DRISHTI

A Revolutionary Concept

MAKERNOVA 1.0

ATTENDANCE RECORDER SYSTEM

TEAM MEMBERS

RONGALI BALAJI

MANEESH KUMAR

RAJA SINGH

AMISHA JHA

MISBAH SHAIKH

VATSAL SHAH

ATISH RANJAN

TEAM MENTORS

DEV DESAI

RAM RAJAVADHA

INDEX

1. INTRODUCTION

Attendance Recorder System is a biometric method of identifying an individual by comparing live capture or digital image data with the stored record for that person.

Face Recognition Attendance System is marking of attendance based on this technology. It involves using facial recognition technology to accurately and efficiently track attendance. This system captures an individual's facial features and matches them against a database, eliminating the need for manual attendance taking.

The system's real-time processing capability provides immediate feedback, allowing for quick identification and resolution of attendance discrepancies.

2. PYTHON

Python is a computer programming language often used to build websites and software, automate tasks, and conduct data analysis. Python is a general-purpose language, meaning it can be used to create a variety of different programs and isn't specialized for any specific problems.

The various libraries which we learnt during the course of our project are :

2.1 NUMPY

NumPy stands for Numerical Python. It also has functions for working in the domain of linear algebra, and matrices. The array object in NumPy is called ndarray, it provides a lot of supporting functions that makeworking with ndarray very easy.

The various functions which are possible in numpy are:-

- numpy.randam.rand()-This generates random numbers and random arrays.
- np.sum()- This function takes the sum of the input provided.
- np.mean() - Calculate the mean (average) of array elements.
- np.argmax() and np.argmin() - Return the indices of the maximum and minimum values in an array.

2.2 PANDAS

Pandas is a useful library which helps us arrange data in series and in tabular frames. It is useful for creation of dataframe from dictionaries, lists, csv files, excel files.

- pandas.__version__ : To check the version.
- Series- It is a one-dimensional labeled array that can hold data of various types.
- DataFrame() : It is a multi dimensional table.
- loc[[]] : To return one or more specified rows .
- iloc[] : To access elements by position (It refers to integers).

2.3 TENSORFLOW

TensorFlow is a free and open-source software library for machine learning and artificial intelligence. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks.

Some important libraries of tensorflow which we used are:-

- from tensorflow.keras.models import Model **-** The Model class is used to define a neural network architecture. It allows you to specify the inputs and outputs of the model, as well as how the layers are connected.
- from tensorflow.keras.layers import Dense, Conv2D, MaxPooling2D, Flatten- from this we import the layers, conv2D, maxpooling, flatten and dense which we used to build our project.

2.4 OPERATING SYSTEM LIBRARY

It is a built-in module that provides a way to interact with the operating system.It offers functions that allow you to perform various tasks related to file and directory manipulation, as well as interacting with the system environment.

Some important functions of this library are:-

- os.listdir(path): List files and directories in a given directory.
- os.rename(old, new): Rename a file or directory.
- os.path.join(path, *paths): Join path components intelligently.
- os.remove(path): Deletes a file.

3. OPENCV

OpenCV also known as computer vision is a very important aspect of our project attendance recorder. It helped us to capture the live frame of the person coming in front of the webcam and compare with the existing verification file.

We also utilized OpenCV to capture and store images within their corresponding categories: anchor, positive, and negative folders. In this process, we employed a loop to gather and store a total of 300 images per individual, correctly categorizing them into the anchor and positive folders. Meanwhile, the negative images were obtained from online sources, while the remaining images were sourced from various distinct entries.

Important functions of Opencv :

- cv2.VideoCapture- This function is employed to capture real-time frames from a webcam feed.
- cv2.ImWrite- This function is responsible for saving images with designated names by capturing frames at specific moments. It was particularly useful in our case for saving input images, which were subsequently compared with verification images.
- cv2.waitKey- by using this function the frame was seen by the user till the time that was set in the waitkey.
- Converting BGR color to RGB color format : RGB_img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
- cv2.IMREAD_GRAYSCALE: It specifies to load an image in grayscale mode. Alternatively, we can pass integer value 0 for this flag.
- putText() : cv2.putText(image, text, org, font, fontScale, color[, thickness[, lineType[, bottomLeftOrigin]]])

4. NEURAL NETWORKS

Neural network is a model structured on the basis of the human brain and its functioning. Similar to the human brain it analyzes inputs and produces output by the help of neurons and activation functions.

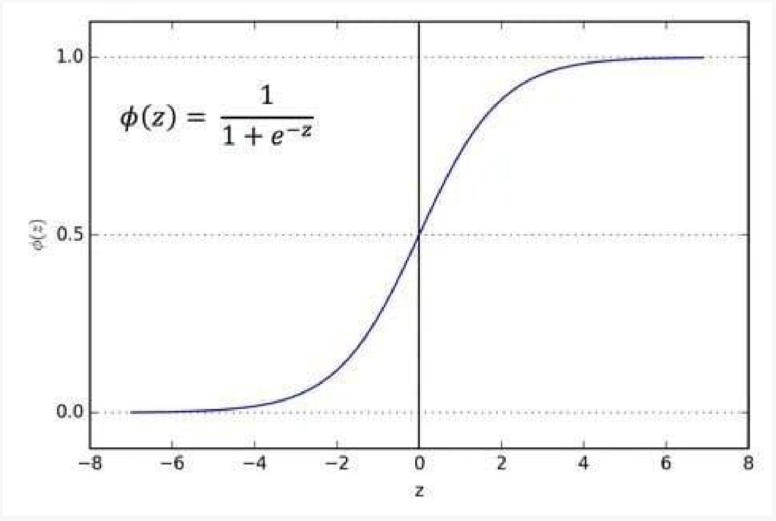
It works on the following pillars:-

- Neurons and Layers- A unit that receives inputs, performs a weighted sum of those inputs, applies an activation function, and produces an output. A collection of neurons that process input data together. Common types of layers include input, hidden, and output layers.
- Activation functions- the functions which give non linearity to the linear inputs are termed as activation functions. They are responsible for producing the desired output.

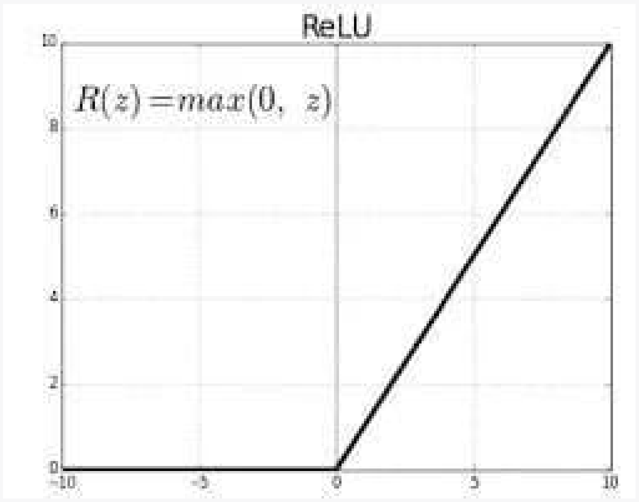
$$Y = \sum ((weights*input) + bias)$$

The activation functions we are using in our module are:-

1) Sigmoid activation function- It is a s-shaped curve which gives the output between 0 and 1. The formula of this activation function is f(x) = 1 / (1 + exp(-x)).



2) Relu activation function- it introduces non linearity by mapping all the negative values to 0 and keeping the positive values unchanged.



Loss function - It gives us the difference between the predicted output value and the output value produced..The goal of training epochs is to minimize the loss function.

The loss function which we used in our model is binary cross entropy (log loss)

- Binary cross entropy- it measures the dissimilarity between the actual output value and predicted output value

Binary Cross-Entropy = - (y_actual * log(y_pred) + (1 - y_actual) * log(1 - y_pred))

$$logloss = -\frac{1}{N}\sum_{i}^{N}\sum_{j}^{M} y_{ij}\log(p_{ij})$$

- N is the number of rows.
- M is the number of classes.

4.1 Convolutional Neural Network-

It is a type of neural network to process the structured grid such as image, video.
They are very useful in object detection, image detection and many more. In this the filters present in the layers run over the image and detect various distinguishable. The filters extract important features from the input image and minimizes the spatial arrangement. After the layers pass through the input image, the activation function acts and introduces non linearity to the network.training cnn involves the regular updation of the weights and the biases in order to decrease the loss function.back propagation and gradient descent are responsible for the updation of these parameters.

The functions of convolutional neural network which we used in our model are:-

- Max pooling layer-max pooling is an important operation of CNN which helps to reduce the spatial distribution of the feature maps. This filter helps to extract the maximum value from each region by passing the filter of the required n*n matrix

- Conv2D- 2D convolutional layers perform convolution operations on 2D input data (e.g., images) using filters or kernels to extract features. The function mentioned here takes its input as, no. of filters, n*n matrix and the activation function to be applied

- Flatten- flatten is used in neural networks to reshape the data before passing it into the fully connected layer. It is used to convert a 2D ar a multi dimensional array into 1 dimensional vector that can used to feed into the succeeding layers

- Dense- It connects every neuron from the previous layer to every neuron in the current layer. It takes inputs as the no. of neurons and activation function to be applied.

4.2 Siamese Neural Network

Siamese Neural Network is a comparator model i.e. checks whether two samples (images) passed are similar or not. And for our project, we've molded this for our task of classification. Its implementation involves the application of the same CNN to 2 images, as mentioned below. The inputs which pass through the two networks are anchor image and positive/negative image. The third argument is the label which is either 0 or 1. After the model is trained (here 50 EPOCHS) we expect the computer to be able to recognize the negative and positive images for the provided anchor images. For negative image, 0 is given as output which shows that the image is dissimilar to the anchor and for positive 1 is given as

output which verifies the image passed. With the help of a siamese model the two inputs are passed and they are classified on the basis of their training accuracy.

Siamese Network architecture

- It is a combination of 2 shallow(few hidden layers), identical CNNs. The structure can be anything you wish to have.
- The parameters between these CNNs are shared i.e. same weights and biases being used for both the CNNs. Only one set of weights is trained and used for both CNNs.
- It uses triplet or contrastive loss functions. Never heard of them? will discuss soon
- The final expected output is a binary (0 or 1) where 1= similar images else 0.

Loss Functions

- It is a loss/cost/error function that works when there are discrete outputs in the problem, more specifically when there are only 2 discrete quantities then this function is the best choice in Deep Learning.
- Then Binary cross-entropy loss is calculated as follows:

$$BCE = -\frac{1}{N}\sum_{i=1}^{i=N}[y\_true_i \cdot log(y\_pred_i) + (1 - y\_true_i) \cdot log(1 - y\_pred_i)]$$

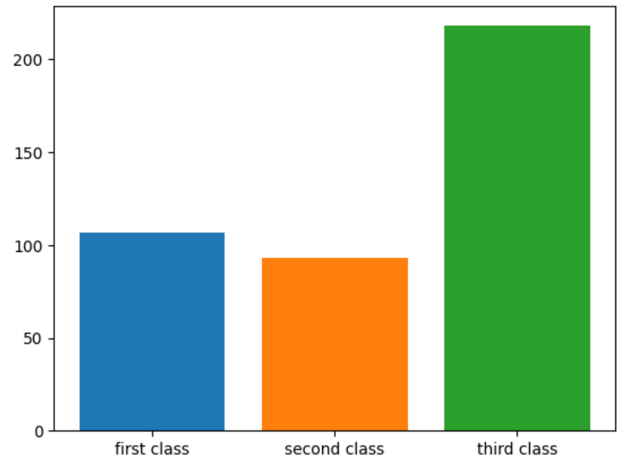
$$BCE = -\frac{1}{N}\sum_{i=1}^{i=N}[y_i \cdot log(\widehat{y_i}) + (1 - y_i) \cdot log(1 - \widehat{y_i})]$$

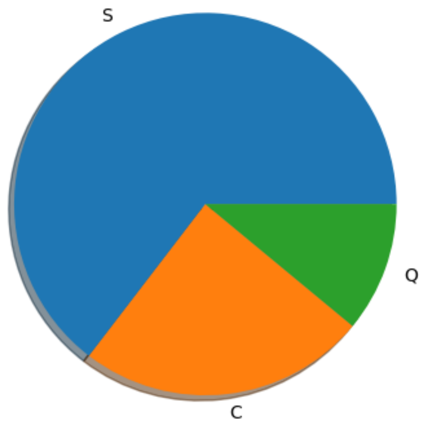
$$\begin{aligned}\implies BCE = -\frac{1}{3}[&y_1 \cdot log(\widehat{y_1}) + (1 - y_1) \cdot log(1 - \widehat{y_1}) + \\ &y_2 \cdot log(\widehat{y_2}) + (1 - y_2) \cdot log(1 - \widehat{y_2}) + \\ &y_3 \cdot log(\widehat{y_3}) + (1 - y_3) \cdot log(1 - \widehat{y_3})]\end{aligned}$$

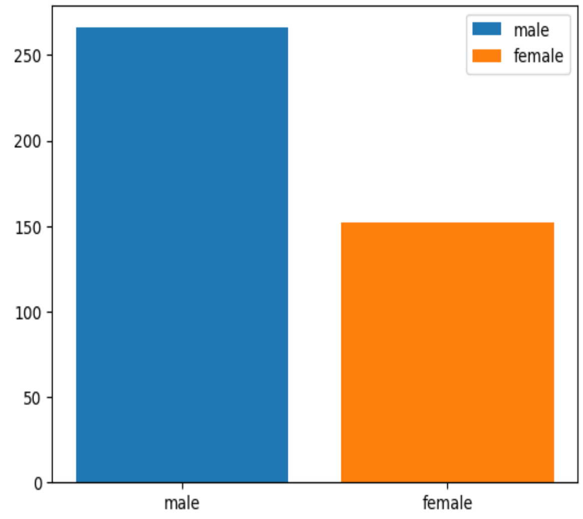
5. TASKS

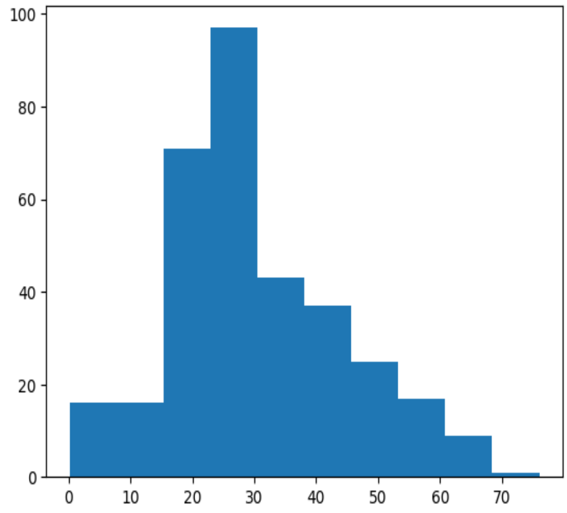
5.1 Analyzing the titanic dataset and plotting graphs accordingly.

- The outputs are as follows:







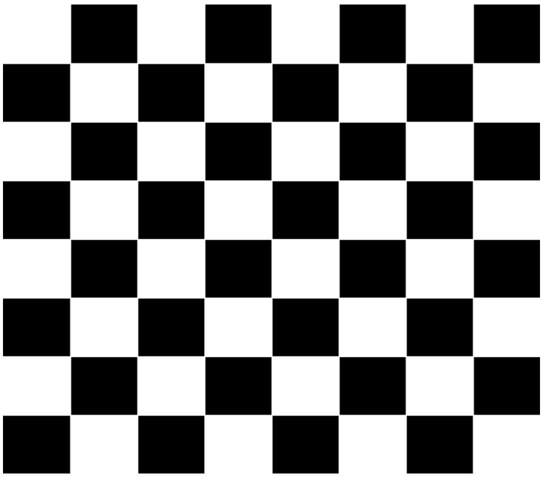


5.2 Making a chessboard

Code :-

```
Import cv2
Import numpy as np
rows = 8

colms = 8
square_size = 50

blackSreen = np.zeros((rows * square_size, colms * square_size, 3),np.uint8)  # creating a black screen using numpy

for row in range(rows):
    for col in range(colms):
        #print(row)


        print(col)
        x = col * square_size
        y = row * square_size

        if (row + col) % 2 != 0:
            blackSreen[y:y + square_size, x:x + square_size] = [255, 255, 255]

cv2.imshow('Chessboard', blackSreen)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

The Output :-

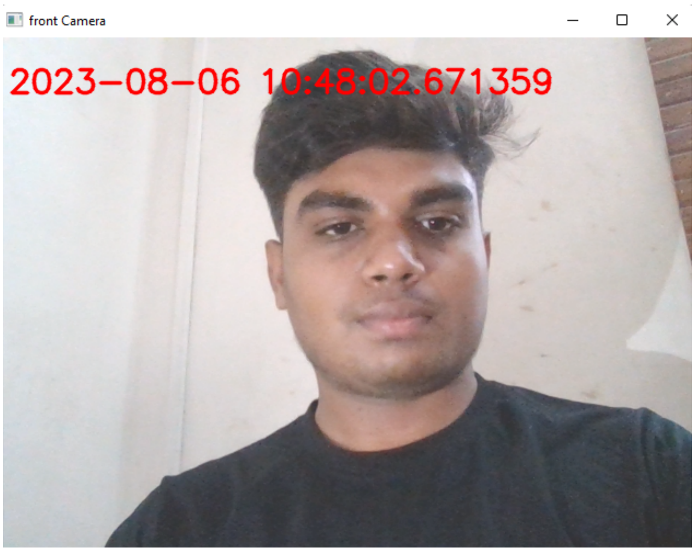


5.3 Design a selfie capturing system

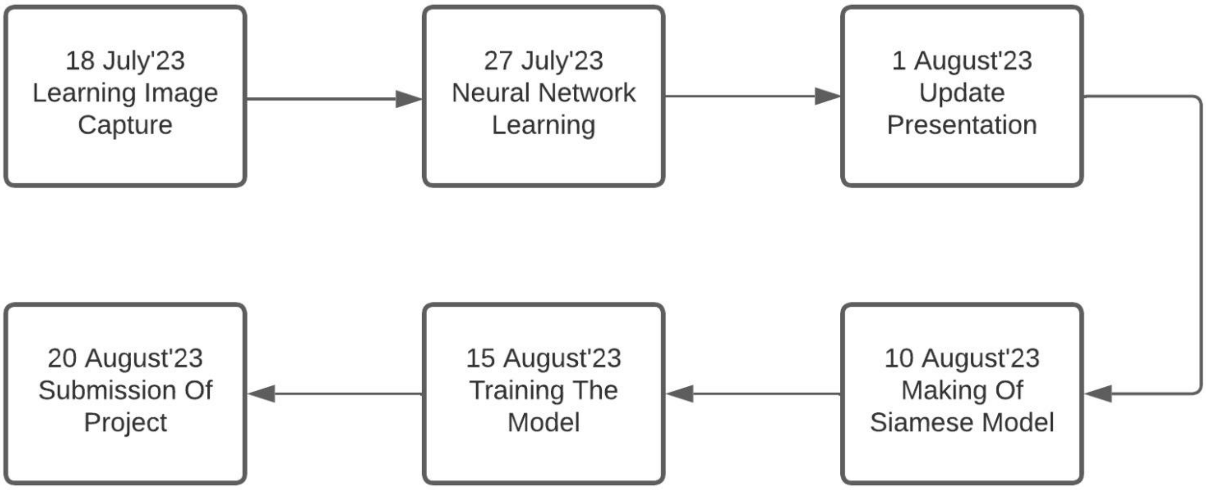
Code :-

```
import cv2
import datetime

cap = cv2.VideoCapture(0)

while True:
    ret, frame = cap.read()
    font = cv2.FONT_HERSHEY_SIMPLEX
    dt = str(datetime.datetime.now())
    print(dt)

    frame= cv2.putText(frame,dt,(10,50),font,1,(0,0,255),2,cv2.LINE_AA)
    cv2.imshow('front Camera', frame)

    if cv2.waitKey(1) & 0xFF == ord('c'):
        cv2.imwrite('photo.png', frame)  # saving image using imwrite()
        print("image saved!")

    elif cv2.waitKey(1) & 0xFF == ord('b'):
        break

cap.release()
cv2.destroyAllWindows()
```

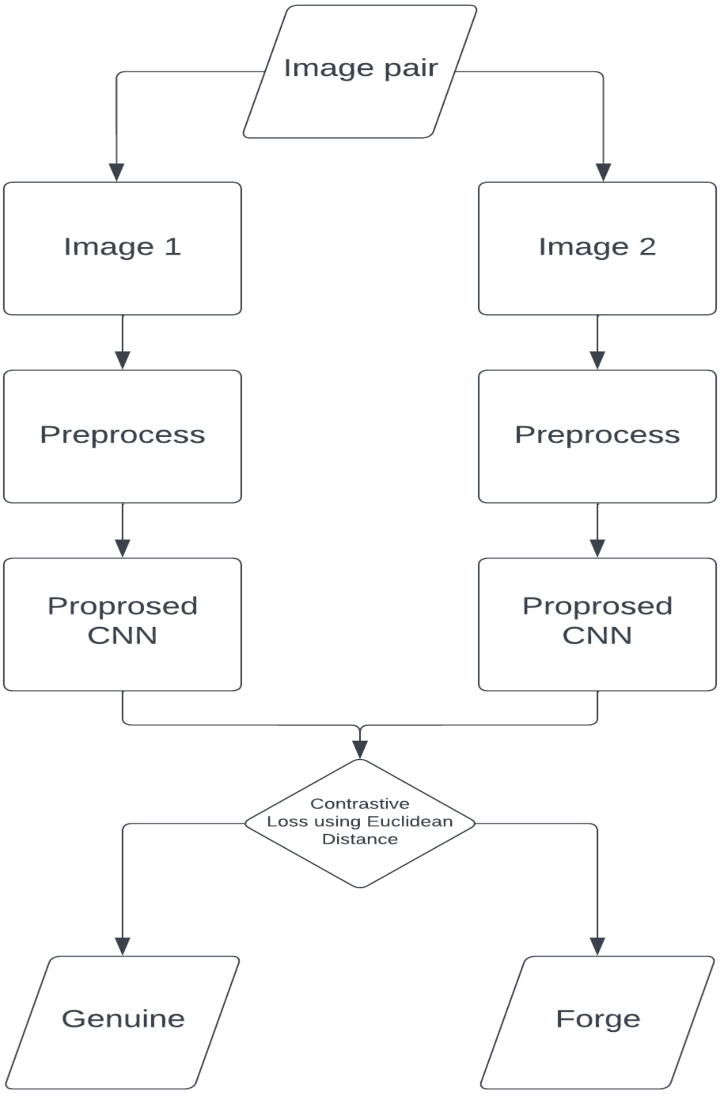
The Output :-



6. TIMELINE

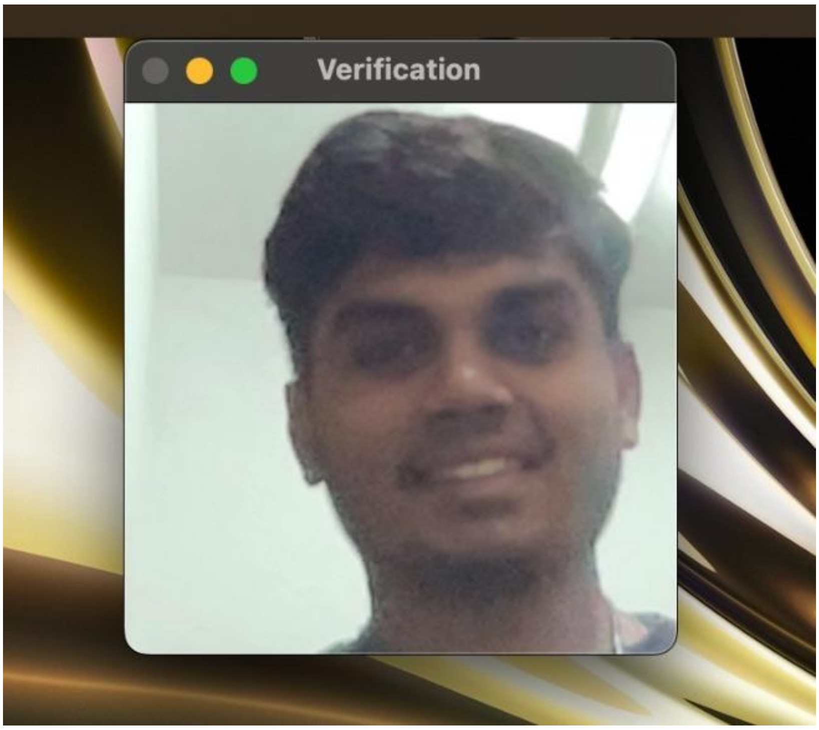


7. FLOWCHART

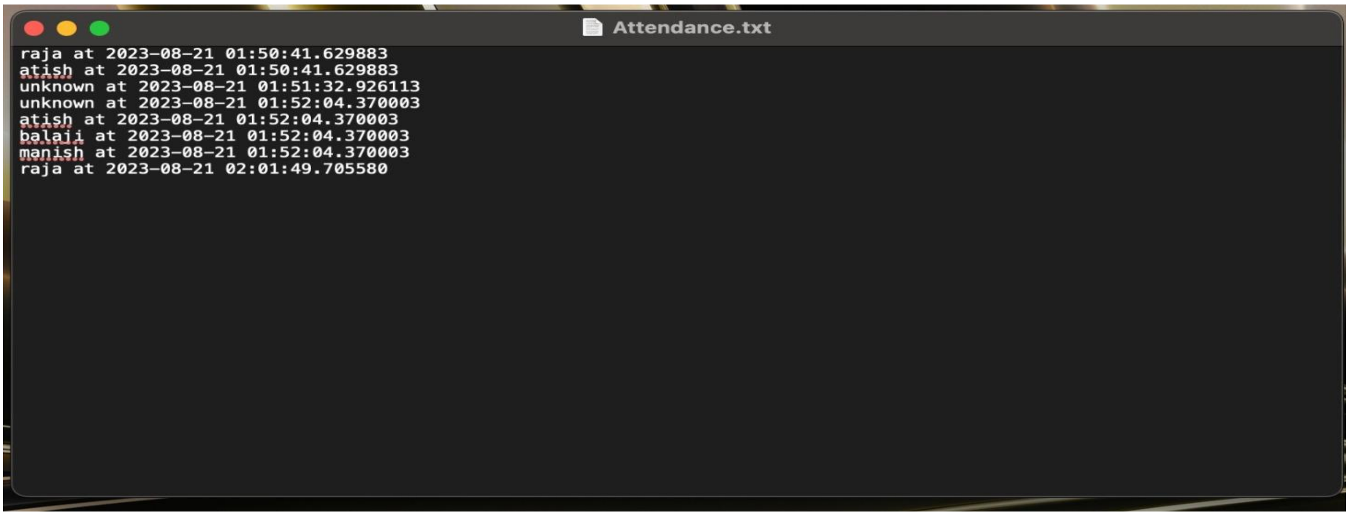


8. FINAL RESULT

Input image provided from a webcam



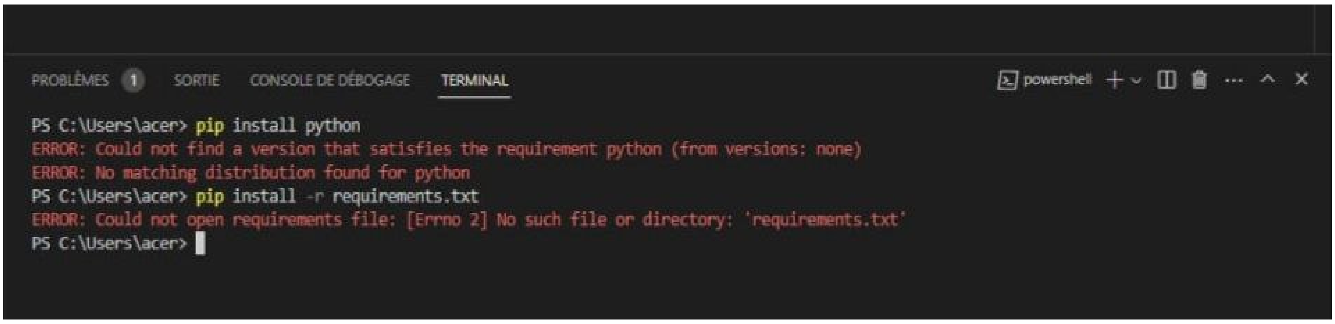
As output we got the attendance recorded in a text file



```
raja at 2023-08-21 01:50:41.629883
atish at 2023-08-21 01:50:41.629883
unknown at 2023-08-21 01:51:32.926113
unknown at 2023-08-21 01:52:04.370003
atish at 2023-08-21 01:52:04.370003
balaji at 2023-08-21 01:52:04.370003
manish at 2023-08-21 01:52:04.370003
raja at 2023-08-21 02:01:49.705580
```

9. ERRORS

1. Stack Overflow -Error while installing Matplotlib in vscode



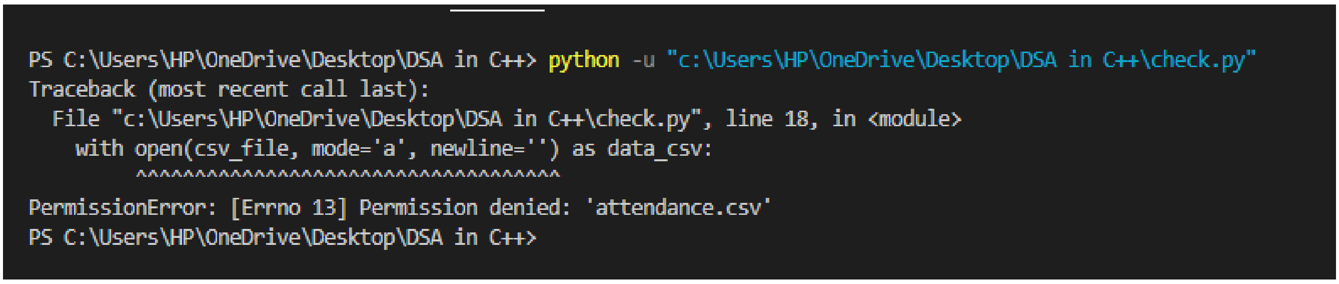
```
PS C:\Users\acer> pip install python
ERROR: Could not find a version that satisfies the requirement python (from versions: none)
ERROR: No matching distribution found for python
PS C:\Users\acer> pip install -r requirements.txt
ERROR: Could not open requirements file: [Errno 2] No such file or directory: 'requirements.txt'
PS C:\Users\acer>
```

Solution :-

- Upgrade pip: Run the command pip install --upgrade pip to make sure you have the latest version of pip.
- Clear cache: Sometimes, cached data can cause issues during installation. Try running pip cache purge to clear the pip cache

.

2. Permission error

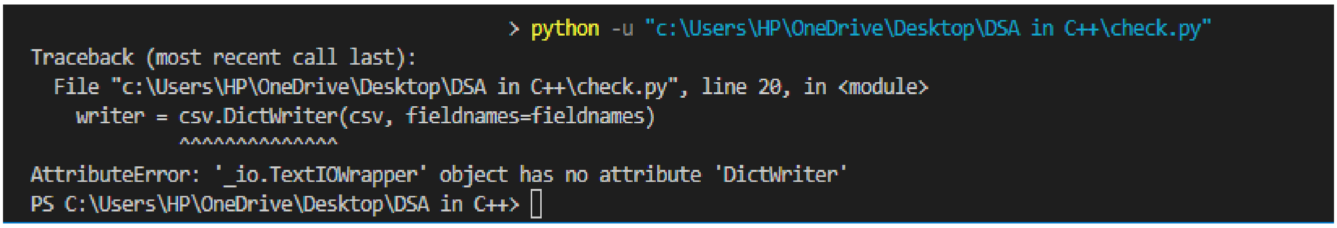


```
PS C:\Users\HP\OneDrive\Desktop\DSA in C++> python -u "c:\Users\HP\OneDrive\Desktop\DSA in C++\check.py"
Traceback (most recent call last):
  File "c:\Users\HP\OneDrive\Desktop\DSA in C++\check.py", line 18, in <module>
    with open(csv_file, mode='a', newline='') as data_csv:
         ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
PermissionError: [Errno 13] Permission denied: 'attendance.csv'
PS C:\Users\HP\OneDrive\Desktop\DSA in C++>
```

Solution :-

- Close File: Ensure that the file is not already open by another process. If the file is open, close it and tra. running the script again.
- Change File Mode: In your open() function, you have mode='a' and newline. It seems like you're missing the actual mode ('w' for write, 'a' for append, etc.) and the newline parameter should have a value assigned.

3. Attribute error



```
                                          > python -u "c:\Users\HP\OneDrive\Desktop\DSA in C++\check.py"
Traceback (most recent call last):
  File "c:\Users\HP\OneDrive\Desktop\DSA in C++\check.py", line 20, in <module>
    writer = csv.DictWriter(csv, fieldnames=fieldnames)
             ^^^^^^^^^^^^^^
AttributeError: '_io.TextIOWrapper' object has no attribute 'DictWriter'
PS C:\Users\HP\OneDrive\Desktop\DSA in C++>
```

Solution :-

Instead of Dictwriter, it should be DictWriter with a capital "W".

10. REFERENCES

1.https://faculty.washington.edu/otoomet/machinelearning-py/numpy-and-pandas.html (numpy ,pandas and matplotlib).
2. https://www.kaggle.com/datasets/yasserh/titanic-dataset (titanic dataset task).
3. https://youtu.be/kdLM6AOd2vc (opencv).
4.https://youtube.com/playlist?list=PLpFsSf5Dm-pd5d3rjNtIXUHT-v7bdaEIe(Neural Networks).
5.https://www.cs.cmu.edu/~rsalakhu/papers/oneshot1.pdf (Siamese Neural Network)