1.INTRODUCTION

1.1 Overview:

A Body Language Decoder using Mediapipe involves creating a system that interprets and analyzes human body language using pose estimation techniques. The goal is to understand and interpret gestures, postures, and movements to infer emotions, intentions, or communication signals.

1.2 Purpose:

The Body Language Decoder using Mediapipe aims to develop an intelligent system that interprets and decodes human body language from real-time video streams. Leveraging the power of Mediapipe's pose estimation, the project seeks to understand and classify subtle cues such as gestures and postures, providing valuable insights into an individual's emotional state and intentions. This technology can find applications in diverse fields, including communication enhancement, human-computer interaction, and emotion-aware computing, fostering a deeper understanding of non-verbal communication for improved interpersonal dynamics and user experience

2.LITERATURE SURVEY

2.1 Existing problem

The existing problem in the "BODY LANGUAGE DECODER USING MEDIAPIPE" project lies in the lack of a specialized dataset for training the model to accurately decode a wide range of body language cues. Creating a comprehensive and diverse dataset that covers various gestures, postures, and expressions is crucial for enhancing the model's performance and generalizability. Additionally, ensuring ethical data collection practices and addressing potential biases in the dataset are essential to develop a reliable and unbiased body language decoder. Further refinements in the training process, model architecture, and real-world testing scenarios are needed to achieve optimal results.

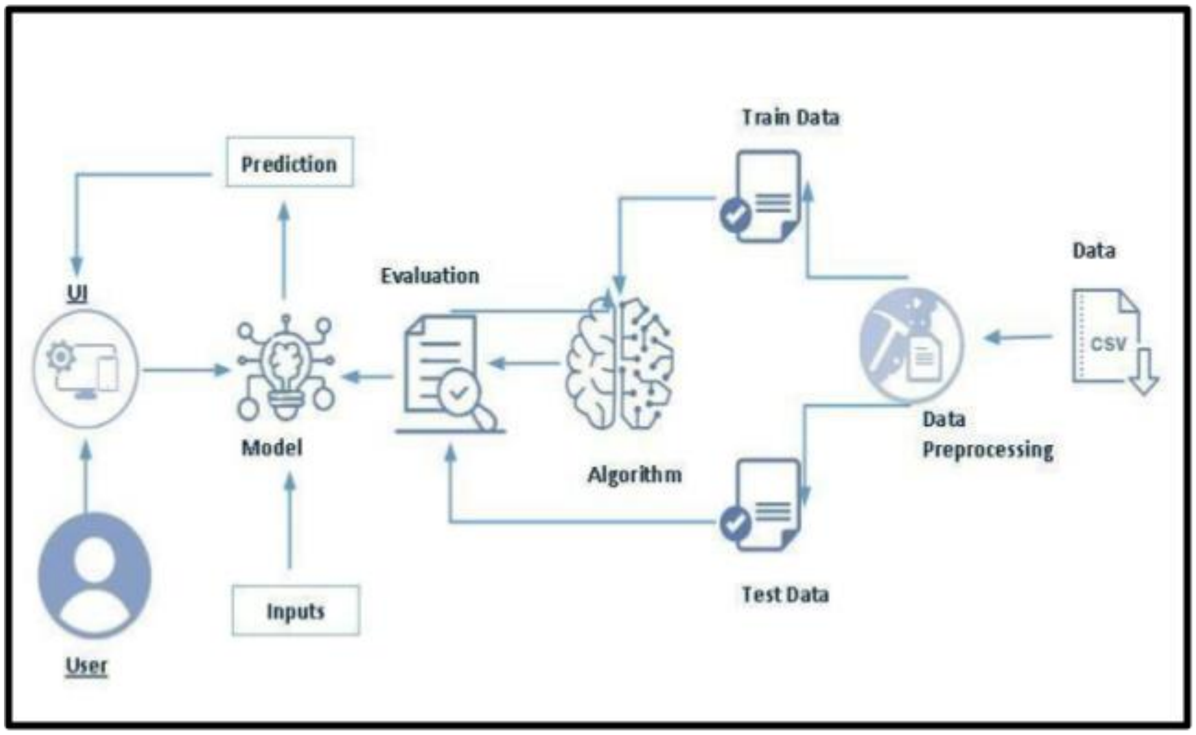
2.2 Proposed solutions

The proposed solution is to develop a Body Language Decoder using the Mediapipe library, which enables real-time detection of key body landmarks through webcam input. Leveraging pose estimation and hand tracking, the system interprets gestures, posture, and facial expressions. These features are then analyzed and classified using machine learning, allowing the system to decode body language cues such as confidence, openness, and positivity. The extracted data is stored in a CSV file for further analysis. This project aims to enhance communication understanding, emotional intelligence, and human-computer interaction through the interpretation of non-verbal cues.

3.THEORETICAL ANALYSIS

3.1 Technical Architecture

Technical Architecture:



3.2 Hardware and Software Designing

To complete this project, you must require following software's , concepts and packages

VS Code :

Refer to the link below to download VS Code.

- Link : https://code.visualstudio.com/download

- Create Project:
    - Open VS Code.
    - Create a Folder and name it "AI_Body_Language_Detector" .

- Machine Learning Concepts
    - Machine Learning: https://towardsdatascience.com/machine-learning-an-introduction-23b84d51e6d0
    - ML Models : https://towardsdatascience.com/all-machine-learning-models-explained-in-6-minutes- 9fe30ff6776a
- Web concepts:
    - o Get the gist on streamlit :

      https://www.geeksforgeeks.org/a-beginners-guide-to-streamlit/
- Mediapipe:
    - o About Mediapipe :

      https://www.geeksforgeeks.org/python-facial-and-hand-recognition-using-mediapipe-holistic/

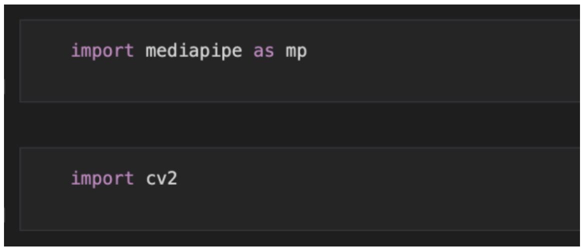
4. DATA COLLECTION

4.1 Collect The Dataset

ML depends heavily on data. It is the most crucial aspect that makes algorithm training possible. So, this section allows you to create the required dataset.

4.1.2: Make Some Detections.

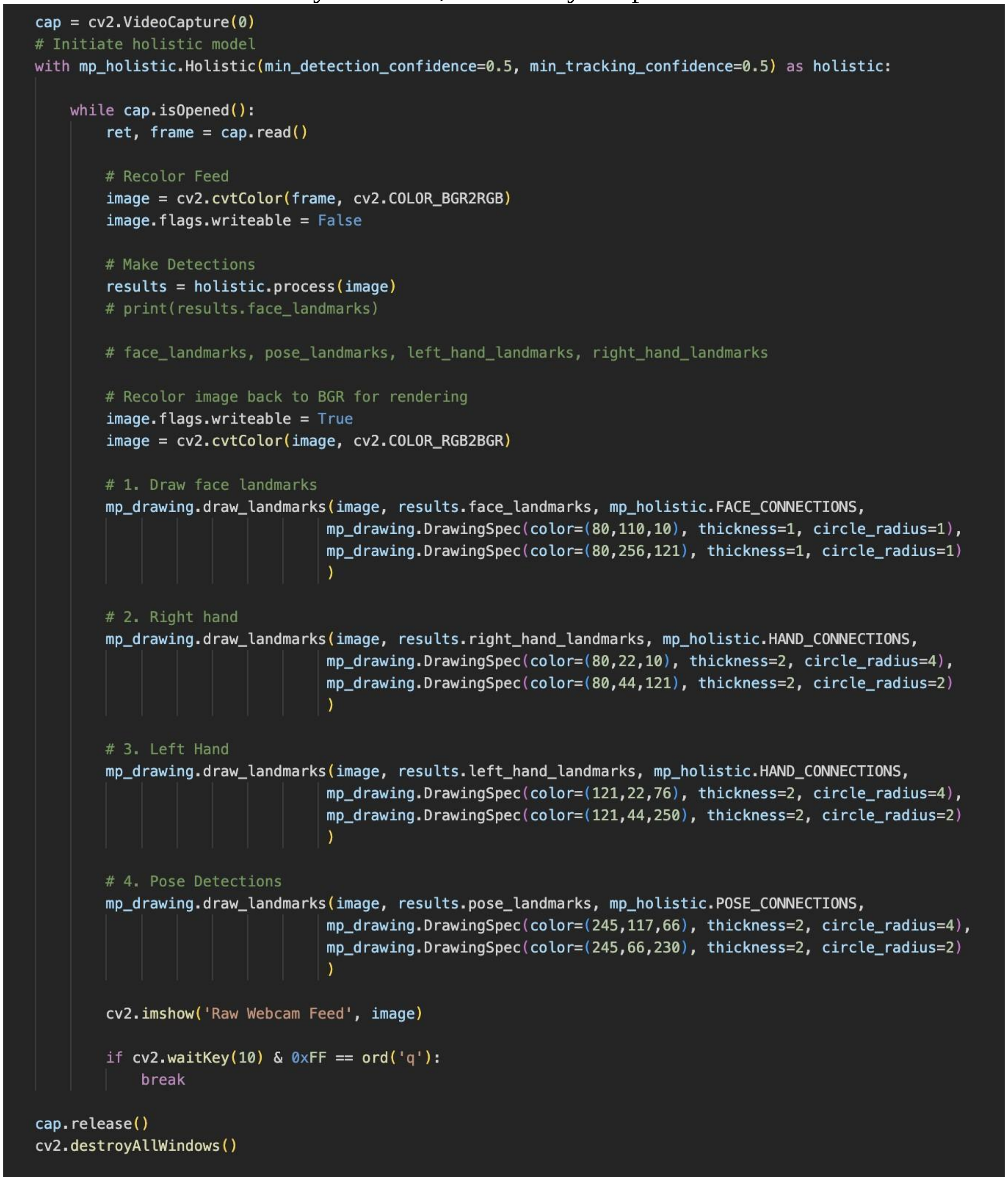
First we will import some required packages


```python
import mediapipe as mp
```

```python
import cv2
```

The MediaPipe Holistic Landmarker task lets you combine components of the pose, face, and hand landmarks to create a complete landmarker for the human body.

Now we’ll make some detections of face, hands and pose.The below code will detect and draw lines on you hands, face and your pose.

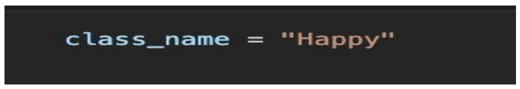


```python
cap = cv2.VideoCapture(0)
# Initiate holistic model
with mp_holistic.Holistic(min_detection_confidence=0.5, min_tracking_confidence=0.5) as holistic:

    while cap.isOpened():
        ret, frame = cap.read()

        # Recolor Feed
        image = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
        image.flags.writeable = False

        # Make Detections
        results = holistic.process(image)
        # print(results.face_landmarks)

        # face_landmarks, pose_landmarks, left_hand_landmarks, right_hand_landmarks

        # Recolor image back to BGR for rendering
        image.flags.writeable = True
        image = cv2.cvtColor(image, cv2.COLOR_RGB2BGR)

        # 1. Draw face landmarks
        mp_drawing.draw_landmarks(image, results.face_landmarks, mp_holistic.FACE_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(80,110,10), thickness=1, circle_radius=1),
                                 mp_drawing.DrawingSpec(color=(80,256,121), thickness=1, circle_radius=1)
                                 )

        # 2. Right hand
        mp_drawing.draw_landmarks(image, results.right_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(80,22,10), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(80,44,121), thickness=2, circle_radius=2)
                                 )

        # 3. Left Hand
        mp_drawing.draw_landmarks(image, results.left_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(121,22,76), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(121,44,250), thickness=2, circle_radius=2)
                                 )

        # 4. Pose Detections
        mp_drawing.draw_landmarks(image, results.pose_landmarks, mp_holistic.POSE_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(245,117,66), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(245,66,230), thickness=2, circle_radius=2)
                                 )

        cv2.imshow('Raw Webcam Feed', image)

        if cv2.waitKey(10) & 0xFF == ord('q'):
            break

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

Once you run this code, your webcam will get activated and you can see the detections of your face, hands and pose.

4.1.2: Collecting Data For Happy Mood

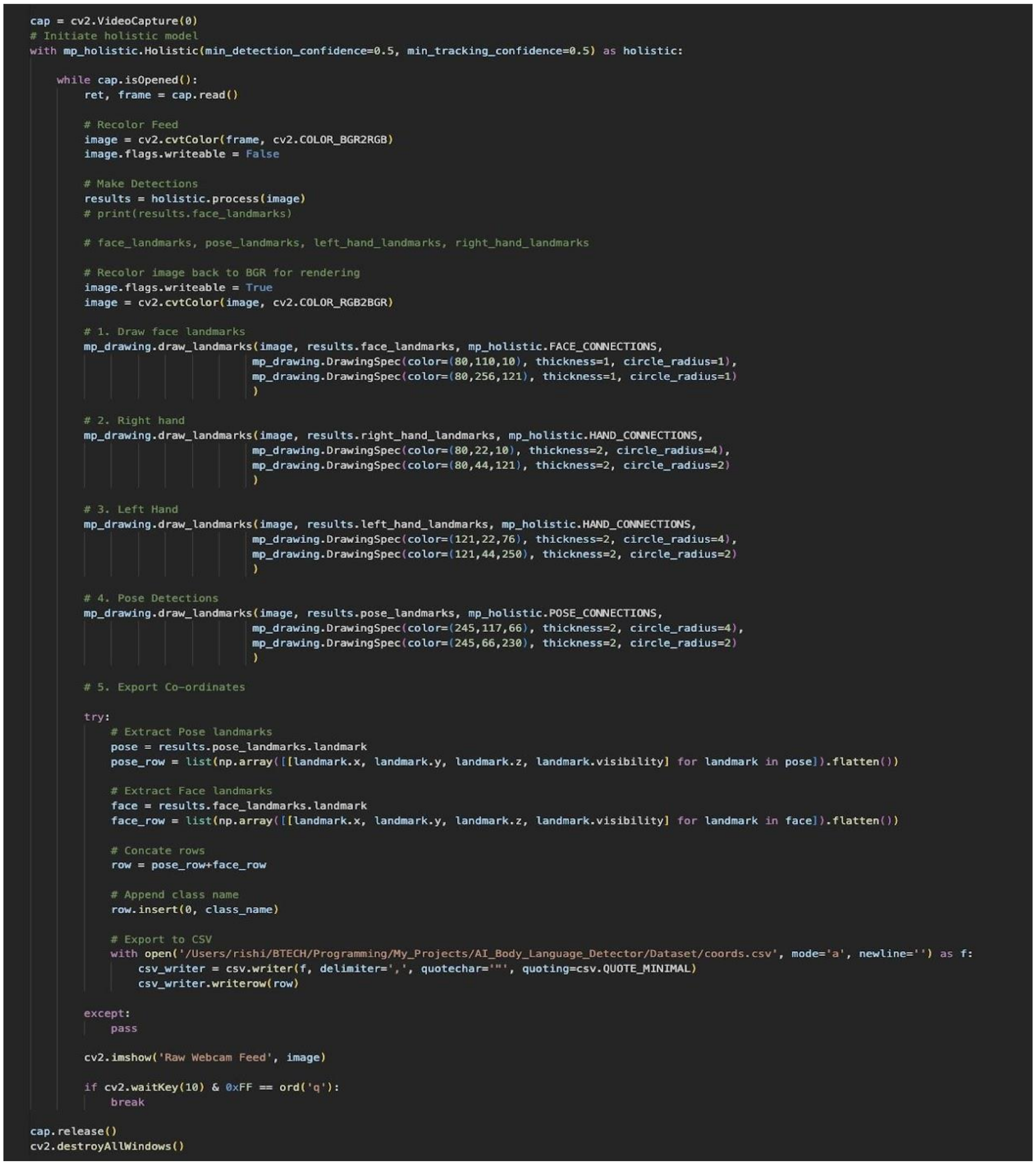
Initialize a variable “class_name” equals “Happy”.



```
class_name = "Happy"
```

Now let us write a code which allows us to detect our body landmarks and save them into a .csv file.

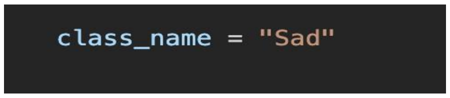
For now we’ll collect the data for happy mode. So, once you run the code your webcam will get activated and you’ve to record your happy face for 10-15 seconds and close the window.



```python
cap = cv2.VideoCapture(0)
# Initiate holistic model
with mp_holistic.Holistic(min_detection_confidence=0.5, min_tracking_confidence=0.5) as holistic:

    while cap.isOpened():
        ret, frame = cap.read()

        # Recolor Feed
        image = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
        image.flags.writeable = False

        # Make Detections
        results = holistic.process(image)
        # print(results.face_landmarks)

        # face_landmarks, pose_landmarks, left_hand_landmarks, right_hand_landmarks

        # Recolor image back to BGR for rendering
        image.flags.writeable = True
        image = cv2.cvtColor(image, cv2.COLOR_RGB2BGR)

        # 1. Draw face landmarks
        mp_drawing.draw_landmarks(image, results.face_landmarks, mp_holistic.FACE_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(80,110,10), thickness=1, circle_radius=1),
                                 mp_drawing.DrawingSpec(color=(80,256,121), thickness=1, circle_radius=1)
                                 )

        # 2. Right hand
        mp_drawing.draw_landmarks(image, results.right_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(80,22,10), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(80,44,121), thickness=2, circle_radius=2)
                                 )

        # 3. Left Hand
        mp_drawing.draw_landmarks(image, results.left_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(121,22,76), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(121,44,250), thickness=2, circle_radius=2)
                                 )

        # 4. Pose Detections
        mp_drawing.draw_landmarks(image, results.pose_landmarks, mp_holistic.POSE_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(245,117,66), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(245,66,230), thickness=2, circle_radius=2)
                                 )

        # 5. Export Co-ordinates

        try:
            # Extract Pose landmarks
            pose = results.pose_landmarks.landmark
            pose_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in pose]).flatten())

            # Extract Face landmarks
            face = results.face_landmarks.landmark
            face_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in face]).flatten())

            # Concate rows
            row = pose_row+face_row

            # Append class name
            row.insert(0, class_name)

            # Export to CSV
            with open('/Users/rishi/BTECH/Programming/My_Projects/AI_Body_Language_Detector/Dataset/coords.csv', mode='a', newline='') as f:
                csv_writer = csv.writer(f, delimiter=',', quotechar='"', quoting=csv.QUOTE_MINIMAL)
                csv_writer.writerow(row)

        except:
            pass

        cv2.imshow('Raw Webcam Feed', image)

        if cv2.waitKey(10) & 0xFF == ord('q'):
            break

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

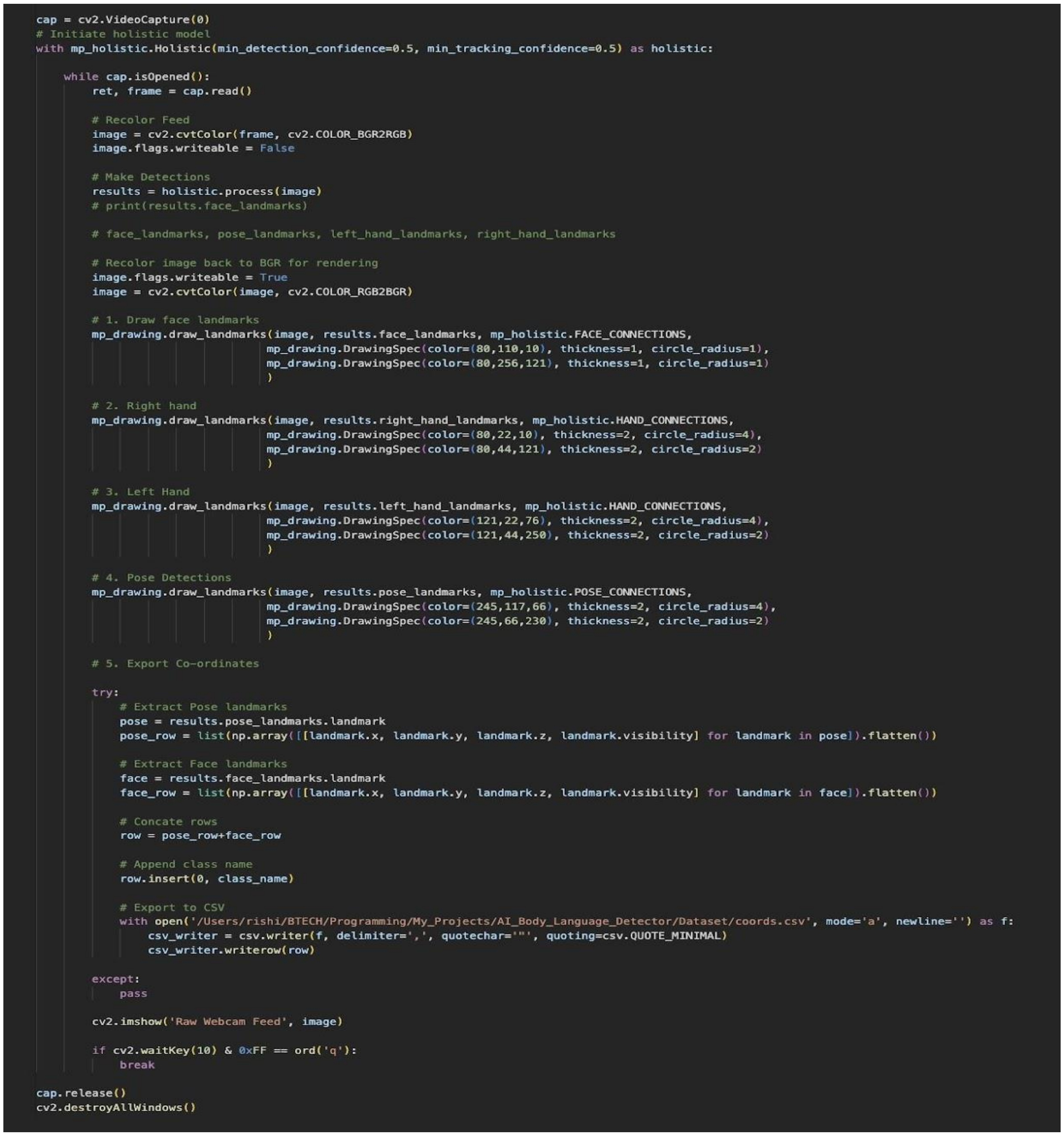
4.1.3: Collecting Data For Sad Mood

Initialize a variable “class_name” equals “Sad”.



```python
class_name = "Sad"
```

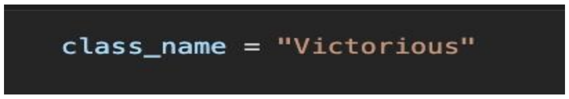
Now let us write a code which allows us to detect our body landmarks and save them into a .csv file.
For now we'll collect the data for sad mode. So, once you run the code your webcam will get activated and you've to record your sad face for 10-15 seconds and close the window.



```python
cap = cv2.VideoCapture(0)
# Initiate holistic model
with mp_holistic.Holistic(min_detection_confidence=0.5, min_tracking_confidence=0.5) as holistic:

    while cap.isOpened():
        ret, frame = cap.read()

        # Recolor Feed
        image = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
        image.flags.writeable = False

        # Make Detections
        results = holistic.process(image)
        # print(results.face_landmarks)

        # face_landmarks, pose_landmarks, left_hand_landmarks, right_hand_landmarks

        # Recolor image back to BGR for rendering
        image.flags.writeable = True
        image = cv2.cvtColor(image, cv2.COLOR_RGB2BGR)

        # 1. Draw face landmarks
        mp_drawing.draw_landmarks(image, results.face_landmarks, mp_holistic.FACE_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(80,110,10), thickness=1, circle_radius=1),
                                 mp_drawing.DrawingSpec(color=(80,256,121), thickness=1, circle_radius=1)
                                 )

        # 2. Right hand
        mp_drawing.draw_landmarks(image, results.right_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(80,22,10), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(80,44,121), thickness=2, circle_radius=2)
                                 )

        # 3. Left Hand
        mp_drawing.draw_landmarks(image, results.left_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(121,22,76), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(121,44,250), thickness=2, circle_radius=2)
                                 )

        # 4. Pose Detections
        mp_drawing.draw_landmarks(image, results.pose_landmarks, mp_holistic.POSE_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(245,117,66), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(245,66,230), thickness=2, circle_radius=2)
                                 )

        # 5. Export Co-ordinates

        try:
            # Extract Pose landmarks
            pose = results.pose_landmarks.landmark
            pose_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in pose]).flatten())

            # Extract Face landmarks
            face = results.face_landmarks.landmark
            face_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in face]).flatten())

            # Concate rows
            row = pose_row+face_row

            # Append class name
            row.insert(0, class_name)

            # Export to CSV
            with open('/Users/rishi/BTECH/Programming/My_Projects/AI_Body_Language_Detector/Dataset/coords.csv', mode='a', newline='') as f:
                csv_writer = csv.writer(f, delimiter=',', quotechar='"', quoting=csv.QUOTE_MINIMAL)
                csv_writer.writerow(row)

        except:
            pass

        cv2.imshow('Raw Webcam Feed', image)

        if cv2.waitKey(10) & 0xFF == ord('q'):
            break

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

4.1.2: Collecting Data For Victorious Mood

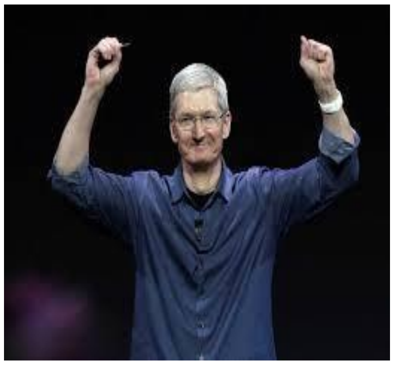
Initialize a variable "class_name" equals "Victorious".



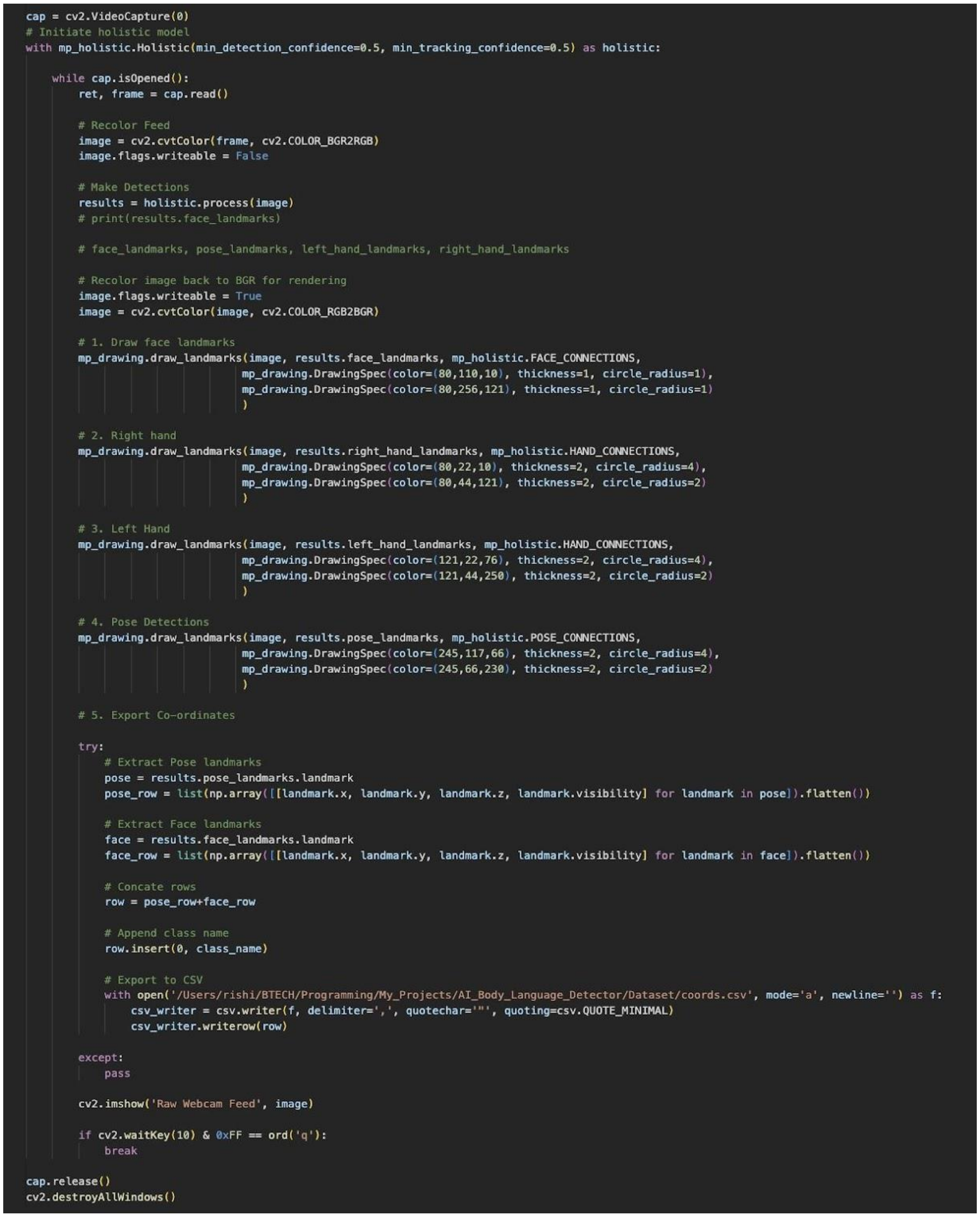
```
class_name = "Victorious"
```

Now let us write a code which allows us to detect our body landmarks and save them into a .csv file.

Victorious Body Language : Put your two hands up and hold your fists. Just how Tim Cook is posing.



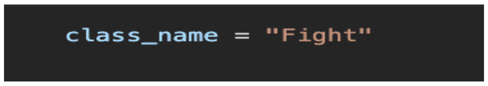
For now we’ll collect the data for victorious mode. So, once you run the code your webcam will get activated and you’ve to record your victorious body language for 10-15 seconds and close the window.



```python
cap = cv2.VideoCapture(0)
# Initiate holistic model
with mp_holistic.Holistic(min_detection_confidence=0.5, min_tracking_confidence=0.5) as holistic:

    while cap.isOpened():
        ret, frame = cap.read()

        # Recolor Feed
        image = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
        image.flags.writeable = False

        # Make Detections
        results = holistic.process(image)
        # print(results.face_landmarks)

        # face_landmarks, pose_landmarks, left_hand_landmarks, right_hand_landmarks

        # Recolor image back to BGR for rendering
        image.flags.writeable = True
        image = cv2.cvtColor(image, cv2.COLOR_RGB2BGR)

        # 1. Draw face landmarks
        mp_drawing.draw_landmarks(image, results.face_landmarks, mp_holistic.FACE_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(80,110,10), thickness=1, circle_radius=1),
                                 mp_drawing.DrawingSpec(color=(80,256,121), thickness=1, circle_radius=1)
                                 )

        # 2. Right hand
        mp_drawing.draw_landmarks(image, results.right_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(80,22,10), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(80,44,121), thickness=2, circle_radius=2)
                                 )

        # 3. Left Hand
        mp_drawing.draw_landmarks(image, results.left_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(121,22,76), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(121,44,250), thickness=2, circle_radius=2)
                                 )

        # 4. Pose Detections
        mp_drawing.draw_landmarks(image, results.pose_landmarks, mp_holistic.POSE_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(245,117,66), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(245,66,230), thickness=2, circle_radius=2)
                                 )

        # 5. Export Co-ordinates

        try:
            # Extract Pose landmarks
            pose = results.pose_landmarks.landmark
            pose_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in pose]).flatten())

            # Extract Face landmarks
            face = results.face_landmarks.landmark
            face_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in face]).flatten())

            # Concate rows
            row = pose_row+face_row

            # Append class name
            row.insert(0, class_name)

            # Export to CSV
            with open('/Users/rishi/BTECH/Programming/My_Projects/AI_Body_Language_Detector/Dataset/coords.csv', mode='a', newline='') as f:
                csv_writer = csv.writer(f, delimiter=',', quotechar='"', quoting=csv.QUOTE_MINIMAL)
                csv_writer.writerow(row)

        except:
            pass

        cv2.imshow('Raw Webcam Feed', image)

        if cv2.waitKey(10) & 0xFF == ord('q'):
            break

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

4.1.2: Collecting Data For Fight Mood

Initialize a variable “class_name” equals “Fight”.

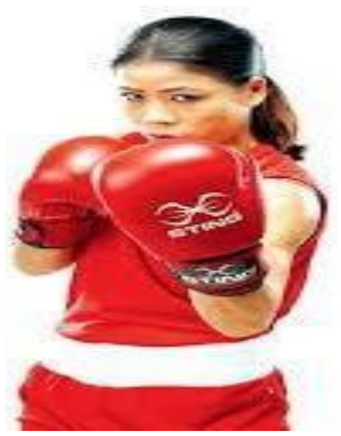


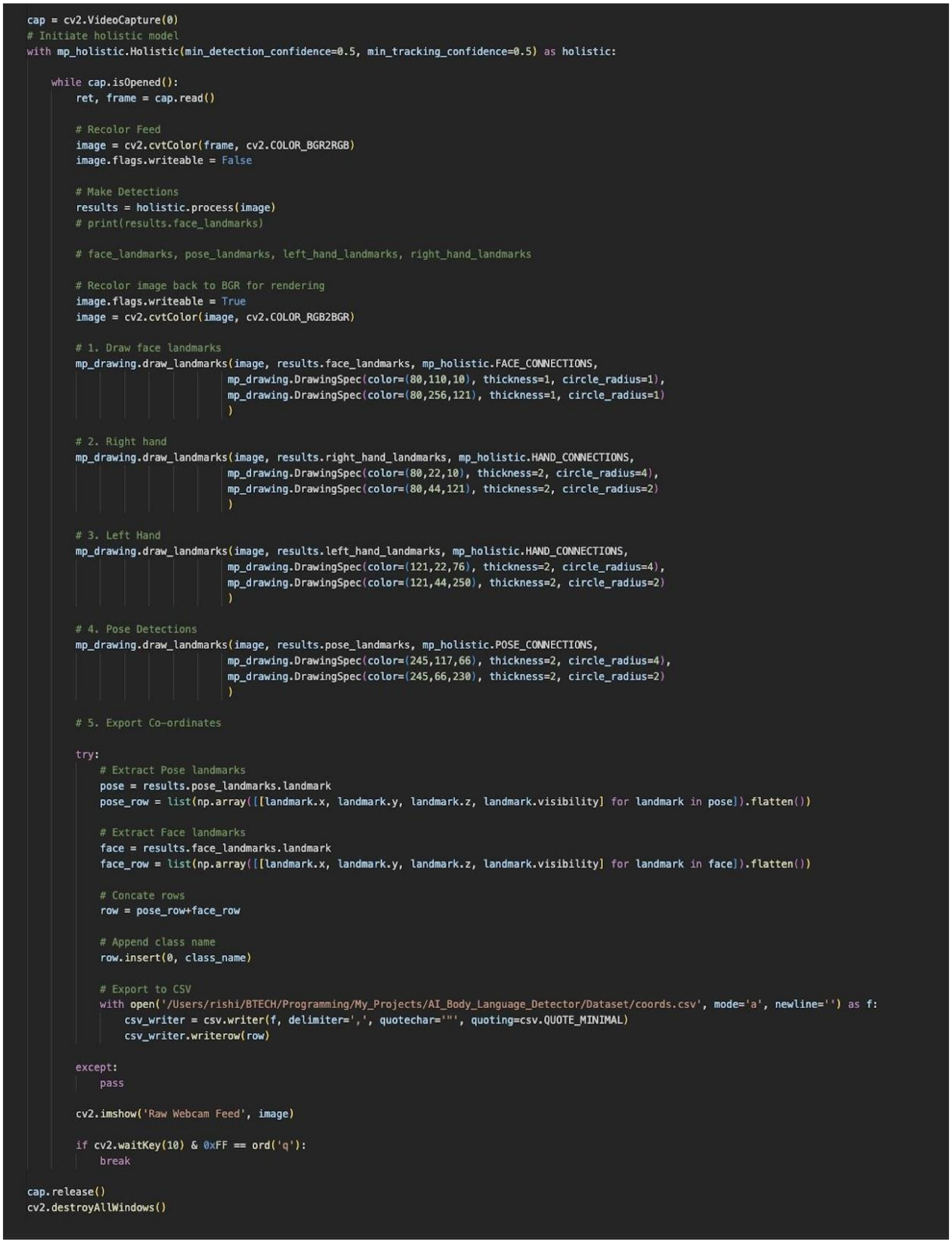
```
class_name = "Fight"
```

Now let us write a code which allows us to detect our body landmarks and save them into a .csv file.

For now we’ll collect the data for fight mode. So, once you run the code your webcam will get activated and you’ve to record your fight body language for 10-15 seconds and close the window.

Fight Body Language : Put your two hands in front of your face and hold your fists. Just how Mary Kom is posing.

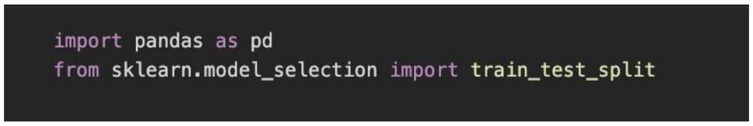




```python
cap = cv2.VideoCapture(0)
# Initiate holistic model
with mp_holistic.Holistic(min_detection_confidence=0.5, min_tracking_confidence=0.5) as holistic:

    while cap.isOpened():
        ret, frame = cap.read()

        # Recolor Feed
        image = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
        image.flags.writeable = False

        # Make Detections
        results = holistic.process(image)
        # print(results.face_landmarks)

        # face_landmarks, pose_landmarks, left_hand_landmarks, right_hand_landmarks

        # Recolor image back to BGR for rendering
        image.flags.writeable = True
        image = cv2.cvtColor(image, cv2.COLOR_RGB2BGR)

        # 1. Draw face landmarks
        mp_drawing.draw_landmarks(image, results.face_landmarks, mp_holistic.FACE_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(80,110,10), thickness=1, circle_radius=1),
                                 mp_drawing.DrawingSpec(color=(80,256,121), thickness=1, circle_radius=1)
                                 )

        # 2. Right hand
        mp_drawing.draw_landmarks(image, results.right_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(80,22,10), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(80,44,121), thickness=2, circle_radius=2)
                                 )

        # 3. Left Hand
        mp_drawing.draw_landmarks(image, results.left_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(121,22,76), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(121,44,250), thickness=2, circle_radius=2)
                                 )

        # 4. Pose Detections
        mp_drawing.draw_landmarks(image, results.pose_landmarks, mp_holistic.POSE_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(245,117,66), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(245,66,230), thickness=2, circle_radius=2)
                                 )

        # 5. Export Co-ordinates

        try:
            # Extract Pose landmarks
            pose = results.pose_landmarks.landmark
            pose_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in pose]).flatten())

            # Extract Face landmarks
            face = results.face_landmarks.landmark
            face_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in face]).flatten())

            # Concate rows
            row = pose_row+face_row

            # Append class name
            row.insert(0, class_name)

            # Export to CSV
            with open('/Users/rishi/BTECH/Programming/My_Projects/AI_Body_Language_Detector/Dataset/coords.csv', mode='a', newline='') as f:
                csv_writer = csv.writer(f, delimiter=',', quotechar='"', quoting=csv.QUOTE_MINIMAL)
                csv_writer.writerow(row)

        except:
            pass

        cv2.imshow('Raw Webcam Feed', image)

        if cv2.waitKey(10) & 0xFF == ord('q'):
            break

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

4.2: Read The Collected Data

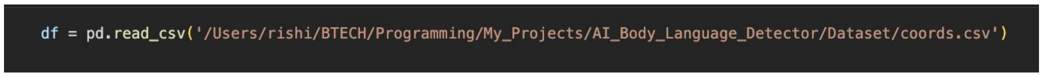
- Importing required packages :



```
import pandas as pd
from sklearn.model_selection import train_test_split
```

- Read the recorded .csv file :

Paste the path of the .csv file in the quotes.



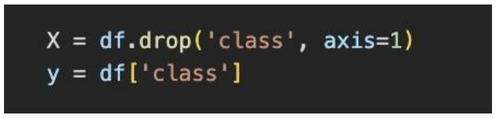
```
df = pd.read_csv('/Users/rishi/BTECH/Programming/My_Projects/AI_Body_Language_Detector/Dataset/coords.csv')
```

After this you can just run the following commands to view the data :

- *“ df.head() ”*
- “ df.tail() ”

4.3: Data Preparation:

As we have understood how the data is, let's pre-process the collected data.
Divide the data into dependent and independent variable

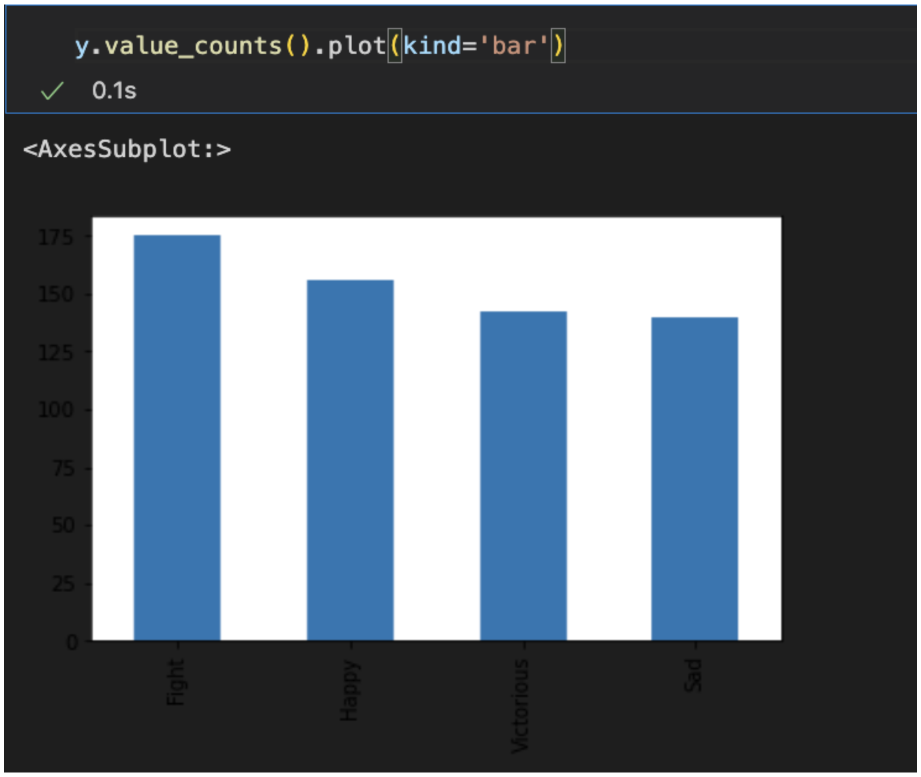


```
X = df.drop('class', axis=1)
y = df['class']
```

5. EXPLORATORY DATA ANALYSIS

5.1 VISUAL ANALYSIS:

Visual analysis is the process of using visual representations, such as charts, plots, and graphs, to explore and understand data. It is a way to quickly identify patterns, trends, and outliers in the data, which can help to gain insights and make informed decisions.Visual analysis is mostly used for numerical data



```
y.value_counts().plot(kind='bar')
✓ 0.1s
```

```
<AxesSubplot:>
```

Splitting Data Into Train And Test And Validation Sets

Now let's split the Dataset into train and test sets. The spilt will be in 8:2 ratio : train : test respectively.

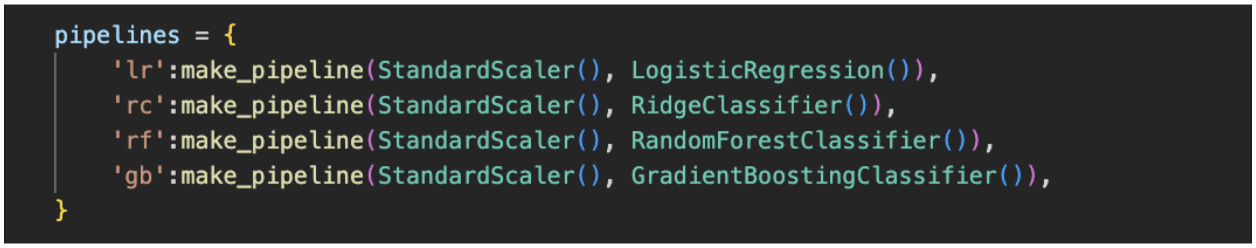
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=1234)
```

6.Model Building

Importing Necessary Libraries

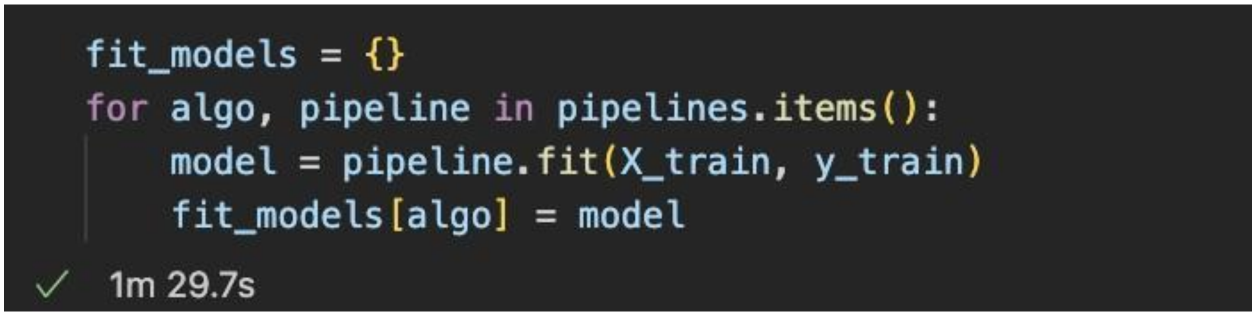
```
from sklearn.pipeline import make_pipeline
from sklearn.preprocessing import StandardScaler

from sklearn.linear_model import LogisticRegression, RidgeClassifier
from sklearn.ensemble import RandomForestClassifier, GradientBoostingClassifier
```

Designing A Pipeline To Train On Multiple Algorithms



```
pipelines = {
    'lr':make_pipeline(StandardScaler(), LogisticRegression()),
    'rc':make_pipeline(StandardScaler(), RidgeClassifier()),
    'rf':make_pipeline(StandardScaler(), RandomForestClassifier()),
    'gb':make_pipeline(StandardScaler(), GradientBoostingClassifier()),
}
```

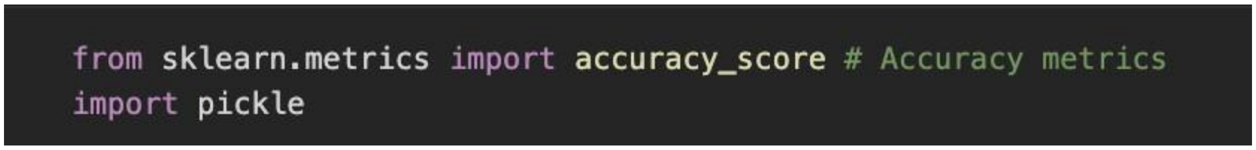
Train The Models



```
fit_models = {}
for algo, pipeline in pipelines.items():
    model = pipeline.fit(X_train, y_train)
    fit_models[algo] = model
✓  1m 29.7s
```

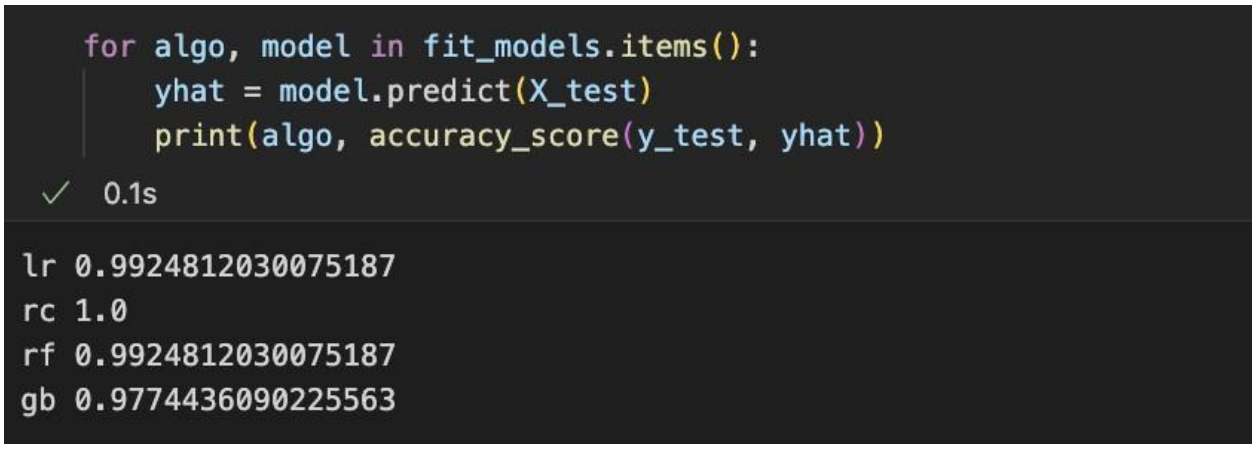
7. Model Deployment

Importing Packages



```
from sklearn.metrics import accuracy_score # Accuracy metrics
import pickle
```

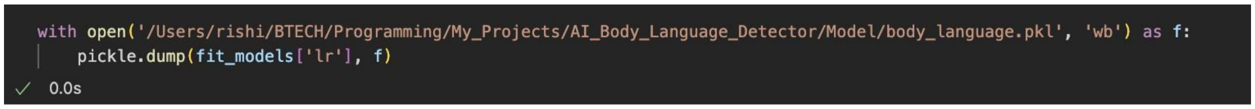
Model Evaluation



```
for algo, model in fit_models.items():
    yhat = model.predict(X_test)
    print(algo, accuracy_score(y_test, yhat))
✓  0.1s
```

```
lr 0.9924812030075187
rc 1.0
rf 0.9924812030075187
gb 0.9774436090225563
```

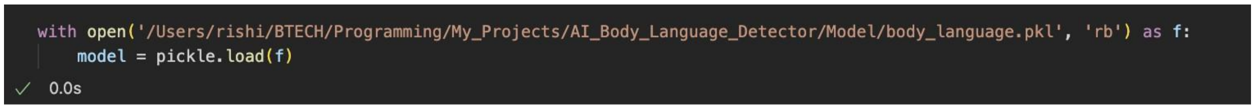
Save The Model



```
with open('/Users/rishi/BTECH/Programming/My_Projects/AI_Body_Language_Detector/Model/body_language.pkl', 'wb') as f:
    pickle.dump(fit_models['lr'], f)
```

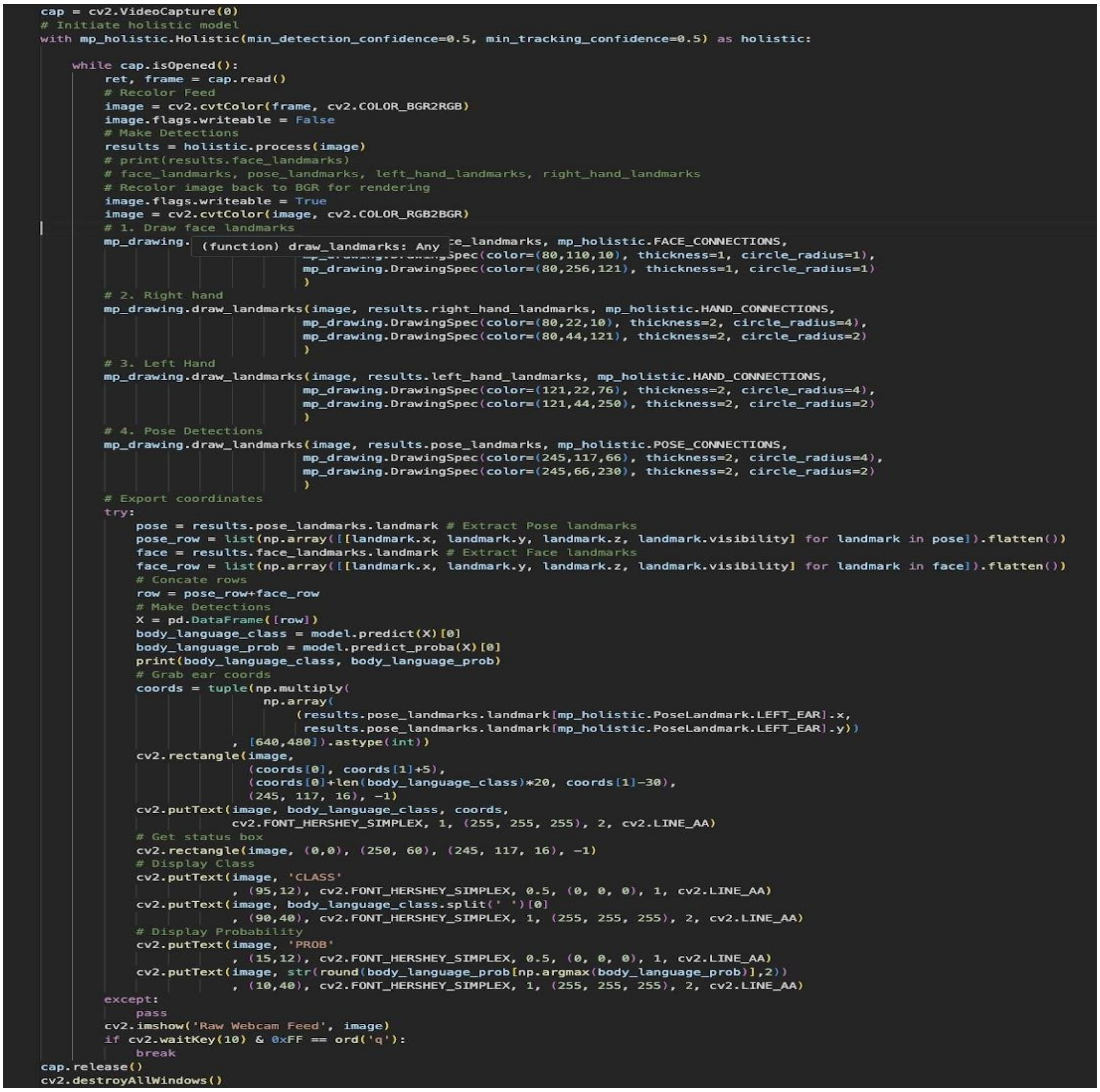
✓ 0.0s

Testing The Model



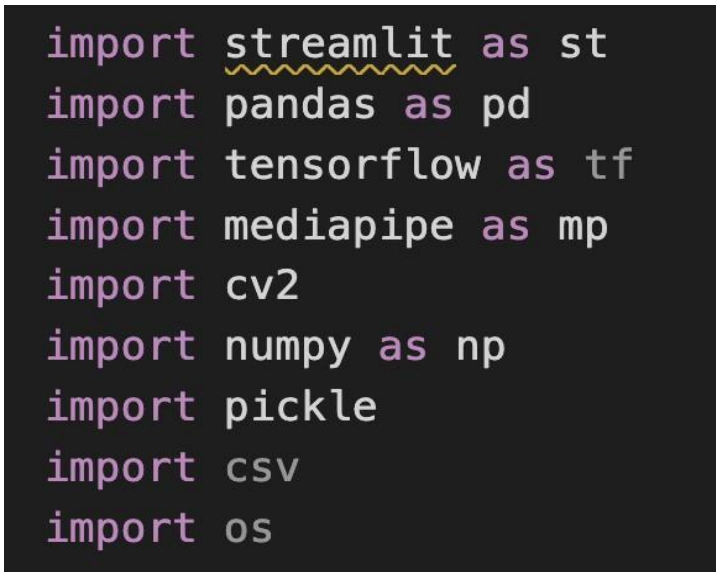
```
with open('/Users/rishi/BTECH/Programming/My_Projects/AI_Body_Language_Detector/Model/body_language.pkl', 'rb') as f:
    model = pickle.load(f)
```

✓ 0.0s



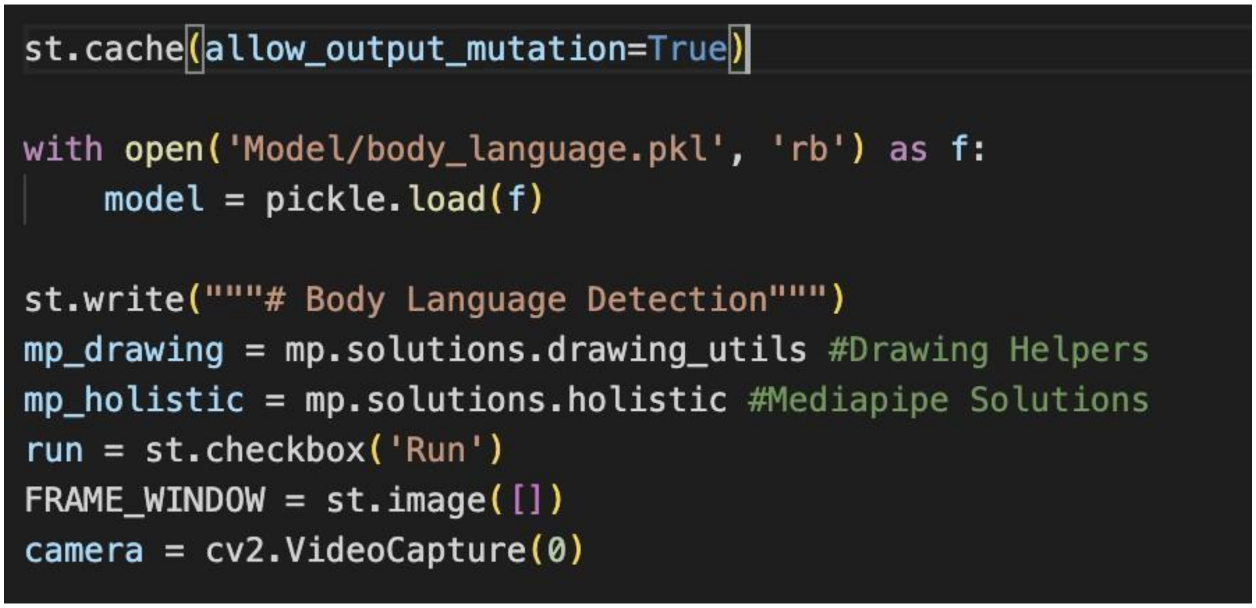
```
cap = cv2.VideoCapture(0)
# Initiate holistic model
with mp_holistic.Holistic(min_detection_confidence=0.5, min_tracking_confidence=0.5) as holistic:

    while cap.isOpened():
        ret, frame = cap.read()
        # Recolor Feed
        image = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
        image.flags.writeable = False
        # Make Detections
        results = holistic.process(image)
        # print(results.face_landmarks)
        # face_landmarks, pose_landmarks, left_hand_landmarks, right_hand_landmarks
        # Recolor image back to BGR for rendering
        image.flags.writeable = True
        image = cv2.cvtColor(image, cv2.COLOR_RGB2BGR)
        # 1. Draw face landmarks
        mp_drawing.                    ce_landmarks, mp_holistic.FACE_CONNECTIONS,
                                       Spec(color=(80,110,10), thickness=1, circle_radius=1),
                                 mp_drawing.DrawingSpec(color=(80,256,121), thickness=1, circle_radius=1)
                                 )
        # 2. Right hand
        mp_drawing.draw_landmarks(image, results.right_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(80,22,10), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(80,44,121), thickness=2, circle_radius=2)
                                 )
        # 3. Left Hand
        mp_drawing.draw_landmarks(image, results.left_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(121,22,76), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(121,44,250), thickness=2, circle_radius=2)
                                 )
        # 4. Pose Detections
        mp_drawing.draw_landmarks(image, results.pose_landmarks, mp_holistic.POSE_CONNECTIONS,
                                 mp_drawing.DrawingSpec(color=(245,117,66), thickness=2, circle_radius=4),
                                 mp_drawing.DrawingSpec(color=(245,66,230), thickness=2, circle_radius=2)
                                 )
        # Export coordinates
        try:
            pose = results.pose_landmarks.landmark # Extract Pose landmarks
            pose_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in pose]).flatten())
            face = results.face_landmarks.landmark # Extract Face landmarks
            face_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in face]).flatten())
            # Concate rows
            row = pose_row+face_row
            # Make Detections
            X = pd.DataFrame([row])
            body_language_class = model.predict(X)[0]
            body_language_prob = model.predict_proba(X)[0]
            print(body_language_class, body_language_prob)
            # Grab ear coords
            coords = tuple(np.multiply(
                            np.array(
                                (results.pose_landmarks.landmark[mp_holistic.PoseLandmark.LEFT_EAR].x,
                                 results.pose_landmarks.landmark[mp_holistic.PoseLandmark.LEFT_EAR].y))
                        , [640,480]).astype(int))
            cv2.rectangle(image,
                          (coords[0], coords[1]+5),
                          (coords[0]+len(body_language_class)*20, coords[1]-30),
                          (245, 117, 16), -1)
            cv2.putText(image, body_language_class, coords,
                        cv2.FONT_HERSHEY_SIMPLEX, 1, (255, 255, 255), 2, cv2.LINE_AA)
            # Get status box
            cv2.rectangle(image, (0,0), (250, 60), (245, 117, 16), -1)
            # Display Class
            cv2.putText(image, 'CLASS'
                        , (95,12), cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 0, 0), 1, cv2.LINE_AA)
            cv2.putText(image, body_language_class.split(' ')[0]
                        , (90,40), cv2.FONT_HERSHEY_SIMPLEX, 1, (255, 255, 255), 2, cv2.LINE_AA)
            # Display Probability
            cv2.putText(image, 'PROB'
                        , (15,12), cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 0, 0), 1, cv2.LINE_AA)
            cv2.putText(image, str(round(body_language_prob[np.argmax(body_language_prob)],2))
                        , (10,40), cv2.FONT_HERSHEY_SIMPLEX, 1, (255, 255, 255), 2, cv2.LINE_AA)
        except:
            pass
        cv2.imshow('Raw Webcam Feed', image)
        if cv2.waitKey(10) & 0xFF == ord('q'):
            break
cap.release()
cv2.destroyAllWindows()
```

Create A Web.Py File And Import Necessary Packages



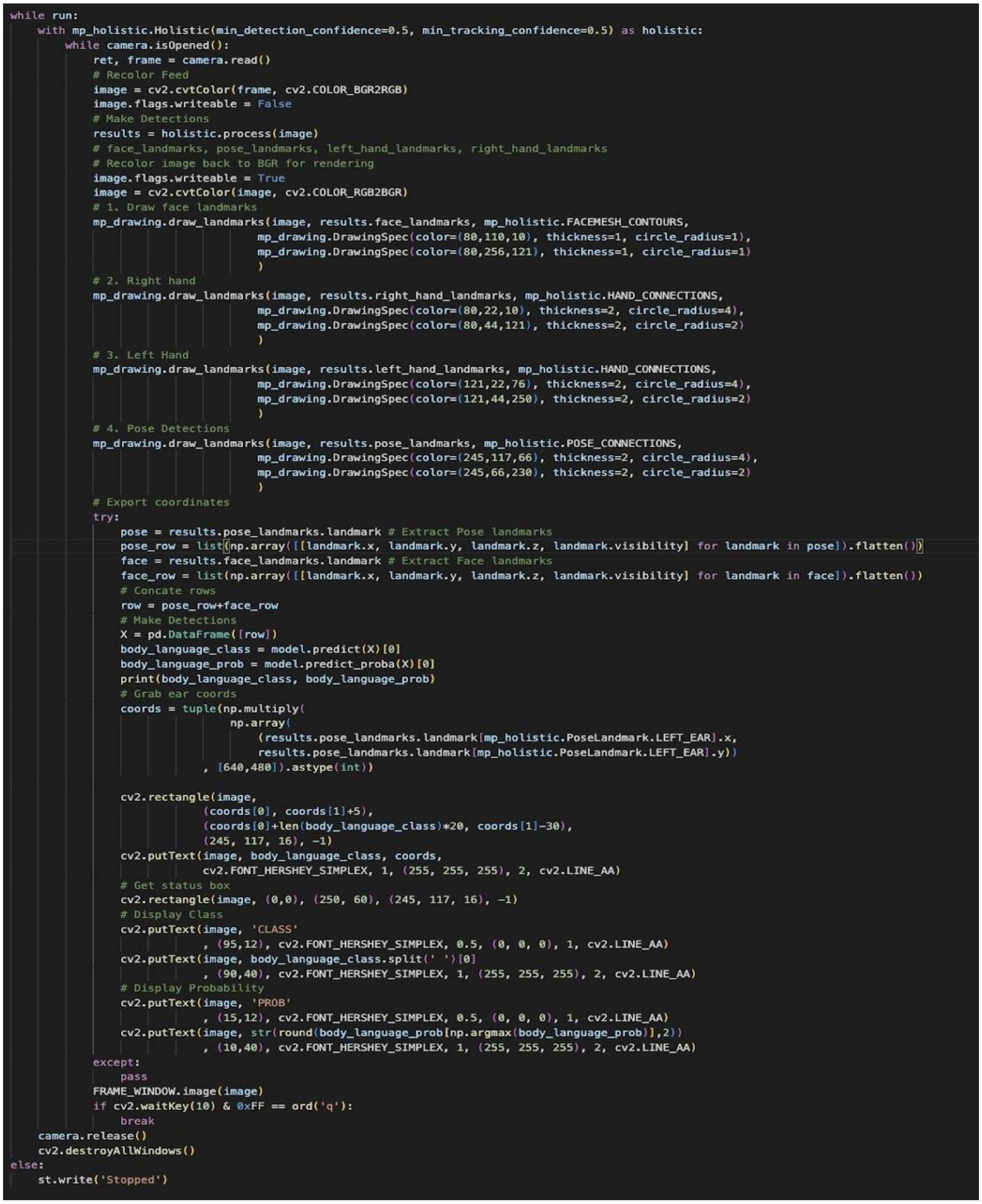
```python
import streamlit as st
import pandas as pd
import tensorflow as tf
import mediapipe as mp
import cv2
import numpy as np
import pickle
import csv
import os
```

Loading The Model And Creating A Frame Window To Use OpenCV:

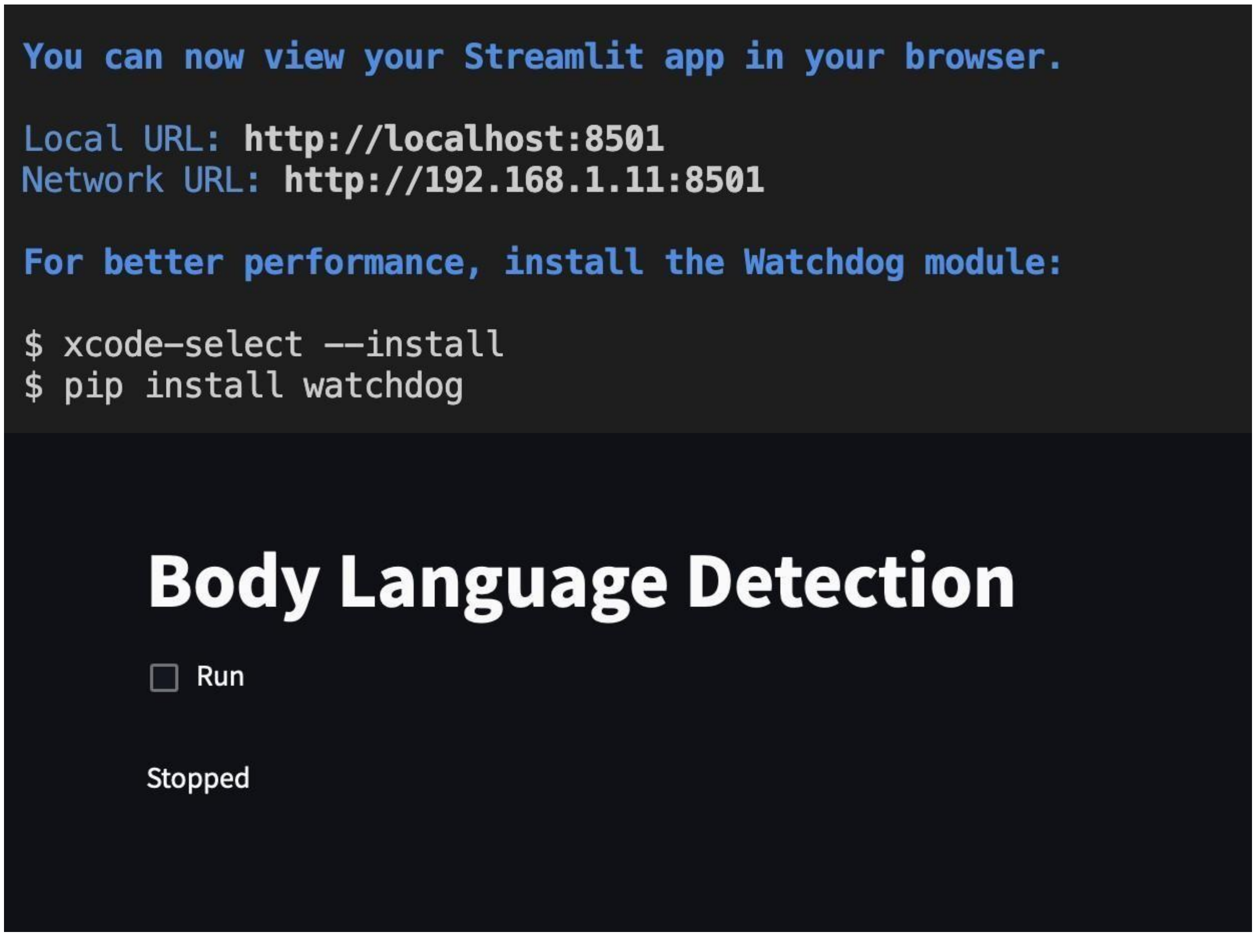


```python
st.cache(allow_output_mutation=True)

with open('Model/body_language.pkl', 'rb') as f:
    model = pickle.load(f)

st.write("""# Body Language Detection""")
mp_drawing = mp.solutions.drawing_utils #Drawing Helpers
mp_holistic = mp.solutions.holistic #Mediapipe Solutions
run = st.checkbox('Run')
FRAME_WINDOW = st.image([])
camera = cv2.VideoCapture(0)
```

Accepting The Input From User And Prediction

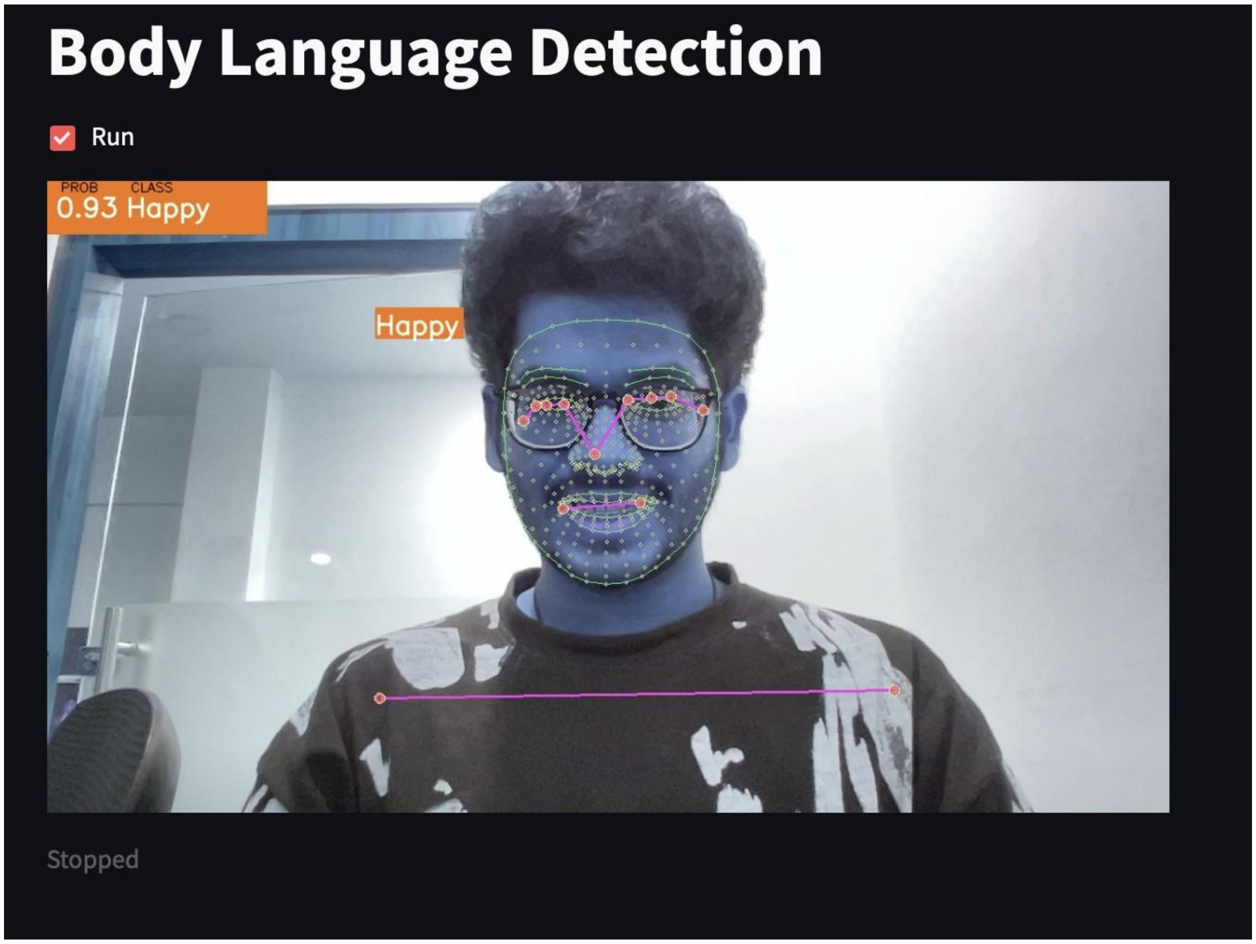


```python
while run:
    with mp_holistic.Holistic(min_detection_confidence=0.5, min_tracking_confidence=0.5) as holistic:
        while camera.isOpened():
            ret, frame = camera.read()
            # Recolor Feed
            image = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
            image.flags.writeable = False
            # Make Detections
            results = holistic.process(image)
            # face_landmarks, pose_landmarks, left_hand_landmarks, right_hand_landmarks
            # Recolor image back to BGR for rendering
            image.flags.writeable = True
            image = cv2.cvtColor(image, cv2.COLOR_RGB2BGR)
            # 1. Draw face landmarks
            mp_drawing.draw_landmarks(image, results.face_landmarks, mp_holistic.FACEMESH_CONTOURS,
                                    mp_drawing.DrawingSpec(color=(80,110,10), thickness=1, circle_radius=1),
                                    mp_drawing.DrawingSpec(color=(80,256,121), thickness=1, circle_radius=1)
                                    )
            # 2. Right hand
            mp_drawing.draw_landmarks(image, results.right_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                    mp_drawing.DrawingSpec(color=(80,22,10), thickness=2, circle_radius=4),
                                    mp_drawing.DrawingSpec(color=(80,44,121), thickness=2, circle_radius=2)
                                    )
            # 3. Left Hand
            mp_drawing.draw_landmarks(image, results.left_hand_landmarks, mp_holistic.HAND_CONNECTIONS,
                                    mp_drawing.DrawingSpec(color=(121,22,76), thickness=2, circle_radius=4),
                                    mp_drawing.DrawingSpec(color=(121,44,250), thickness=2, circle_radius=2)
                                    )
            # 4. Pose Detections
            mp_drawing.draw_landmarks(image, results.pose_landmarks, mp_holistic.POSE_CONNECTIONS,
                                    mp_drawing.DrawingSpec(color=(245,117,66), thickness=2, circle_radius=4),
                                    mp_drawing.DrawingSpec(color=(245,66,230), thickness=2, circle_radius=2)
                                    )
            # Export coordinates
            try:
                pose = results.pose_landmarks.landmark # Extract Pose landmarks
                pose_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in pose]).flatten())
                face = results.face_landmarks.landmark # Extract Face landmarks
                face_row = list(np.array([[landmark.x, landmark.y, landmark.z, landmark.visibility] for landmark in face]).flatten())
                # Concate rows
                row = pose_row+face_row
                # Make Detections
                X = pd.DataFrame([row])
                body_language_class = model.predict(X)[0]
                body_language_prob = model.predict_proba(X)[0]
                print(body_language_class, body_language_prob)
                # Grab ear coords
                coords = tuple(np.multiply(
                                np.array(
                                    (results.pose_landmarks.landmark[mp_holistic.PoseLandmark.LEFT_EAR].x,
                                    results.pose_landmarks.landmark[mp_holistic.PoseLandmark.LEFT_EAR].y))
                            , [640,480]).astype(int))

                cv2.rectangle(image,
                            (coords[0], coords[1]+5),
                            (coords[0]+len(body_language_class)*20, coords[1]-30),
                            (245, 117, 16), -1)
                cv2.putText(image, body_language_class, coords,
                            cv2.FONT_HERSHEY_SIMPLEX, 1, (255, 255, 255), 2, cv2.LINE_AA)
                # Get status box
                cv2.rectangle(image, (0,0), (250, 60), (245, 117, 16), -1)
                # Display Class
                cv2.putText(image, 'CLASS'
                            , (95,12), cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 0, 0), 1, cv2.LINE_AA)
                cv2.putText(image, body_language_class.split(' ')[0]
                            , (90,40), cv2.FONT_HERSHEY_SIMPLEX, 1, (255, 255, 255), 2, cv2.LINE_AA)
                # Display Probability
                cv2.putText(image, 'PROB'
                            , (15,12), cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 0, 0), 1, cv2.LINE_AA)
                cv2.putText(image, str(round(body_language_prob[np.argmax(body_language_prob)],2))
                            , (10,40), cv2.FONT_HERSHEY_SIMPLEX, 1, (255, 255, 255), 2, cv2.LINE_AA)
            except:
                pass
            FRAME_WINDOW.image(image)
            if cv2.waitKey(10) & 0xFF == ord('q'):
                break
    camera.release()
    cv2.destroyAllWindows()
else:
    st.write('Stopped')
```



```
You can now view your Streamlit app in your browser.

Local URL: http://localhost:8501
Network URL: http://192.168.1.11:8501

For better performance, install the Watchdog module:

$ xcode-select --install
$ pip install watchdog
```

Body Language Detection



Body Language Detection

✓ Run

Stopped