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Smart Attendance Management System Using Convolutional Neural Network

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Abstract: Businesses and educational institutions rely heavily on attendance records to ensure everything runs smoothly. Logging in and out allows for an accurate record of attendance, but the manual nature of the system raises the possibility of forgeries and proxies. These days, machine learning has been extensively researched for use in computer vision. In order to create reliable and accurate automated attendance systems, we use the idea of machine learning in Face - recognition. For the purpose of taking attendance, this research equips computers with face recognition and face detection algorithms that can quickly and accurately locate and identify human faces in digital photos or video. For this purpose, we employ a camera that sends its data through a Raspberry Pi module. The information is processed by a CNN algorithm, after which an Excel file (.csv) is created, uploaded to the cloud, and sent off to the appropriate authorities.

KEYWORDS: Smart Campus, Machine Learning, Digitalization of attendance, Face Recognition, Convolutional Neural Network (CNN).

INTRODUCTION

The number of features of each facial understudy image is designed to be constant, for instance 16 DCT coefficient, according to the Student Attendance System in Classroom That Uses Face Recognition Technique. Grayscale standardisation, histogram balancing, Discrete Wavelet Transform (DWT), and Discrete Cosine Transform (DCT) are all performed to completion (DCT). A closer look into the dissatisfaction with recognising the other students' faces reveals that a novice may be mistaken for another student (s) Taking into account the overall level of recognition that emerged from the inquiry but did not satisfy the exclusive criterion. Depending on the camera model, load the appropriate drivers from the math works site. Then, they employ at least 500 and a maximum of 1000 captures each person. They employed a high-definition camera to increase the precision of their findings. Using the face-distinguishing article-falling-class and b-box method is possible. Small 112x92 pixel images of the captured faces are the end result. It's size corresponds to 11 KB. We anticipate that the photos of people in the database will neatly arrange themselves in our office. The pictures from the gallery will be placed in there. Once all the HOG highlights have been sorted and stored as an exhibit list, it will provide a checkmark that corresponds with the inputted data.

Using a smartphone app and Near Field Communication (NFC) technology, we may enhance the attendance system. At the time of enrollment, the study article claims, each student is issued an individually numbered near-field communication (NFC) tag. Then, the lecturer's mobile phone can detect when one of these tags is touched or moved, accurately recording attendance for each lesson. The phone's built-in camera will then take a photo of the student's face, which will be sent to the college's server for verification and confirmation. The benefits of this approach include the NFC's ease of use and the lightning-fast speed at which connections may be set

up. Taking attendance is now much more efficient. However, if the original owner of the NFC tag does not manually tag it, the system will not detect the violation. On the other hand, the ease with which students may utilise their own smartphones as NFC readers was a source of frustration for the instructor. What plan B would be in place to keep track of attendance if the professor failed to bring their phone to class? Additionally, most professors will not appreciate this usage of their own smart phones owing to privacy concerns. Therefore, the NFC tag should be replaced with other methods, such as biometrics or facial recognition, that rely on the student's unique information. This will guarantee that the genuine student is the one to first record attendance.

When an employee's face is recognised in a taken picture and matches a photo in the face database, attendance is recorded. The primary benefit of this method is that attendance is recorded on a server that is completely secure and cannot be accessed by unauthorised users. In addition, the suggested system uses the skin categorization method to enhance the face detection algorithm, making it more accurate. The technology is not yet portable, despite ongoing attempts to improve the accuracy of the face recognition algorithm. A separate computer is required for this system, and as it will need a steady power source, it is immobile. Staff members only need to record their presence once per day, making a stationary system ideal for tracking their attendance; students, on the other hand, need to register their presence at each class on a given day, making a stationary system undesirable. Therefore, this problem may be addressed by creating a portable module that contains the whole attendance management system and requiring just the execution of python to function.

Image processing is used to teach the computer to recognise human faces. After a camera captures a person's likeness, the picture is transformed to grayscale so that the image removal method may be performed. After that, the picture is saved to the server for subsequent processing. In order to make the participation results accessible to a validated web customer, the author developed an approach in which the framework was employed as an online Web Server. To complete facial recognition, we first implement Local Binary Patterns (LBP), where the human face serves as the region of interest (ROI), and then we use the Haar Feature-based Cascade computation.

After that, LBPs are used to separate the image's highlights, and the separated highlights are compared to the produced datasets. Participation results are stored in a MySQL database and made generally accessible to the web server by hitting "c" as in "catch" on the console framework. In her article "Face Recognition Based Attendance System," Nandhini R. explains that the project's central principle is that the video-recorded data is converted into an image for identification and understanding. Facial recognition is calculated using a convolutional neural network. To speed up the processing of the necessary conditions, a CNN (Convolution Neural Network) employs a structure similar to a multilayer perceptron. Once the process of identifying and processing the face is complete, it is compared to the student's database of faces to re-engage them. The post-preparation phase involves re-entering the students' names into the corresponding surpass expectations page. The understudy's involvement may be tracked on a weekly or monthly basis using the weekly or monthly exceed expectations sheets.

2. Literature Review

Monthly attendance records may be kept with the use of the Teacher's Attendance and Roll Book forms. Each monthly page of the roll book will include space for 26 students' information. Input custom symbols for absences, latenesses, and absences altogether, such as "A" for absent, "T" for tardy, and "N" for no school. This is a straightforward and basic form. The teacher's page in the attendance book is an excel spreadsheet, thus you'll need excel viewer or above to access it. Managers and educators in both the business and educational sectors may use this downloadable attendance sheet on a weekly basis to keep tabs on who is present and who is absent [1]. The Attendance is a tool for recording student and staff presence in various settings. A daily log of a student's, teacher's, or worker's presence may be kept in an attendance register. Its primary function is to ensure academic consistency across students. The Attendance tool may be used in either virtual or physical classroom settings. Roll Call Attendance is available for all organisations [2] after it is enabled on a per-account basis.

For the purposes of payroll and salaries, companies utilise employee attendance registers to keep track of employees' regular and occasional absences.

Payroll records include employee attendance and time off for vacation, illness, jury duty, jury service, job training, and other reasons.

Human resources, management, and company owners utilise this information to determine employee pay. Employees may record their presence or absence from

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the workplace with the use of attendance registers that come either with or without payroll computations.

You may compute the salary of up to 40 workers with the help of this comprehensive Salary Sheet with Attendance Register [4]. We've made it easier by providing a preformatted and formula-driven Employee Attendance Template. This template has space for 50 workers' attendance records. The employee information you input only has to be done so once [5]. Choose the appropriate option from the menu to indicate whether or not the employee was present. Excel, Google Sheets, Open Office Calc, and Apple Numbers are just few of the file types that accommodate this template.

A standard practise in schools, student attendance registers let teachers track who shows up to class and how often.

It helps educators keep track of who was in class and who wasn't for a whole school year.

It also serves to lessen the pressure on educators, freeing up time that may be put to better use elsewhere.

Student attendance records are also kept for the sake of consistency [6].

Employee Sign-In Sheets Time spent working by workers on an hourly basis is tracked in registers. Daily, weekly, or biweekly instalments are all viable options. The time an employee spends on the work is documented in these registers. Historically, this has taken the shape of a single sheet of paper containing rows and columns of information. The timesheets have gone paperless. Timesheets, in their most basic definition, are documents used to tally the number of hours worked by each employee within a certain pay period. It keeps track of when employees clock in and out and how much time they really spend working [7].

Biometric time and attendance systems have become more common in the corporate sector as a means of monitoring workers' whereabouts and productivity.

Businesses have relied on the biometric attendance system for quite some time now to increase productivity while decreasing overhead.

The biometric attendance system may replace the more laborious and error-prone practise of keeping track of attendance manually or on paper.

This manual's goal is to explain biometric technologies and their numerous benefits to businesses so that they can make informed decisions about using them [8].

Figure 1: Bio-metric

Radio-frequency identification (RFID) devices are electrical gadgets that have a tiny antenna and a computer chip. Using radio frequency electromagnetic fields, this gadget transfers data about people, pets, books, and other items from a reader to an RFID tag. It can store 2,000 bytes of information [9]. Antenna, transponder, and transceiver are the three main components of the many RFID systems available today. Tags may be placed either in close proximity to the RFID reader or at a greater distance. Low, medium, and high frequencies are the primary functioning ranges for these gadgets. High frequencies are between 2.4 and 2.5 kHz, whereas the low frequencies span from 30 to 500 kHz [10].

Figure 2: Radio Frequency Based Identification

3. Proposed System

Structure of Networks This experiment's model for the CNN infrastructure. The layers in this architecture are as follows: input, convolution 1, pooling 1, convolution 2, pooling 2, completely connected, and Softmax regression classification. The use of convolutional and pooling layers to extract picture

characteristics sets CNN apart from more conventional neural networks. Layers of all components produced after filtering the input picture are represented by the convolutional layer, which is also known as the feature extraction layer. The local characteristics are recovered by connecting the input of each neuron to the local receptive field of the preceding layer. This layer signifies that the original picture is convolutionally operated upon to produce a set of derivative images. The formulaic procedure of convolution. The target picture is placed second from the left after the convolution kernel value is arbitrarily chosen. Select the picture matrices from left to right, top to bottom, and then multiply the result by the convolution kernel. Each convolution acts as a sieve to extract features from a picture, keeping only the relevant information. The greater the activation value, the greater the occurrence of the screening circumstances. Like the filter effect, which allows us to extract various characteristics from the input, convolution does not alter the size of the picture, therefore the treated image retains the same dimensions.

Individuals' identifying information, such as their IDs and photographs, must be entered into the attendance management system before it can function. Taking pictures of people's faces using a camera is the first step in the portrait acquisition process. When a picture is taken, the system looks for faces to identify them; if it doesn't find any, it asks the user to take another one until it does. In this case, each student will need to submit 10 photographs. Given the large number of students at the institution, the decision to keep just 10 portraits per student was made in order to save space on the raspberry pi. The photos will then go through a series of pre-processing steps to create a grayscale image and to crop the faces so that they are all the same size. The following diagram illustrates the aforementioned two procedures. Methods for Gathering Data and Preprocessing Images. Following processing, the photos are saved in a hierarchical file structure. In this project, all of the avatars will be saved in a database folder organised hierarchically. There will be several subfolders inside the database folder, each representing a different person, and within each of those people's subfolders will be a collection of photographs of their faces. Each person's ID number, which is different for everyone in the institution, will serve as the name of the subfolder that represents that person. The create database.py script is responsible for retrieving images, preprocessing them, and storing them.

These days, computers have no trouble at all with face detection.

Some machine learning models have even surpassed human performance in computer vision.

For this purpose of face identification and extraction, we are employing a pretrained CNN model.

1. Display red rectangles around all identified faces in the picture. FaceDetectionCNN.py is the name of the Python file.

Faces may be extracted from all of the photographs in a folder and then individually saved to a new folder, making for a convenient dataset. FaceExtraction.py is the name of the Python file.

3.1. OpenCV

OpenCV is a collection of computer vision-related programming tools designed for use in real time. The package's modular design indicates that it contains many independent libraries, either dynamically linked or statically linked. We use an image processing module that allows us to do things like convert colour spaces, create histograms, and perform a variety of geometric adjustments on images (including resizing, affine warping, and perspective warping).

3.2. CNN Training Experiment

Choice of Datasets The olivettifaces face database from New York University is utilised for the experiments, and it has 400 photographs of 40 persons (10 pictures of each person). Each image has an 8-bit grayscale, with grayscale values between 0 and 255, and a total resolution of 1190 by 942 pixels. Each of the 520 faces is 57 47 = 2679 pixels in size (1190/20) (942/20). A total of 320 samples are used as training data, while an additional 320 are used for verification and 100 are used for testing. Contemporary Portfolio Display The term "face recognition" refers to any system that uses a person's facial features to establish or confirm their identification. People in images, videos, or live-streams may all be identified with the use of face recognition technology.

Existing gear, including cameras and image capture software, may be used. It's the only available biometric for one-on-one passive identification. Various settings It is the most effective technique in Corona Pandemic for automatically collecting student attendance for online classes. The user does not have to do anything physically. It's reliable and may provide substantial enrollment and validation rates. The comparative result is easily understood by everybody.

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There are two kinds of comparisons that may be used for facial recognition. The FACE Classification System

RECOGNITION.

First, the algorithm does a comparison between the person and their claimed identity, and then returns a yes/no verdict.

Second, the algorithm identifies the person by comparing him or her to everyone else in the database and returning a prioritised list of potential matches.

The following steps are common to all identifying and authentication methods:

1) Capture: The system takes a snapshot of a user's physical or behavioural characteristics during the enrollment and identification/verification processes.

Step 2: Extracting Unique Information from the Sample and Developing a Model.

Third, we compare the new sample to the template.

4) The system determines whether or not the characteristics derived from the new Samples are a match.

The eye's location is determined and environmental factors like illumination and colour variation are handled by a pre-processing module. The first step is to identify any human faces inside the frame. The next step, after face detection, is localization. Different methods of facial recognition focus on different parts of the face or even the whole face (such as lips, eyes etc). Facial expressions and the act of speaking may have a profound effect on one's outward look. Video or still images of the speaker being captured may be used as input.

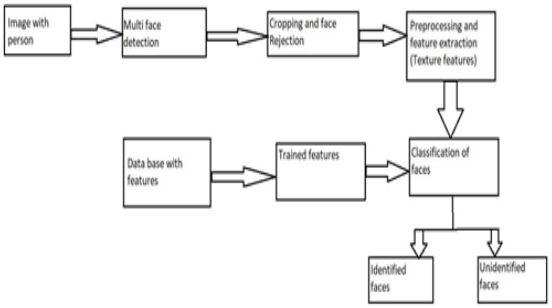

Figure 3: Block Diagram of Attendance System using CNN

Twenty-five individual video frames make to a 1 second clip. Multiple cameras may be utilised to create a 3D face model and prevent unwanted entry via the use of photos. Both visual and aural characteristics may be classified with the help of a synergistic computer. A computer that can mimic synergetic events is called a "synergetic computer." The BIOID develops a prototype of each individual, known as a face print, throughout the training process. Each face print in the database is pre-processed and compared to a freshly recorded pattern. Each comparison is given a numerical value from one to 10 as it is made by the system. A match is declared if the score reaches a certain level. There are three phases to introducing facial recognition software. Methods of Face Recogniztion When we examine ourselves in the mirror, we see that our faces have defining characteristics. The many bumps and hollows that make up the face look like this. Nodal points are what the software uses to identify these landmarks. The average human face has about "80 nodal points." Some of the software's measuring nodes are shown below.

Spatial separation of the eyes
The nostrils' width
The orbital cavity's depth
Cheekbones
Chin and jaw line
Chin

Methods of Face Recogniztion

To provide a broad representation of a face, a Face bunch graph is built using "70 nodal nodes." The Face

bunch graph is used to locate the same spot in a given picture of a face. A face in the database is represented by a string of integers calculated from the distances between these nodes. People use a system of codes known as "facial print" to communicate with one another. For face it software to finish the identification procedure, just 14–22 nodal points are required.

The latest face recognition attendance system is far more effective and secure than its predecessors. A number of distinct systems use facial recognition technology, and each one has vastly varied capabilities to work in a wide range of settings. It's a convenience for the unified database management system. A low-priced solution for keeping track of attendance. Advantages include: little overhead, high safety, and low cost. Automatic timekeeping system that uses facial recognition to verify employees' identities and stamp their attendance.

Calculated Values Based On An Image's Content
Compare Images of the Same Person
Compare Images of the Same Person
Compare Pictures of Individuals
Analyze Pictures of Various People
Compare Students' Ability to Recognize Various Images of People
Honor the True Student
Valid Student I.D. Required
Learn to Identify a Non-Student
Learn to Identify a Non-Student
Record of Attendance
Taking Roll in an Excel Document

The development of Convolutional Neural Networks (CNN) revolutionised how we study visual data. It simplified matters tremendously! By concentrating on a small area at a time and then scanning the rest of the picture, CNN simulates the way people view images. Each picture is reduced to a numerical vector in CNN, which may then be taught to an ANN using its fully linked Dense layers. Click here for further CNN details. The ANN's number of neurons and the depths of its convolution, max pooling, and hidden layers are all adjustable. In addition, if there are a lot of photos (say, 50,000 or more), the laptop's CPU may not be powerful enough to learn them all, therefore you'll need a GPU-enabled laptop or to turn to a cloud service like AWS or Google Cloud. With just 244 photos used for training, the data used in this presentation fits comfortably on a laptop. In addition to choosing the optimal number of layers and the number of neurons in it, for each layer, there are certain hyper parameters which has to be set.
Look at some of the most crucial hyperparameters quickly.

When performing the convolution stage, the number 32 denotes the number of filters being applied to the picture pixels. Some filters are designed to highlight specific features, such as outlines, colour changes, or sharp edges. The photographs provide crucial insight in the end. Standard practise calls for 32 filters in the first layer, with subsequent layers increasing the number of filters by powers of 2. The next layer above has 64, the one after that has 128, and so on.

To specify the size of the convolutional sliding window while using CNN, we use the parameter kernel size=(5,5). This case study will teach you how to use Convolutional Neural Networks to build a facial recognition system. Any collection of photographs may be classified using this template by simply being organised into a class and folder.

3.3. Acquiring Photographs for the Analysis:
There are 16 cropped photos of people's faces in the data, split evenly across the training and testing sets. The photos in the Training folder will be used to train the CNN model, and the images in the Testing folder will be used to test the model and see whether it can correctly identify the face number of previously unknown images.

3.4. Making a connection between index numbers and personal names:
Keys in the aforementioned class index dictionary are character names, and values are the corresponding numerical mappings. Getting the face-name out of the classifier model's returned numerical mapping requires this switch. Since this is a multi-class classification issue, we are also tallying the number of distinct faces to determine how many neurons to utilise in the final stage of the ANN's training process.

Procedures for Facial Recognition:
In this work, we have used OpenCV and NumPy to do face detection and identification. To demonstrate, we used a Raspberry Pi 3, but it could be any other machine. To utilise the programme on a different gadget, just minor adjustments will be required.

Libraries must be installed first.
The prerequisite libraries, OpenCV and NumPy, must first be installed. It's simple to set up because:
To set up OpenCV in Python, just type: pip install opencv-python.
opencv-contrib-python pip install
To install NumPy instead of opencv-python, just replace the former command with the latter:
pip install numpy>

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Face Detection, Step 2
The next step is to set up your camera and link it to your computer. The camera's functionality is crucial for accurate face identification. Our camera has to be able to identify faces before it can identify us. For this purpose, we will use the Haar Cascade classifier. This technique is typically used for object identification, and it involves training a cascade function using both labelled and unlabeled pictures. Our goal is to train a machine that can identify human faces. Because OpenCV includes both a trainer and a detector, it makes it easier to implement the Haar Cascade classifier. Constructing a classifier that can identify photos is possible.

Data Collection Step 3
If your model already has the ability to recognise faces, you may teach it to begin identifying the people in photos. You'll need to feed it a lot of pictures of the people you want it to remember. For this reason, we'll begin by assembling a dataset consisting of photographs. After collecting the required photos, IDs for each individual should be added so the model can properly match names with faces. Using the photos of one individual as a starting point, add at least ten more. To maximise your impact, try using alternative phrasing. You may save time by writing a script to automatically append user IDs to photos. If you wish to apply your model to other people's faces, the script is essential.

Phase 4: Practice
The next step would be to train the model after assembling the picture collection. Inputting the images into your OpenCV recognizer would result in the generation of a file with the name "trainer.yml." At this point, the model only needs to be fed photos and IDs so it can start learning what each image is. The model will be put to the test after training is complete.

3.5. Making the CNN model for facial recognition
Here's a bit of code that implements a convolutional neural network model.

Dual convolutional layers
Maximum pooling with two discrete levels
One layer of smoothing
Layer 1 of the Hidden ANN
Single 16-neuron output layer (one for each face)

The ANN's number of neurons and the depths of its convolution, max pooling, and hidden layers are all adjustable. In addition, if there are a lot of photos (say, 50,000 or more), the laptop's CPU may not be powerful enough to learn them all, therefore you'll need a GPU-enabled laptop or to turn to a cloud service like AWS or Google Cloud.

With just 244 photos used for training, the data used in this presentation fits comfortably on a laptop. In addition to choosing the optimal number of layers and the number of neurons in it, for each layer, there are certain hyper parameters which has to be set.

Look at some of the most crucial hyperparameters quickly.

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The kernel size=(5,5) parameter specifies the size of the sliding window used for convolution; in this example, the window is 5 by 5 pixels.

How quickly or slowly the sliding window should move during convolution (strides=(1, 1)). We've dialled it all the way down to 1x1 pixels. This method involves scanning the whole picture by sliding a 5x5 convolution window (the kernal size) by 1 pixel in both the x and y directions.

Images are just a matrix of RGB values; the input shape parameter should be set to (64, 64, 3). Our photos have been compressed to 64x64 during the pre-processing of the data, therefore the predicted form is 64x64x3. This translates to 3 separate 64x64 arrays, one for each of the primary colours.

Some procedure must determine the value for each weight before the Neurons can begin their calculation (kernel initializer='uniform'). That is what this parameter is for. Variables like "normal" and "glorot uniform" are available as options.

Using activation='relu,' the activation function for the computations occurring inside each neuron may be set. Options include relu, tanh, sigmoid, etc.

The parameter optimizer='adam' helps in determining the best possible values for the neural network's weights. One of the best optimizers is 'adam,' while another is 'rmsprop.'

If batch size=10, then the Network will receive 10 rows at a time for processing before beginning the SSE computation and making weight adjustments depending on the mistakes. This option defines an epoch as the time it takes for all rows to be given in batches of 10 rows. , a complete data cycle. Mini-batch gradient descent is another name for this method. A low value of batch size, such as 2 or 4, will cause the LSTM to examine the data slowly, which may result in overfitting, while a high number, such as 20 or 50, will examine the data rapidly, which may result in underfitting. For this reason, hyperparameter adjustment is required to choose an appropriate value.

With an epochs value of 10, the weight-adjusting process will be repeated 10 times. To put it simply, the LSTM revisits the whole training data set 10 times to fine-tune its weights.

Convolutional Neural Networks (CNNs) are a kind of neural network design that, unlike traditional machine learning methods, do not need feature selection or feature extraction, but instead extract the features implicitly without any previous understanding. The CNN's popularity stems from the fact that it can be used to a wide variety of computer vision tasks, from object identification and picture segmentation to facial recognition. CNN designs have changed over time to accommodate new computer vision challenges. Le Net, Alex Net, VGG16, Inception, etc., are only a few examples of such widely used designs. Many effective designs for smart attendance using facial recognition have been presented in the literature.

However, these models have low generalizability, i.e., the capacity to manage a real-world circumstance. This means that application-specific models must be developed. This study creates a web application for online attendance posting named Smart Attendance Management System and offers a unique CNN architecture inspired by the popular designs that have been published recently (SAMS). The paper's most significant contributions are

New convolutional neural network architecture for full-face recognition.
Through the use of an automated system called Smart Attendance Management System (SAMS), student facial data may be collected.

A. This study follows the following structure for its web-based application. Data collection and enhancement are discussed in the next section after an introduction to the Smart Attendance Management System (SAMS).

In this part, we'll go through the specifics of the proposed web-based application for SAMS's facial recognition via CNNs. The difficulties of collecting large test and training datasets for real-world use are also discussed. A. Smart Attendance Management System (SAMS) - An Overview SAMS is a web-based programme used for recording attendance using facial recognition (SAMS). Python and the flask framework were used in its creation. Fig-1 provides an overview of the suggested application. The application consists mostly of the following parts:

1) User Interface Front-End (Camera)
2) Server
3. The CNN Model
4) Database
Five) The Outcome (Display Screen)

The camera feed is fed into the Front-End Interface, which is a web page that uses the OpenCV library for computer vision. The server is the part of the software that processes data and communicates with the user interface, model, database, and display screen on the front end. Video frames are received from the user interface and processed on the server, where face detection is performed and fed into a model for label prediction. The server verifies whether the attendance has already been entered. If not, the time and date of the attendance are recorded. The screen, which is a web page, displays the related student's information. displays screenshots of the application's user interface and final output.

B. Students' facial data is acquired via an automated method that uses the system camera to capture video frames, which is then processed into a dataset through the steps outlined below.
Locate the subject's face in the video.
Take a picture of someone's face and then grayscale it.
Label images according to their category and save the results as a CSV.

The representative photos from the data set, broken down by kind. To better comprehend the patterns in the data, a three-dimensional scatter plot is created after applying principal component analysis (PCA) to the data.

C. Data Augmentation: Real-world data collection is a time-consuming and laborious process. Accuracy

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improvement requires a substantial amount of training data. Thus, new samples are generated by modifying the old data, a process known as data augmentation. More recently, unrestricted face recognition using face-specific data augmentation. In the present study, random synthetic pictures are created using the following procedures:

Zoom
Shear
Elevation Change
Rotation
Change in Width

The data-augmented synthetic pictures created.

D. The dataset was built using training and evaluation samples of 10,029 photos of faces organised into four categories. Except for class-3, which has 2,529 photographs, each class comprises 2,500 photos of people's faces. In order to speed up processing and improve CNN training, the dataset is normalised and the train data is enriched. The proposed CNN architecture for the SAMS application is described in depth below. In addition, the many layers that comprise the CNN model and their respective explanations are provided. Twenty layers make up the proposed CNN architecture, which includes:

Layer of Convolutions in Two Dimensions (Conv2D)
Layer for Normalizing Batches
Pooling Max Depth
Overlying Mass
Features are extracted using a two-dimensional convolutional layer, and then the input is normalized using a batch normalization layer, which also helps to solve the vanishing gradient and expanding gradient problems. Overfitting can be prevented with the dropout layer and the dimensionality of the input may be reduced with the max pooling layer. The architecture predicts the picture class label given a grayscale image of form (100, 100, 1). CNN has a total of 7,658,629 parameters, of which 7,656,197 can be trained and 2,432 cannot.

The suggested Convolution Neural Network (CNN) is built with the help of TensorFlow [18], an open-source python framework. The following system setup is used for the tests.

The GPU in use is 1X Tesla K80, which has 2496 CUDA cores and 12GB of GDDR5 VRAM.

The CPU is 1X single-core hyper-threaded Xeon, and it has a 45MB cache, 12.6GB of RAM, and a 320GB hard drive.

This article provides a comprehensive overview of how CNN may be used for attendance tracking and face recognition. Smart Attendance Management System (SAMS) is a web-based programme whose operation procedure is described here. Information gathering and data enhancement for the CNN model are described. In addition, an unique CNN model for face recognition is proposed in this research, which is then utilised to create SAMS. The effectiveness of the suggested CNN model and the SAMS web application is shown by the experimental results. The setup and maintenance of SAMS are simple. The longer-term goal of this study is to create a powerful tool for smart attendance management, which can be used by a larger school with more pupils in real time.

Using the RMSprop optimizer, we train the proposed Convolutional Neural Network (CNN) using a learning rate of 0.001, category cross entropy as the loss measure, a batch size of 256, and 50 epochs. When training a CNN, you can use the Reduce LRO n Plateau, Early Stopping, Tensor Board, and Model Checkpoint callbacks to slow down the learning rate if the network is plateauing, halt training if accuracy isn't improving, get a visual representation of your network, and save your model's weights for later use. During training, CNN's accuracy, and training loss as a function of epochs are shown. As the number of epochs increases, the accuracy improves and the loss decreases, and that after a certain threshold has been reached, neither the loss nor the accuracy improves any further.

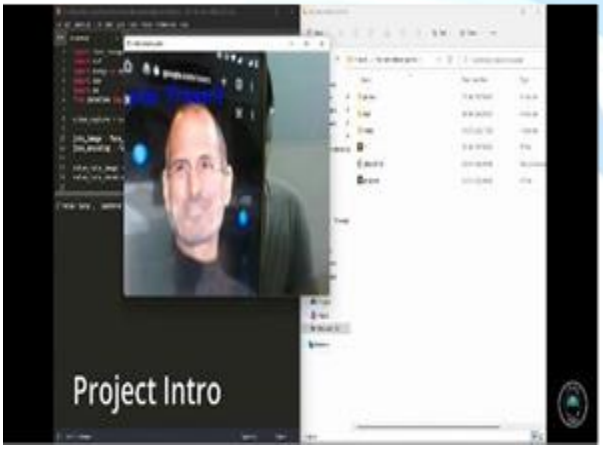
Measures of classification performance include the Kappa statistic for determining inter-rater reliability, the ratio of properly predicted positive to total predicted positive observations (precision), and the ratio of correctly predicted positive to all observations (recall).

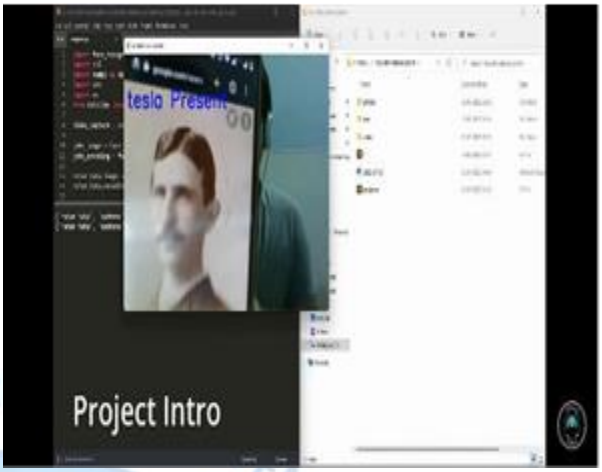
4. Experimental analysis

In this system we have implemented an attendance system for a lecture, section or laboratory by which lecturer or teaching assistant can record students' attendance. It saves time and effort, especially if it is a lecture with a huge number of students. Automated Attendance System has been envisioned for the purpose of reducing the drawbacks in the traditional

(manual) system. This attendance system demonstrates the use of image processing techniques in the classroom. This system cannot only merely help in the attendance system. Using the all the functions we have created; we have tested for output in using existing test images as well as in real-time. Following section, the screenshots of the output of different functions are given. We have tested the system with the help of four volunteers. Taking images from cam to create the test database.

Smart Attendance Management System is simple and works efficiently. The system works automatically once the registration of individual students is created by the administration. The attendance system proved to recognize images in different angles and light conditions. The faces which are not in our training dataset are marked as unknown. The attendance of recognized images of students is marked in real time. And import to excel sheet and saved by the system automatically. Automated attendance monitoring system was the project chosen by us by keeping in view of the demands of day to day needs and wants of society. The advancements in technology lead us to think out of the box and come up with some ideas that could be future changing. Education is the most important thing which every person should acquire as it is the basis for a better lifestyle and will surely improve the standard of a living community. What our education system lacks is the involvement of students in the schools, colleges, and universities. Instead of attending lectures and studying they prefer staying away from class and keeping engaged in using these gadgets. Low attendance means that the students and not there acquire the knowledge which they are supposed get and is of immense importance for them and can lead them to a better future.





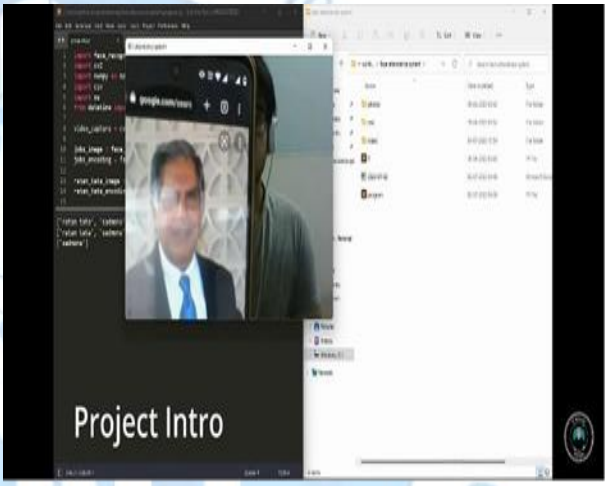


Figure 4: Persons on camera

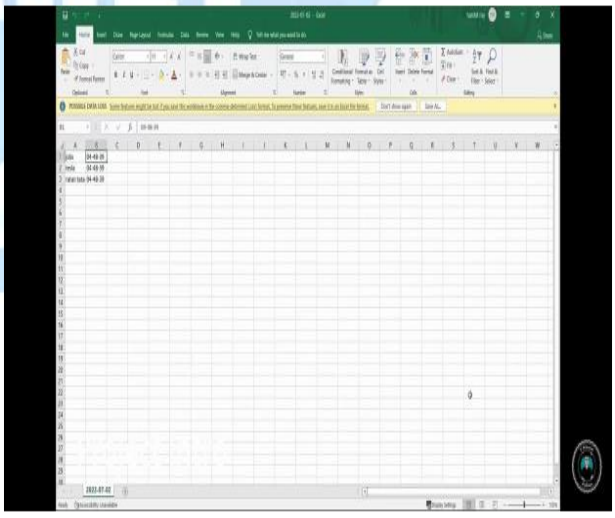


Figure 5: Triggered to Excel Sheet

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Using the technology we devised, individual attendance in a classroom is now practical. With the right upgrades and the development of a good database including all the information of each student in the college or university, it may be extensively utilised at the collegiate level. Students, as well as the students of teachers, staff, and non-staff members, may all be managed using this system. One further improvement we want to achieve is full automation of the system. The system now requires supervision to prevent irregularities like tampering with the gadgets. Our hope is that by eliminating the need for human oversight and employing a live feed from a camera to record students' attendance, we can generate attendance records that cannot be falsified. The match index is the minimal difference between the student's face encoding from the live video capture and the face encodings in the database, as determined by the implementation configuration. Real-time video captures the development process as the technology is put into place. The default confidence threshold for the match index is 0.6. The face will be recognized and designated as the same if the match index value is lower than the confidence level. Figure 14 depicts the correlation between the face distance (i.e., match index) of the photos in the dataset and the confidence score from the live image capture. After that, a CSV file is created that contains the student's attendance records. Only the names of pupils whose faces were scanned and identified will appear on the attendance sheet.

In this study, we implement a classroom attendance system based on the CNN algorithm, which can automatically record a student's presence by recognising his or her face in a lecture hall, laboratory, or other learning environment. This is very helpful when dealing with a big class size. The suggested solution employs a camera and facial recognition software to easily monitor a student's presence in class. After the faces are compared, a record is made in a database to verify the person's existence or absence. After a comparison is made between the stored images in the database, the student's attendance in class is automatically stamped. The information may be used by teachers to keep track of students' attendance and send them reminder emails if necessary. If you need to contact someone and they are unavailable, a text message will do the trick. This is a more efficient method of tracking student attendance since it monitors students automatically and indirectly during class and lecture.

5. Conclusion and Future Scope

In this effort, an automated system for recording classroom attendance has been built. Students' information is entered, a training dataset is created, faces are recognized, and attendance is automatically marked, all as part of the implementation process. In this work, researchers employed a CNN model that can detect and identify a person's characteristics even if they aren't looking directly into the camera. With a maximum accuracy of roughly 92%, the suggested system can identify and recognize the students of the class, saving the instructors time and effort by automatically recording and storing the attendance of the current students. A sufficient and stable number of photos of everyone must be present in the system throughout training for it to function well. The camera must be set up such that it captures a full 360 degrees of the classroom and all the kids in it. Additionally, this system may be used in any business to automatically record employees' attendance.

When many systems need authentication to get access to their respective privileges, the same project may be used for all of them. It may be used to identify dishonest actors in covert dealings. The efficiency with which resources are used is one area where face recognition algorithms may be enhanced, allowing for the identification of a larger number of faces simultaneously. Multiple iterations of the project may be created and use for increased safety at home and other individual or group goals. This approach also allows us to instantly identify a specific employee or student inside an institution.

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