Automatic Attendance Using Face Detection

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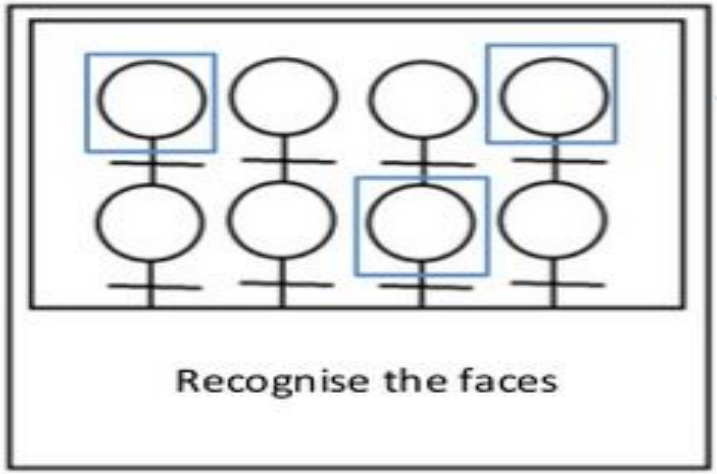
Introduction:

- In order to determine classroom attendance, face detection and face recognition are performed.
- Face detection is used to determine the location of the faces in the classroom image and extract sub images for each face.
- Then, in face recognition, the face images detected will be compared with the database consisting of images of students in the class, and attendance will be recorded accordingly.



Recognise the faces

Image processing and comparison module

Compares with Database and fills up the attendance

Database

X	Present
Y	Absent
Z	Absent

Face Recognition:

- Face Recognition is the process of identifying a person using their face. There has been great progress in face recognition due to increase in computation power.
- Humans have an exceptional ability to recognize faces irrespective of the lighting conditions and varying expressions.
- The aim of face recognition systems is to surpass the human level of accuracy and speed.
- Alexnet is used as the base model for the creation of the CNN model. This model is trained to detect specific faces.
- The Haar Cascades in OpenCV is used to extract faces from the images received from the camera in real-time.
- The extracted faces are passed through the trained model for prediction and the results are displayed on the face using face tracking.

Part One: DataSet Generation

Dataset can be the collection of images of different persons not taken using the real time-camera.

- Store the images in certain format as the ones generated images have.
- Convert the images into grayscale which will be done to the images generated by OpenCV.

**code commented in 02_face_training.py*

Dataset can be the collection of images of different persons taken using the real time-camera using the OpenCV.

- Store the images in certain format to identify the id of the person.
- The images are converted into grayscale to extract features from the image by OpenCV.

Part Two:
Face Data Training

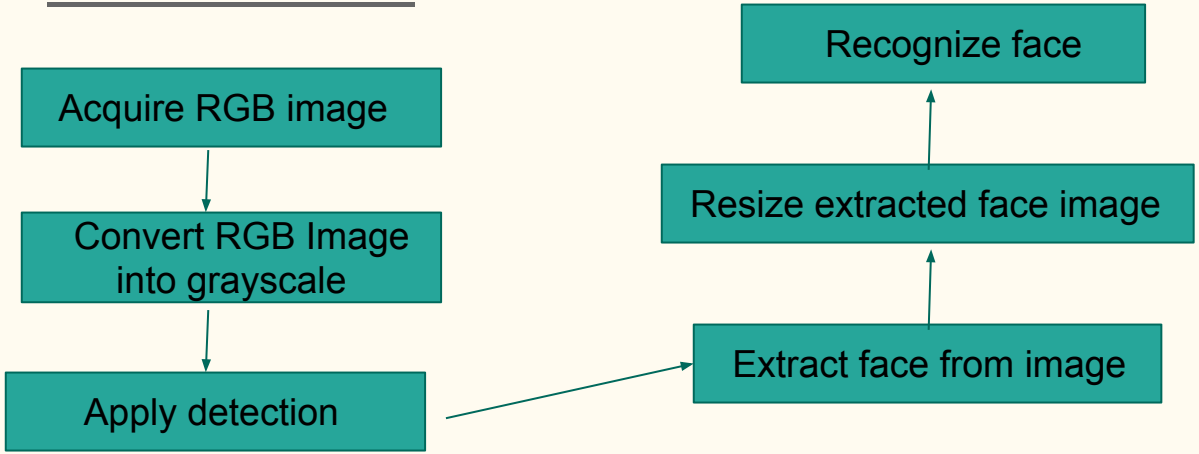
Face Recognition

What is Face Recognition?

With the facial images already extracted, cropped, resized and usually converted to grayscale,

the face recognition algorithm is responsible for finding characteristics which best describe the image.

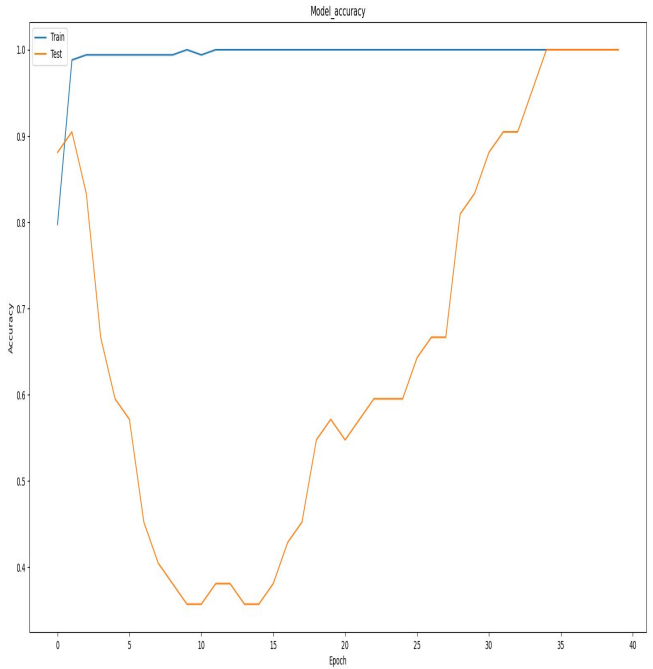
Process Outline:



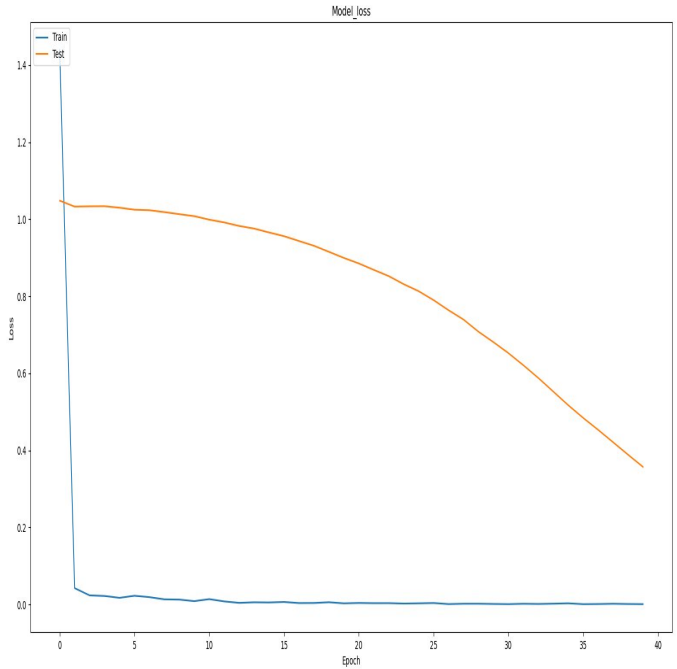
- **Getting Images and Labels:**
  - Firstly from the dataset folder created in Dataset Generation, We separate the Faces and Ids from the Dataset as in X and Y of the typical ML problems.
  - The images in dataset are conveniently named as the “User.UserId.ImageNo.Username.jpg” .
  - So they can be separated easily by the separator “.” .
- Initialize the model.
- Now the Images are refined using function named downsample_image().
  - **Downsampling** changes the image in the input of anysize to array.
  - And then convert it into the standard size of 32*32 .
  - Later both the images and labels array are modified as per the format according to the model.
- Even the augmented images are also included in the training set.

- Data is split into the Training and Validation sets using the train_test_split function.
- Implemented a checkpoint which ensures that the best model is saved as per the monitor parameter(*In this case "Validation Accuracy is taken"*).
- Now the model is trained using the training and validation data for a number of epochs which is chosen by us.
- The Loss occurred and Accuracy are plotted for both the Training and Validation Data and are saved.
- The Model Architecture is saved and summary is printed before the epochs start.
- For the input of image the output we get is the list of list whose length is number of users, with values representing probability of the image being that of that particular user corresponding to the index.

Results

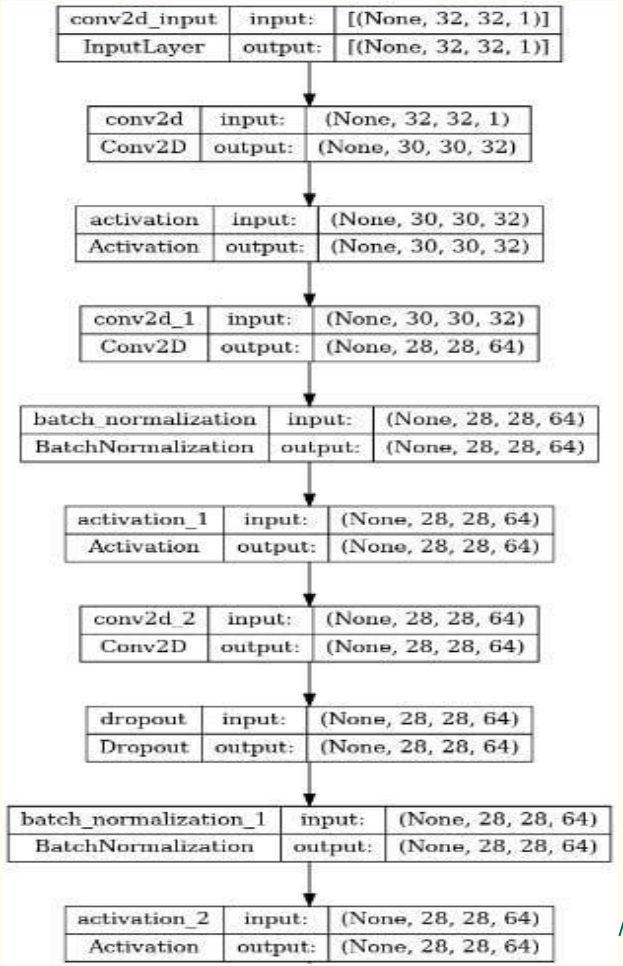


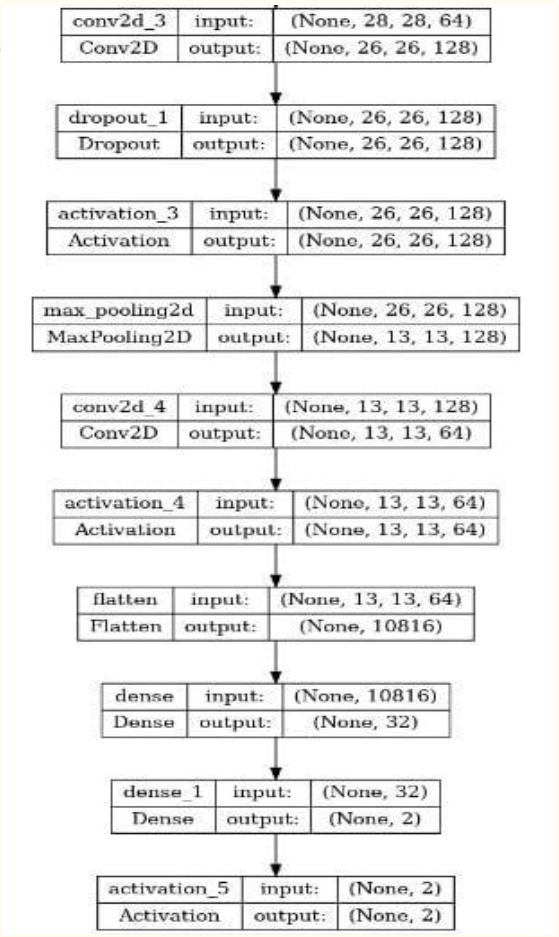
Model Accuracy



Model Loss

Model Architecture





Part Three:
Face Detection and Automatic Attendance

Face Detection:

- The dataset is similarly broken into labels and faces as in part 2.
- The weights are obtained from the model which is previously saved.
- From OpenCV the functions:
  - Cascade Classifier — used for checking the features which represent the frontal face.
  - Font_Hershey_Simplex – for the font generation.
  - Video Capture – Live camera used for Attendance.
- Now the Video Capture is started and a infinite while loop kicks in.
- Every frame is captured and read to recognize the face in it by using the model we previously trained to predict the username.
- Before it goes for checking(predicting) it is checked for the frontal features using Cascade Classifier.If it passes it then only the face is read otherwise it moves on to the next.
- The frame also undergoes preprocessing to standard size scaling and the conversion to the grayscale.
- All the predictions are stored into a list.

Automatic Attendance:

- The list which got stored is refined to get the Id of the user which is attached to the maximum probability and gets stored into separate list.
- A restraint is maintained such that to reduce the discrepancies to be recognized in **threshold** number of frames.
- A list is maintained for every user which holds the count of no.of frames of appearance and **Excel** (**Attendance**) **sheet** containing the Usernames in one column and whether they are **present** or **absent** in another column initialised to *absent* for everyone.
- After every frame is processed the user predicted is printed and count associated with it increases, If it reaches the threshold(*say 30*) the value in the "**Attendance.csv**" which is updated to *present*.

Additional:

- The Face to be read or being processed in each frame is enclosed by the rectangle which is displayed to us on the LiveCam.
- The Username predicted will be written on the Rectangle using the Font function of OpenCV previously mentioned.

Conclusion

- From our experiment, we noticed the face recognition was sensitive to face background, light, and head orientations.
- This technique described the accurate and efficient method of automatic attendance in the classroom which could replace the traditional method.
- An automatic attendance has many advantages, most of the existing systems are time consuming and require semi manual interference from lecturers, our system seeks to solve these issues by using face recognition in the process to save the time and labor.
- And No need for installing complex hardware for taking the attendance in classroom, all we need is a camera and laptop. We used algorithms that can detect and recognize faces in the image.

References:

1) https://github.com/rishabhshah13/Real-Time-Face-Recognition-Using-CNN
2) https://arxiv.org/pdf/2010.04517.pdf
3)


THANK
YOU