of face recognition is to enable computers to quickly and accurately locate and identify human faces in pictures and movies. For enhancing face recognition performance, a variety of algorithms and methods have been developed [7]. Deep learning has recently been extensively investigated for computer vision applications. The human brain is capable of instantaneously and automatically identifying several faces. On a computer, however, it is exceedingly difficult to complete all the tough tasks at the level of the human brain. Face recognition is a crucial component of biometrics. The fundamental characteristics of a human are compared to the data in biometrics. Through the use of algorithms, facial traits are retrieved, which are effective and a few changes are made to enhance the current algorithm approaches [8, 9]. Face-recognition computers might be used for a broad range of real-world purposes, such as identity verification, security measures, and criminal identification. There are typically two phases in the facial recognition system:

• Face Detection: This method looks for faces in the input image and cleans up the facial image for easy recognition.

• Face Recognition: To identify a person, the detected and processed face is matched to a database of recognized faces.

2. Background

Face recognition research has been done in the service of human interests, particularly those related to surveillance systems, electronic eavesdropping, and general proof of identity, related to image research, law enforcement agencies, "Smart Card" applications, youtube clip indexing, multi-media environments, and observer face reconfiguration [1]. The literature is replete with works on Radio Frequency Identification (RFID)-based Attendance Systems. In an RFID-based system, students must use an ID card with an RFID tag to register their attendance by placing the card on the card reader [5]. This strategy has a flaw in that passing around a gadget during class might provide distractions for the pupils [3]. A fundamental tool for human-computer interaction is real - time face [4]. The faces in photographs or videos might provide information to it. Face recognition software analyses a face picture to extract facial features, which is followed by the identification of a specific target [6].

3.METHODOLOGY

The following modules are part of the face detection and face recognition algorithm-based attendance system in figure 1.

(1) Take a video and make sure each pupil is seen in it.

(2) Establish a minutely frame for class attendance.

(3) Use CNN's deep learning algorithm in the module for facial detection. Find the faces of every pupil and output their coordinates.

(4) Implement a deep learning system for facial identification.

(5) A module for automatic attendance analysis. Students' seats are fixed, making it impossible to compare the coordinates of their faces and

identify each student in order to accomplish automated attendance.

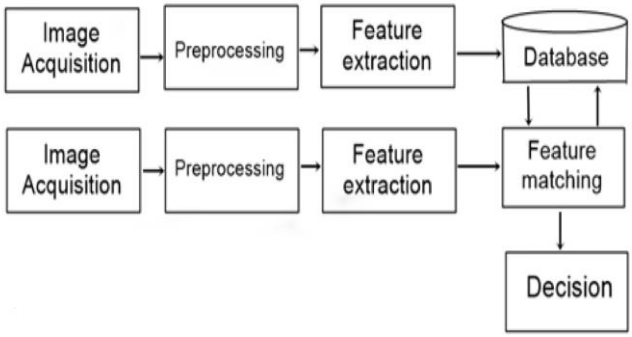


Figure 1: Pipeline for CNN.

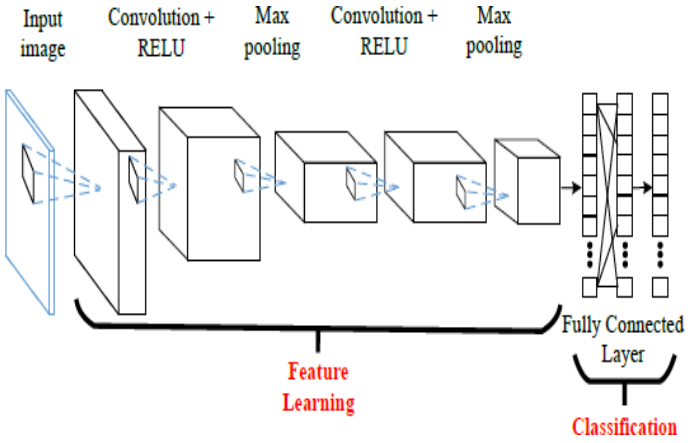


Figure 2: Method for Face Recognition Using Convolutional Neural Network [9].

4. EXPERIMENTAL DESIGN

4.1. Dataset

Each of the 40 different themes is represented by ten different photographs in the ORL Database of Faces, totaling 400 different images [10].

4.2. Evaluation Measures and Result

Based on Table 1, metrics like accuracy and loss will be determined for the face recognition in Table 2 using figure2.

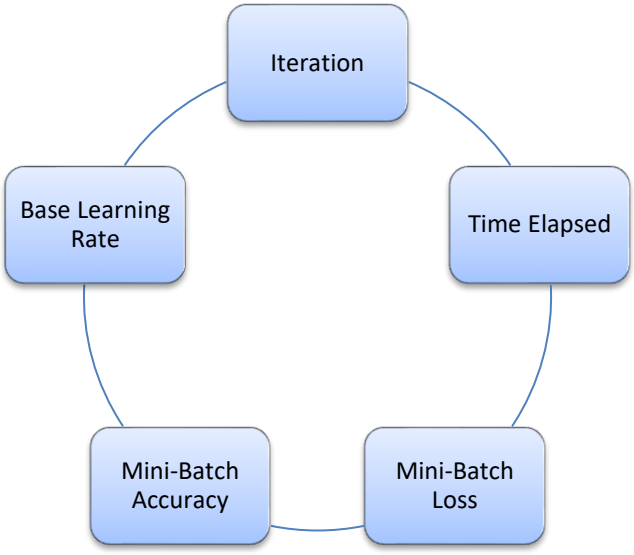
Table 1: CNN layers with type and Properties.

Layer	Type	Properties
Layer 1	Input	32×32
Layer 2	1 Convolutional	16 feature maps 3×3 kernel dimension
Layer 3	Pooling	2×2 kernel dimension probability 0.25
Layer 4	2 Convolutional	16 feature maps 3×3 kernel dimension
Layer 5	Pooling	2×2 kernel dimension probability 0.25
Layer 6	Fully-connected	3000 neurons
Layer 7	Fully-connected (Softmax)	40 neurons (classes)

Table 2: Result analysis and Learning Rate based on CNN.

Epoch	Iteration	Time Elapsed (seconds)	Mini-batch Loss	Mini-batch Accuracy	Base Learning Rate
1	1	1.68	4.0947	1.67 %	0.0100
2	10	18.69	4.0931	0.00 %	0.0100
4	20	38.03	4.0889	1.67 %	0.0100
6	30	56.68	4.0742	22.50 %	0.0100
8	40	74.59	3.9835	25.00 %	0.0100
10	50	89.78	2.3881	56.67 %	0.0100
12	60	105.14	0.6209	76.67 %	0.0010
14	70	120.30	0.0182	100.00 %	0.0010
16	80	136.81	0.0045	100.00 %	0.0010
18	90	153.30	0.0080	100.00 %	0.0010
20	100	169.10	0.0049	100.00 %	0.0010

The three methods for estimating the effectiveness of a facial recognition-based attendance management system utilizing deep learning models in Python using the Keras library shown in table 2 are as follows:



5. Conclusion

In this paper, we provided an experimental analysis of the suggested CNN's performance. The various numbers of training photos and test images were used to achieve the overall performances. The finest outcomes to date are achieved using convolutional neural networks. It is feasible to get accuracy rates of approximately 98% using complicated designs. Despite this impressive result, CNNs inevitably have drawbacks. Large training datasets require a lot of compute and memory, which requires a considerable amount of processing power to be applied effectively.

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