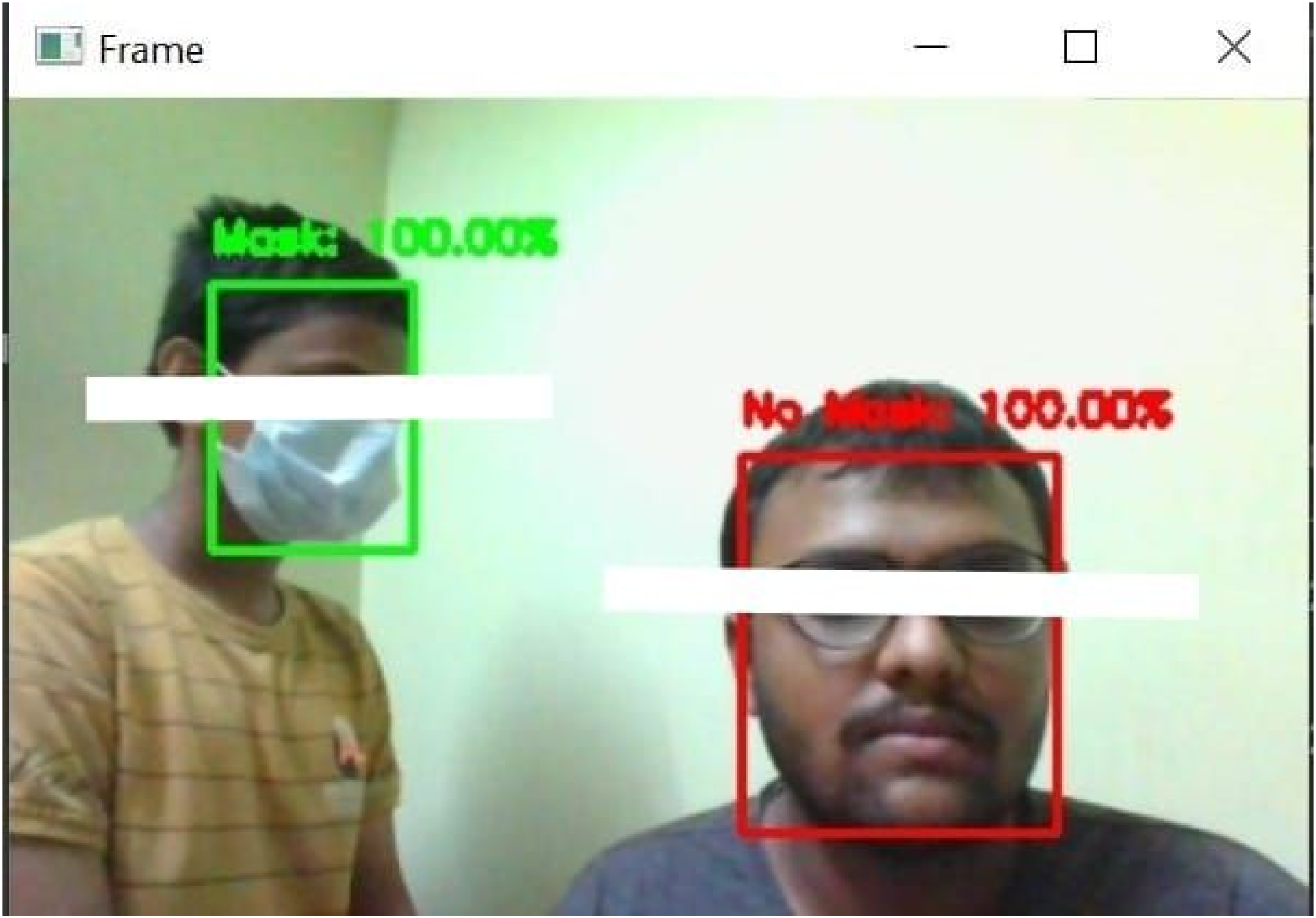
```
 1 # import the necessary packages
 2 from tensorflow.keras.applications.mobilenet_v2
   import preprocess_input
 3 from tensorflow.keras.preprocessing.image import
   img_to_array
 4 from tensorflow.keras.models import load_model
 5 from imutils.video import VideoStream
 6 import numpy as np
 7 import imutils
 8 import time
 9 import cv2
10 import os
11
12 def detect_and_predict_mask(frame, faceNet, maskNet):
13     # grab the dimensions of the frame and then
   construct a blob
14     # from it
15     (h, w) = frame.shape[:2]
16     blob = cv2.dnn.blobFromImage(frame, 1.0, (224,
   224),
17         (104.0, 177.0, 123.0))
18
19     # pass the blob through the network and obtain
   the face detections
20     faceNet.setInput(blob)
21     detections = faceNet.forward()
22     print(detections.shape)
23
24     # initialize our list of faces, their
   corresponding locations,
25     # and the list of predictions from our face mask
   network
26     faces = []
27     locs = []
28     preds = []
29
30     # loop over the detections
31     for i in range(0, detections.shape[2]):
32         # extract the confidence (i.e., probability)
   associated with
33         # the detection
```

```
34          confidence = detections[0, 0, i, 2]
35
36          # filter out weak detections by ensuring the
   confidence is
37          # greater than the minimum confidence
38          if confidence > 0.5:
39              # compute the (x, y)-coordinates of the
   bounding box for
40              # the object
41              box = detections[0, 0, i, 3:7] * np.array
   ([w, h, w, h])
42              (startX, startY, endX, endY) = box.astype
   ("int")
43
44              # ensure the bounding boxes fall within
   the dimensions of
45              # the frame
46              (startX, startY) = (max(0, startX), max(0
   , startY))
47              (endX, endY) = (min(w - 1, endX), min(h
    - 1, endY))
48
49              # extract the face ROI, convert it from
   BGR to RGB channel
50              # ordering, resize it to 224x224, and
   preprocess it
51              face = frame[startY:endY, startX:endX]
52              face = cv2.cvtColor(face, cv2.
   COLOR_BGR2RGB)
53              face = cv2.resize(face, (224, 224))
54              face = img_to_array(face)
55              face = preprocess_input(face)
56
57              # add the face and bounding boxes to
   their respective
58              # lists
59              faces.append(face)
60              locs.append((startX, startY, endX, endY))
61
62      # only make a predictions if at least one face
   was detected
```

```
63      if len(faces) > 0:
64          # for faster inference we'll make batch
    predictions on *all*
65          # faces at the same time rather than one-by-
    one predictions
66          # in the above `for` loop
67          faces = np.array(faces, dtype="float32")
68          preds = maskNet.predict(faces, batch_size=32
    )
69
70      # return a 2-tuple of the face locations and
    their corresponding
71      # locations
72      return (locs, preds)
73
74 # load our serialized face detector model from disk
75 prototxtPath = r"face_detector\deploy.prototxt"
76 weightsPath = r"face_detector\
    res10_300x300_ssd_iter_140000.caffemodel"
77 faceNet = cv2.dnn.readNet(prototxtPath, weightsPath)
78
79 # load the face mask detector model from disk
80 maskNet = load_model("mask_detector.model")
81
82 # initialize the video stream
83 print("[INFO] starting video stream...")
84 vs = VideoStream(src=0).start()
85
86 # loop over the frames from the video stream
87 while True:
88      # grab the frame from the threaded video stream
    and resize it
89      # to have a maximum width of 400 pixels
90      frame = vs.read()
91      frame = imutils.resize(frame, width=400)
92
93      # detect faces in the frame and determine if
    they are wearing a
94      # face mask or not
95      (locs, preds) = detect_and_predict_mask(frame,
    faceNet, maskNet)
```

```
 96
 97     # loop over the detected face locations and
    their corresponding
 98     # locations
 99     for (box, pred) in zip(locs, preds):
100         # unpack the bounding box and predictions
101         (startX, startY, endX, endY) = box
102         (mask, withoutMask) = pred
103
104         # determine the class label and color we'll
    use to draw
105         # the bounding box and text
106         label = "Mask" if mask > withoutMask else "
    No Mask"
107         color = (0, 255, 0) if label == "Mask" else
     (0, 0, 255)
108
109         # include the probability in the label
110         label = "{}: {:.2f}%".format(label, max(mask
    , withoutMask) * 100)
111
112
113         # display the label and bounding box
    rectangle on the output
114         # frame
115         cv2.putText(frame, label, (startX, startY -
    10),
116             cv2.FONT_HERSHEY_SIMPLEX, 0.45, color, 2
    )
117         cv2.rectangle(frame, (startX, startY), (endX
    , endY), color, 2)
118     #cv2.putText(frame, label, (-100, -100),cv2.
    FONT_HERSHEY_SIMPLEX, 1, color, 2)
119     # show the output frame
120     cv2.imshow("Frame", frame)
121     key = cv2.waitKey(1) & 0xFF
122
123     if label == "No Mask":
124         print("Wear mask")
125
126     # if the `q` key was pressed, break from the
```

```
126 loop
127     if key == ord("q"):
128         break
129
130 # do a bit of cleanup
131 cv2.destroyAllWindows()
132 vs.stop()
```


Frame
100.00%
100.00%