



# IJRASET

International Journal For Research in  
Applied Science and Engineering Technology



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# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

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**Volume: 9      Issue: IV      Month of publication: April 2021**

**DOI: <https://doi.org/10.22214/ijraset.2021.33659>**

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# GPU Enabled Face Recognition System using Convolutional Neural Network

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**Abstract:** Face recognition is that the developing and evolving technology that recognizes an individual from the facial expression. Face and expression recognition algorithms, as well as a variety of other video surveillance applications, can take advantage of a facial function. Recently, face recognition systems are attracting researchers towards it. Marking attendance manually may be a monotonous job and misspends lots of your time. The present attendance systems also misspends lots of your time because it isn't automatic and also requires the involvement of the scholars. The work outlined aims at automating the entire process. The proposed approach is by using CNN and implementation is based on Tensorflow. It detects the faces even if it is slightly differs in position. The CNN based approach using Tensorflow shows high accuracy in the face recognition process. Various real-world situations are studied in order to test the efficiency of various face recognition systems and to suggest approaches to be used in order to enhance them.

**Index Terms:** CNN, deep learning, face recognition, tensorflow

## I. INTRODUCTION

Attendance may be a key a part of daily classroom assessment. It's usually checked by the teacher at the start and finishing of the category. However, it appears that a lecturer might miss anyone or that certain students may answer more than once. There are several flaws in current attendance recording methods, including:

It takes a long time to call out each scholar's name one by one.

Students can easily forge their classmate's signatures. If the university administration does not adequately store and maintain the attendance record file, it can be easily lost. Several algorithms and techniques have been developed to improve face recognition efficiency. Deep learning is becoming increasingly popular in the field of computer vision applications. However, when it comes to computers, it's extremely difficult to complete all of the difficult tasks on a human level. Face recognition is an important component in biometrics. Simple human characteristics are matched to the available data in biometrics. Face expressions are extracted and implemented using effective algorithms, with a few changes made to boost the current algorithm models. Face-detection and recognition computers may be used in a variety of practical applications, such as criminal identification, surveillance systems, and bio-metric identification. In most cases, a face recognition device has two stages: Face Detection searches the input image for any faces, then image processing cleans up the facial image to make it easier to recognise. Face detection may be a computer-assisted method for detecting faces in a picture. Algorithms that are currently available were used to detect the frontal face. Face detection technology has progressed as a result of the development of newer, faster algorithms that allow computers to detect faces in images. Face recognition is a method for recognising someone based on their face, which has been previously trained from a dataset. Face recognition is one of the most effective biometric techniques for recognising an individual, and it has advantages over other biometric methods, such as the fact that it does not require the consumer to take any action, and it has non-intrusive characteristics. Surveillance, smart cards, entertainment, law enforcement, information security, image database investigation, civilian applications, and human-computer interactions will all benefit from face recognition technology. The primary part of the face recognition process is image processing, which entails acquiring facial images by scanning, image quality correction, image cropping, image filtering, edge detection, and feature extraction from images. The second element may be a facial recognition technique based on computer science and genetic algorithms, as well as other methods. To summarize the face recognition system's process, three steps are involved: face detection, feature extraction, and classification.

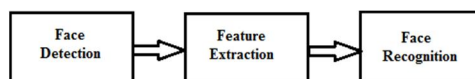


Fig. 1. Basic steps in Image Processing

Face detection is the method of a computer searching an input image for a face-like object. The main goal is to figure out whether or not there is a face in the picture.

If the face remains, the state and extent of the face will be the performance. The next move is to find and remove a facial feature. Eyes, nose, mouth, brow, ears, and chin are examples of facial expressions. The final step is to recognise the face by comparing the output with the database.

## II. RELATED WORKS

Many researchers have proposed various works and methods for face detection.

Kevin Hernandez-Diaz [1] proposed Periocular algorithm and CNN features for the face recognition. The periocular region is mainly indicates to the area around the eye, including sclera, eyelids, lashes, brows and skin. These parts are unique for all people and can detect the person very easily.

In B. K. Mohamed and C. Raghu [2], the conventional system of taking attendance by the way calling the name of the students will wastes a lot of time. Fingerprint based devices are commonly used in corporate environments. These devices store and verify fingerprints by using computers. It can be ported with modifications into an academic environment.

T. Lim, S. Sim, and M. Mansor [3] The basic idea behind a radio frequency-based attendance scheme is to take attendance with an RFID card. The RFID card must be shown to the RFID reader, and the microcontroller memory will record a person's attendance. By the emergence of RFID based attendance system, the problem of student security is increased of the system efficiency instead of photo ID card, it also helps to take the attendance of the workers at their working environment. This method helps to create an easier, faster and secure environment.

P. Viola and M. J. Jones [4] new algorithms and insights are used to construct a framework for robust and rapid visual detection. The image differences in videos and images, auxiliary information's, pixel variations in images can be used to gain high frame rate.

## III. PROPOSED SYSTEM

Deep learning relies on artificial neural networks together with representation learning and it is a subclass of machine learning method. Three types of learning are: supervised, semi-supervised or unsupervised. Convolutional neural network might be a category of deep neural networks and will be used for face recognition. CNNs are designed supported the biological processes within which the connectivity between neurons takes after the structuring of animal visual areas. They permit us to require out an honest range of features from the given images. The network should return similar outputs whenever two different images of the identical person are passed, for both the photographs. The network should refund outputs of various types when images of two different people are given. This recommend that the neural network must be taught to spot different features of faces and calculate numbers supported that automatically. The output produced from neural network is considered as an identifier for a selected person's face - suppose distinct images of the similar person are given as input, the neural network's outputs are very close, whereas given images of a singular person as input, the output are very different. The developing procedure is split into several stages.

- 1) *Data set Preparation:* Data is created by capturing images of all students. As a biometric technique has been selected for implementation, it's crucial for enrolling of every person whose attendance must be recorded. Here each individual's face is taken and it'll be stored in an appropriate database which has the name of the person other required credentials. Multiple samples for one individual with different lighting conditions are going to be taken.
- 2) *Image Capturing:* The camera is placed inside the category room in such the way that faces of all students are accessible. The camera must be used for taking the video which can carries with it many numbers of frames from which anybody of the frames is going to be used for face recognition and marking the attendance.
- 3) *Detecting Faces:* It's often spoken analysis characteristics of person's face image acquired employing a camera. It calculates over the majority facial structure distance between nose, eye and mouth. The captured image is detected and it'll match with stored database within the system.
- 4) *Processing:* The image may contain unwanted back-ground elements and noises aside from faces. So, it's important to eliminate those elements. For this extraction of features is very important to cut back the image. the size of the images are going to be reduced to a size of 150x150 using this method. Histogram equalization methods have to be executed on the reduced image in order that the images are easier to process. (E)Face recognition and classification: - CNNs are a category of Neural Networks and that they have showed very efficient in areas like image recognition and classification. CNNs are a kind of feed-forward neural networks and are made of many layers. CNNs accommodate neurons that have learnable biases and parameters. Each layer will take a collection of inputs, conduct convolution and optionally follow it with a non-linearity. Fig.2 shows a typical CNN architecture. The planning of CNN contains four layers: Convolutional, pooling, Rectified amount, and Fully Connected layers.

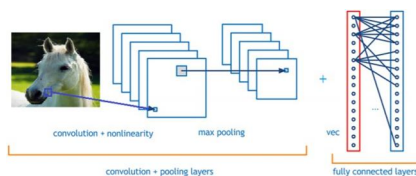


Fig. 2. A Traditional CNN Design

- Convolutional Layer:** The Convolutional layer performs the core building block of a Convolutional Network that does most of the computational work, the primary purpose of the Convolution layer is to extract features from the pc file which can rather be a picture. Convolution maintains the spatial relationship between pixels by analyzing image features using small squares of input images. The input image is convoluted by applying a gaggle of learnable neurons. This produces a feature map or activation map within the output image then the feature maps are fed as an information file to the following convolutional layer.
- Pooling Layer:** Pooling layer reduces the dimensionality of each activation map but continues to possess the foremost important information. The input images are splitted up into a gaggle of non-overlapping rectangles. Each region is down-sampled by a non-linear operation like average or maximum. This layer obtains better generalization, faster convergence, robust to translation and distortion and is commonly positioned between convolutional layers
- ReLU Layer:** ReLU could even be a non-linear operation and includes units employing the rectifier. it is a component wise operation which suggests it's applied per pixel and reconstitutes all negative values within the feature map by zero. So on grasp how the ReLU operates, we assume that there is a neuron input given as  $x$  and from that the rectifier is defined as  $f(x) = \max(0, x)$  within the literature for neural networks.
- Fully Connected Layer:** The term refers to that every filter within the previous layer is connected to every filter within the next layer. the end result of the convolutional, pooling, and

ReLU layers are embodiments of high-level characteristics of the input image. The goal of employing the FCL is to use these features for classifying the input image into various classes supported the training dataset. FCL is taken into consideration final pooling layer feeding the features to a classifier that uses Softmax activation function. The sum of output probabilities of the Fully Connected Layer is 1. This can be often ensured by using the Softmax because the activation function. The Softmax function takes a vector of arbitrary real-valued scores and squashes it to a vector of values between zero and one that sums to 1.

ALGORITHM: - The block diagram of the proposed CNN recognition algorithm is given in Fig. 2.

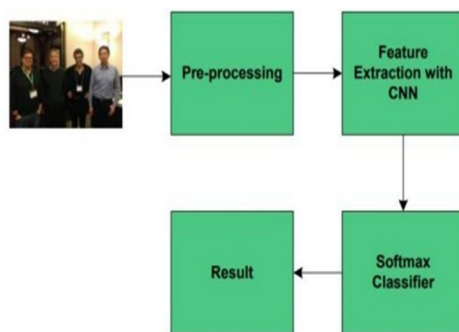


Fig. 3. The block diagram of the proposed algorithm

The algorithm is especially performed in three steps as below:

- Resize the input images as  $16 \times 16 \times 1$ . If  $16 \times 3$ ,  $32 \times 32 \times 1$ ,  $32 \times 32 \times 3$ ,  $64 \times 64 \times 1$ , and  $64 \times 64 \times 1$ .
- Build a CNN structure with eight layers made from convolutional, max pooling, convolutional, max pooling, convolutional, max pooling, convolutional, and convolutional layers respectively.
- After extracting all features, use Softmax classifier for classification. In Fig. 4, the structure of feature extraction block of the proposed CNN is showed.

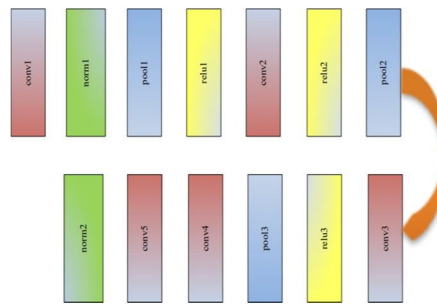


Fig. 4. The structure of feature extraction block of the proposed CNN

#### IV. PERFORMANCE ANALYSIS

In order to evaluate the performance of the previously described parallel algorithms, multiple execution tests were performed in the same computer. The selected platform featured an Intel Core i5-760 2.8 GHz, quad-core CPU. All GPU applications were compiled for the tensorflow architecture. On the other hand, GCC v.4.4.5 was used for linking the final application and for building the CPU tests. It should be noted that all GPU benchmarks were performed without considering the time spent on memory transfers between the CPU and the GPU. This assumption is valid since the final GPU-based face detector will start performing computations only once the image frame is available in the off-chip GPU DRAM memory. It is distributed in the tensorflow framework and has 2913 filters and is organized into 25 stages. Finally, the size of the training images was 24×24 pixels.

#### V. CONCLUSION

In this paper, a student attendance system using facial recognition is proposed. The work outlined aims at automating the entire process. The proposed approach is by using CNN and implementation is based on Tensorflow. It detects the face even if it is slightly differing in position. The CNN based approach using Tensorflow shows high accuracy in the face recognition process. Different real time scenarios are examined to assess the performance various face recognition systems and propose the method, to be employed in order to shield the threats like spoofing. Student data that has been identified in the form of the student's ID number, date and time, is used by the system to record student attendance. This system makes the student attendance process done automatically and is expected to be able to replace the old manual attendance process, which is currently used.

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