IMPORT LIBRARY

```
from tensorflow.keras.callbacks import ModelCheckpoint, EarlyStopping
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.applications import MobileNetV2
from tensorflow.keras.layers import GlobalAveragePooling2D, Dense
from tensorflow.keras.layers import Input
from tensorflow.keras.models import Model
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.applications.mobilenet_v2 import preprocess_input
from tensorflow.keras.preprocessing.image import img_to_array
from tensorflow.keras.preprocessing.image import load_img
from tensorflow.keras.utils import to_categorical
from sklearn.preprocessing import LabelBinarizer
from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report
from imutils import paths
import matplotlib.pyplot as plt
import numpy as np
import os
```

INPUT MODEL MOBILENET

```
base_model = MobileNetV2(weights = "imagenet", include_top = False, input_shape = (224, 22

head_model = base_model.output
head_model = GlobalAveragePooling2D()(head_model)
head_model = Dense(128,activation='relu')(head_model)
head_model = Dense(2, activation='softmax')(head_model)

model_train = Model(inputs = base_model.input, outputs = head_model)

for layer in base_model.layers:
  layer.trainable = False

model_train.summary()
```

```
    block_3_pad (ZeroPadding2D)     (None, 57, 57, 144)  0           block_3_expand_re
    __________________________________________________________________________________
    block_3_depthwise (DepthwiseCon (None, 28, 28, 144)  1296        block_3_pad[0][0]
    __________________________________________________________________________________
    block_3_depthwise_BN (BatchNorm (None, 28, 28, 144)  576         block_3_depthwise
    __________________________________________________________________________________
    block_3_depthwise_relu (ReLU)   (None, 28, 28, 144)  0           block_3_depthwise
    __________________________________________________________________________________
    block_3_project (Conv2D)        (None, 28, 28, 32)   4608        block_3_depthwise
    __________________________________________________________________________________
    block_3_project_BN (BatchNormal (None, 28, 28, 32)   128         block_3_project[0
    __________________________________________________________________________________
    block_4_expand (Conv2D)         (None, 28, 28, 192)  6144        block_3_project_B
```

```
block_4_expand (Conv2D)         (None, 28, 28, 192)  6144        block_3_project_B

block_4_expand_BN (BatchNormali (None, 28, 28, 192)  768         block_4_expand[0]

block_4_expand_relu (ReLU)      (None, 28, 28, 192)  0           block_4_expand_BN

block_4_depthwise (DepthwiseCon (None, 28, 28, 192)  1728        block_4_expand_re

block_4_depthwise_BN (BatchNorm (None, 28, 28, 192)  768         block_4_depthwise

block_4_depthwise_relu (ReLU)   (None, 28, 28, 192)  0           block_4_depthwise

block_4_project (Conv2D)        (None, 28, 28, 32)   6144        block_4_depthwise

block_4_project_BN (BatchNormal (None, 28, 28, 32)   128         block_4_project[0

block_4_add (Add)               (None, 28, 28, 32)   0           block_3_project_B
                                                                 block_4_project_B

block_5_expand (Conv2D)         (None, 28, 28, 192)  6144        block_4_add[0][0]

block_5_expand_BN (BatchNormali (None, 28, 28, 192)  768         block_5_expand[0]

block_5_expand_relu (ReLU)      (None, 28, 28, 192)  0           block_5_expand_BN

block_5_depthwise (DepthwiseCon (None, 28, 28, 192)  1728        block_5_expand_re

block_5_depthwise_BN (BatchNorm (None, 28, 28, 192)  768         block_5_depthwise

block_5_depthwise_relu (ReLU)   (None, 28, 28, 192)  0           block_5_depthwise

block_5_project (Conv2D)        (None, 28, 28, 32)   6144        block_5_depthwise

block_5_project_BN (BatchNormal (None, 28, 28, 32)   128         block_5_project[0

block_5_add (Add)               (None, 28, 28, 32)   0           block_4_add[0][0]
                                                                 block_5_project_B

block_6_expand (Conv2D)         (None, 28, 28, 192)  6144        block_5_add[0][0]

block_6_expand_BN (BatchNormali (None, 28, 28, 192)  768         block_6_expand[0]

block_6_expand_relu (ReLU)      (None, 28, 28, 192)  0           block_6_expand_BN

block_6_pad (ZeroPadding2D)     (None, 29, 29, 192)  0           block_6_expand_re

block_6_depthwise (DepthwiseCon (None, 14, 14, 192)  1728        block_6_pad[0][0]
```

INPUT DATASET

```
directory_dataset = "/content/drive/MyDrive/FaceRecog/new_dataset/dataset20"
category_dataset = ["edi", "unknown"]

data = []
labels = []

for category in category_dataset:
    path = os.path.join(directory_dataset, category)
```

```
    path = os.path.join(directory_dataset, category)
    for img in os.listdir(path):
      img_path = os.path.join(path, img)
      image = load_img(img_path, target_size=(224, 224))
      image = img_to_array(image)
      image = preprocess_input(image)

      data.append(image)
      labels.append(category)
```

LEARNING RATE, EPOCH, BATCH SIZE ETC

```
lb = LabelBinarizer()
labels = lb.fit_transform(labels)
labels = to_categorical(labels)

data = np.array(data, dtype="float32")
labels = np.array(labels)
# print(labels)


learning_rate_size = 1e-4
epoch_size = 10
batch_size_number = 8

(trainX, testX, trainY, testY) = train_test_split(data,
                                                  labels,
                                                  test_size=0.20,
                                                  stratify=labels,
                                                  random_state=42)
```

DATA AUGMENTATION

```
aug = ImageDataGenerator(rotation_range=20,
                         zoom_range=0.15,
                         width_shift_range=0.2,
                         height_shift_range=0.2,
                         shear_range=0.15,
                         horizontal_flip=True,
                         fill_mode="nearest")
```

CALLBACKS

```
checkpoint = ModelCheckpoint("/content/drive/MyDrive/FaceRecog/new_dataset/result/result20
                             monitor="val_loss",
                             mode="min"
```

```
                              mode= 'min',
                              save_best_only = True,
                              verbose=1)

earlystop = EarlyStopping(monitor = 'val_loss',
                          min_delta = 0,
                          patience = 3,
                          verbose = 1,
                          restore_best_weights = True)

# we put our call backs into a callback list
callbacks = [earlystop, checkpoint]
```

OPTIMIZER AND TRAINING

```
print("[INFO] compiling model...")
opt = Adam(lr=learning_rate_size, decay=learning_rate_size / epoch_size)
model_train.compile(loss="binary_crossentropy",
                    optimizer=opt,
                    metrics=["accuracy"])

# train the head of the network
print("[INFO] training head...")
H = model_train.fit(aug.flow(trainX, trainY, batch_size=batch_size_number),
                    steps_per_epoch=len(trainX) // batch_size_number,
                    validation_data=(testX, testY),
                    validation_steps=len(testX) // batch_size_number,
                    epochs=epoch_size,
                    callbacks = callbacks)
```

```
[INFO] compiling model...
[INFO] training head...
Epoch 1/10
4/4 [==============================] - 5s 690ms/step - loss: 0.7968 - accuracy: 0.47

Epoch 00001: val_loss improved from inf to 0.74104, saving model to /content/drive/M
Epoch 2/10
4/4 [==============================] - 2s 434ms/step - loss: 0.7159 - accuracy: 0.45

Epoch 00002: val_loss improved from 0.74104 to 0.64183, saving model to /content/dri
Epoch 3/10
4/4 [==============================] - 2s 434ms/step - loss: 0.6399 - accuracy: 0.67

Epoch 00003: val_loss improved from 0.64183 to 0.57280, saving model to /content/dri
Epoch 4/10
4/4 [==============================] - 2s 434ms/step - loss: 0.5584 - accuracy: 0.80

Epoch 00004: val_loss improved from 0.57280 to 0.51850, saving model to /content/dri
Epoch 5/10
4/4 [==============================] - 2s 435ms/step - loss: 0.5151 - accuracy: 0.75

Epoch 00005: val_loss improved from 0.51850 to 0.47019, saving model to /content/dri
Epoch 6/10
4/4 [==============================] - 2s 437ms/step - loss: 0.3950 - accuracy: 0.96
```

```
Epoch 00006: val_loss improved from 0.47019 to 0.42603, saving model to /content/dri
Epoch 7/10
4/4 [==============================] - 2s 433ms/step - loss: 0.4095 - accuracy: 0.98

Epoch 00007: val_loss improved from 0.42603 to 0.38613, saving model to /content/dri
Epoch 8/10
4/4 [==============================] - 2s 438ms/step - loss: 0.3404 - accuracy: 0.96

Epoch 00008: val_loss improved from 0.38613 to 0.35109, saving model to /content/dri
Epoch 9/10
4/4 [==============================] - 2s 435ms/step - loss: 0.3014 - accuracy: 1.00

Epoch 00009: val_loss improved from 0.35109 to 0.31925, saving model to /content/dri
Epoch 10/10
4/4 [==============================] - 2s 434ms/step - loss: 0.2874 - accuracy: 1.00

Epoch 00010: val_loss improved from 0.31925 to 0.28852, saving model to /content/dri
```

CLASIFICATION REPORT

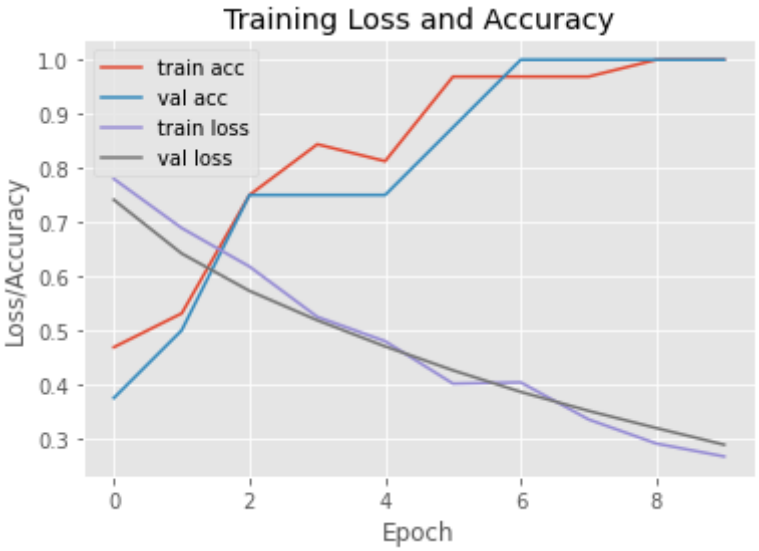
```
# make predictions on the testing set
print("[INFO] evaluating network...")
predIdxs = model_train.predict(testX, batch_size=batch_size_number)

# for each image in the testing set we need to find the index of the
# label with corresponding largest predicted probability
predIdxs = np.argmax(predIdxs, axis=1)

# show a nicely formatted classification report
print(classification_report(testY.argmax(axis=1), predIdxs,
  target_names=lb.classes_))
```

```
[INFO] evaluating network...
              precision    recall  f1-score   support

         edi       1.00      1.00      1.00         4
     unknown       1.00      1.00      1.00         4

    accuracy                           1.00         8
   macro avg       1.00      1.00      1.00         8
weighted avg       1.00      1.00      1.00         8
```

TABLE TRAINING RESULT

```
plt.style.use("ggplot")
plt.figure()

plt.plot(H.history['accuracy'] , label = 'train acc')
plt.plot(H.history['val_accuracy'] , label = 'val acc')
```

```
plt.plot(H.history['loss'] , label = 'train loss')
plt.plot(H.history['val_loss'] , label = 'val loss')

plt.title("Training Loss and Accuracy")
plt.xlabel("Epoch")
plt.ylabel("Loss/Accuracy")
plt.legend()
plt.savefig("/content/drive/MyDrive/FaceRecog/new_dataset/result/result20/result20.png")
```

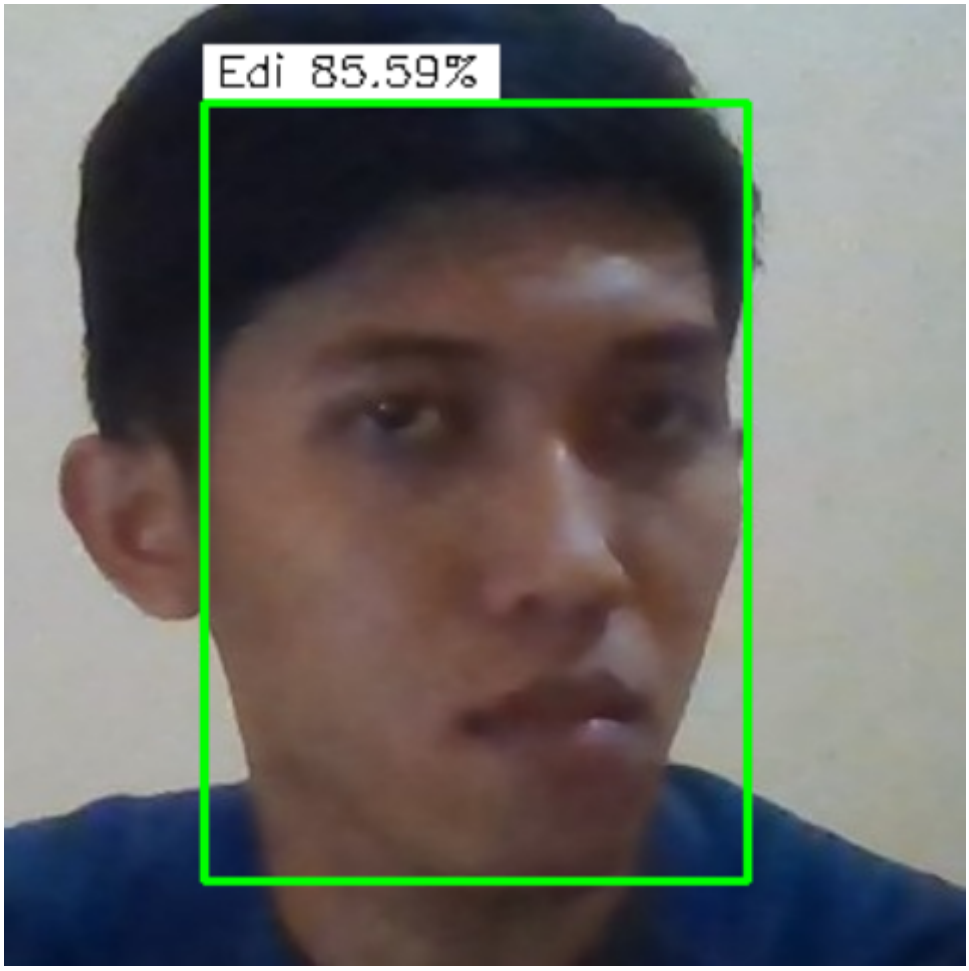


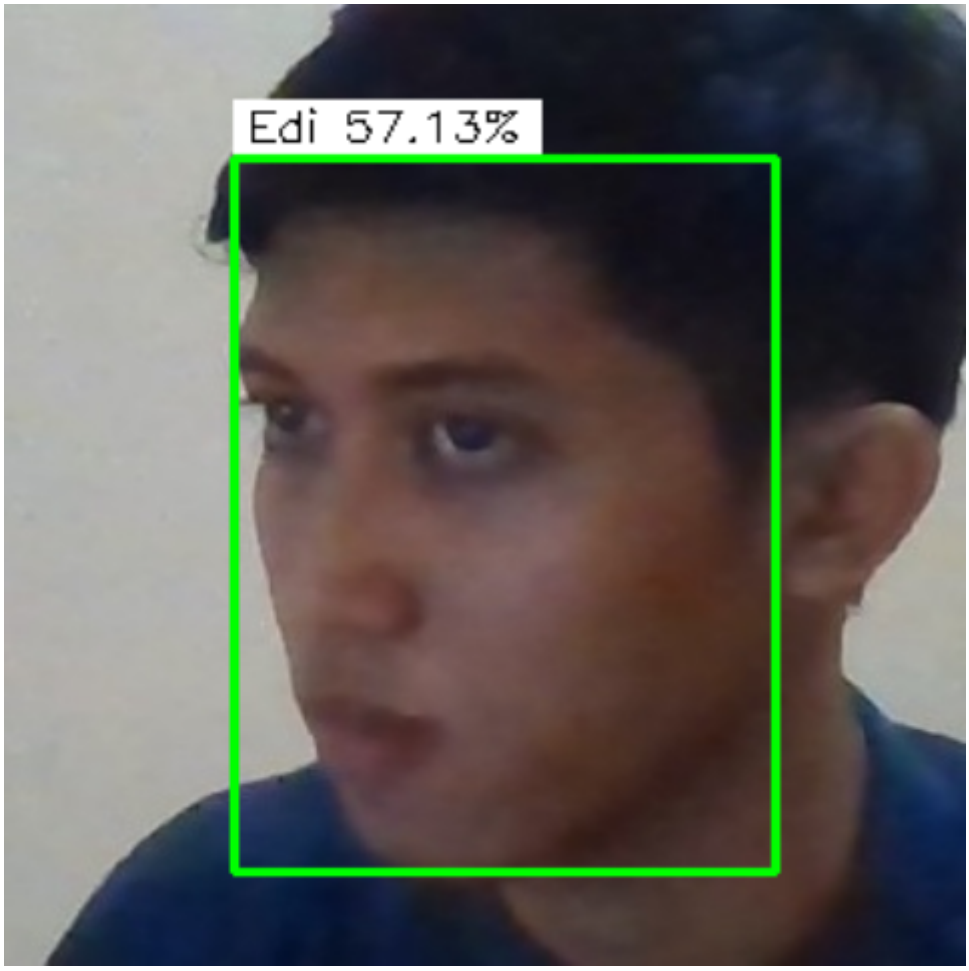
TESTING MODEL

```
from tensorflow.keras.applications.mobilenet_v2 import preprocess_input
from tensorflow.keras.preprocessing.image import img_to_array
from tensorflow.keras.preprocessing import image
from tensorflow.keras.applications import imagenet_utils
from tensorflow.keras.models import load_model
from google.colab.patches import cv2_imshow
import numpy as np
import imutils
import time
import cv2
import os
from os import listdir
from os.path import isfile, join

prototxt_path = "/content/drive/MyDrive/FaceRecog/ssd_face.prototxt"
weights_path = "/content/drive/MyDrive/FaceRecog/ssd_face.caffemodel"

faceNet = cv2.dnn.readNet(prototxt_path, weights_path)

# load the face mask detector model from disk
model_recog = load_model('/content/drive/MyDrive/FaceRecog/new_dataset/result/result20/fac

path = "/content/drive/MyDrive/FaceRecog/new_dataset/test/edi/"
# path = "/content/drive/MyDrive/FaceRecog/new_dataset/test/unknown/"
```

```
    many_file_in_dict = len(os.listdir(path))
    image_file = os.listdir(path)
    # print(image_file)

    for count in range(many_file_in_dict):
      path_image = os.path.join(path+image_file[count])
      input_image = cv2.imread(path_image)

      # cv2_imshow(input_image)

      (h, w) = input_image.shape[:2]
      blob = cv2.dnn.blobFromImage(input_image, 1.0, (224, 224), (104.0, 177.0, 123.0))

      faceNet.setInput(blob)
      detections = faceNet.forward()

      # faces = []
      pred = {"0", "1"}

      for i in range(0, detections.shape[2]):
        confidence = detections[0, 0, i, 2]
        box = detections[0, 0, i, 3:7] * np.array([w, h, w, h])
        (startX, startY, endX, endY) = box.astype("int")

        if confidence > 0.5:
          (startX, startY) = (max(0, startX), max(0, startY))
          (endX, endY) = (min(w - 1, endX), min(h - 1, endY))

          face_detect = cv2.cvtColor(input_image, cv2.COLOR_BGR2RGB)
          face_detect = cv2.resize(face_detect, (224, 224))
          face_detect = img_to_array(face_detect)
          face_detect = preprocess_input(face_detect)
          face_detect = np.expand_dims(face_detect, axis=0)

          preds = model_recog.predict(face_detect)
          label_percent = str("{:.2f}%".format((max(max(preds)))*100))

          preds = np.argmax(preds)

          # facial = pred[str(preds)]

          if preds == 0:
            label = "Edi"
            color = (0, 255, 0)
          if preds == 1:
            label = "Unknown"
            color = (0, 0, 255)

          label_full = label+" "+label_percent
          label_size = cv2.getTextSize(label_full, cv2.FONT_HERSHEY_SIMPLEX, 0.5, 1)
          cv2.rectangle(input_image, (startX, startY), (endX, endY), color, 2)
          cv2.rectangle(input_image, (startX, startY - 20), ((startX + label_size[0][0]) + 10,
          cv2.putText(input_image, label_full, (startX + 4, startY - 6), cv2.FONT_HERSHEY_SIMF

      image_resize = cv2.resize(input_image, (480, 480))
```

```
        # print(preds)
        cv2_imshow(image_resize)
        cv2.imwrite("/content/drive/MyDrive/FaceRecog/new_dataset/result/result20/test"+str(cour
        time.sleep(1)
        print('\n')
```


Edi 85.59%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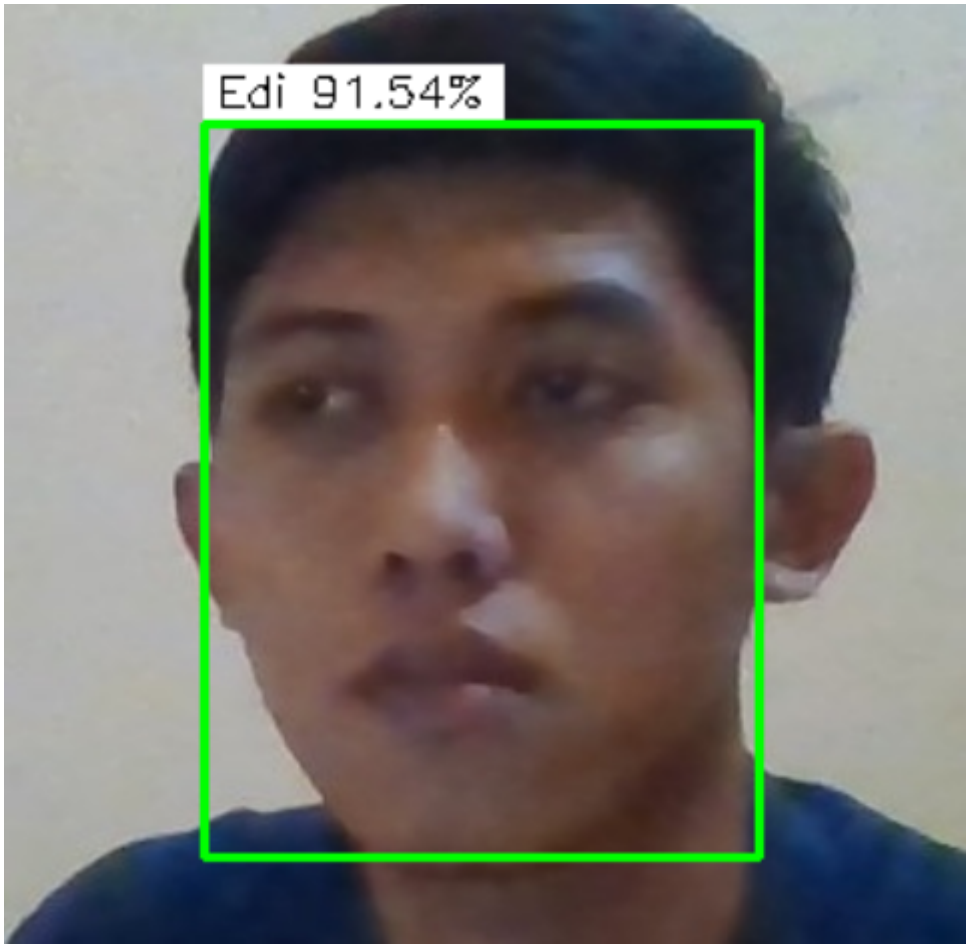
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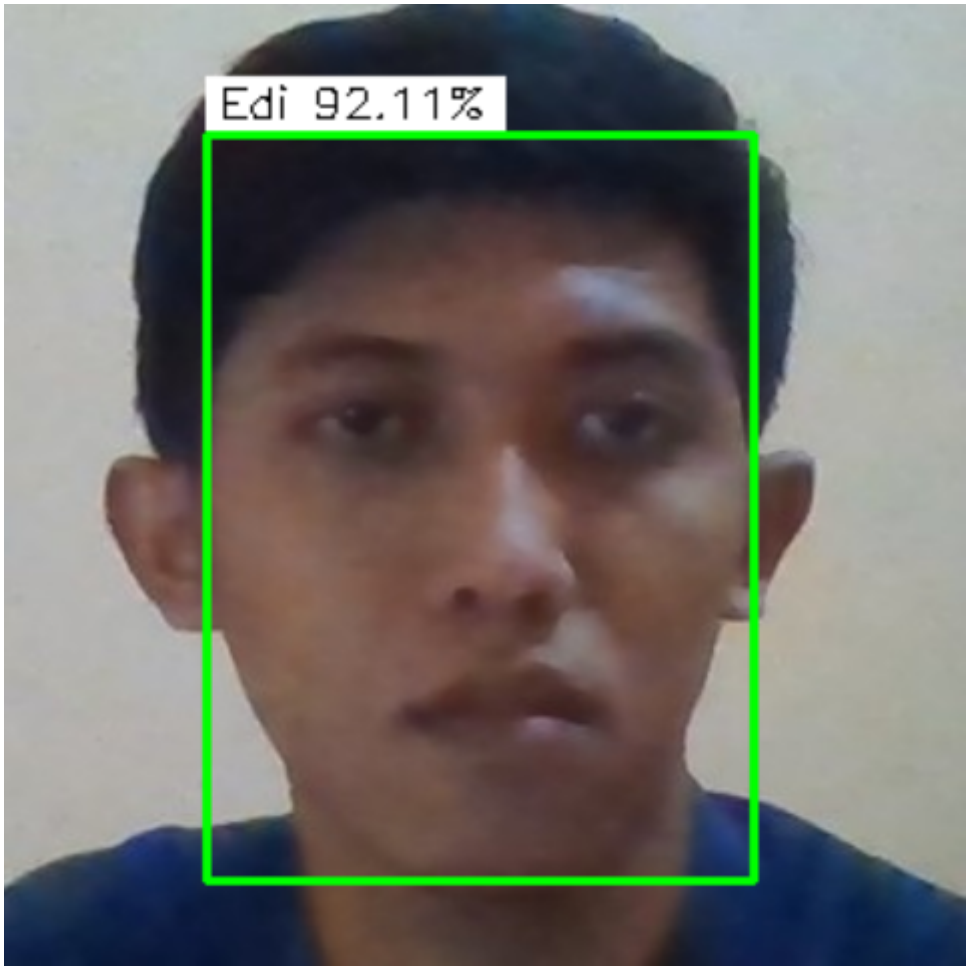
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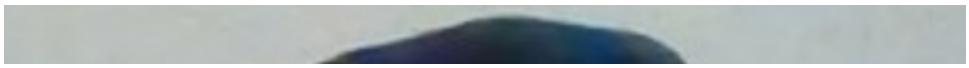

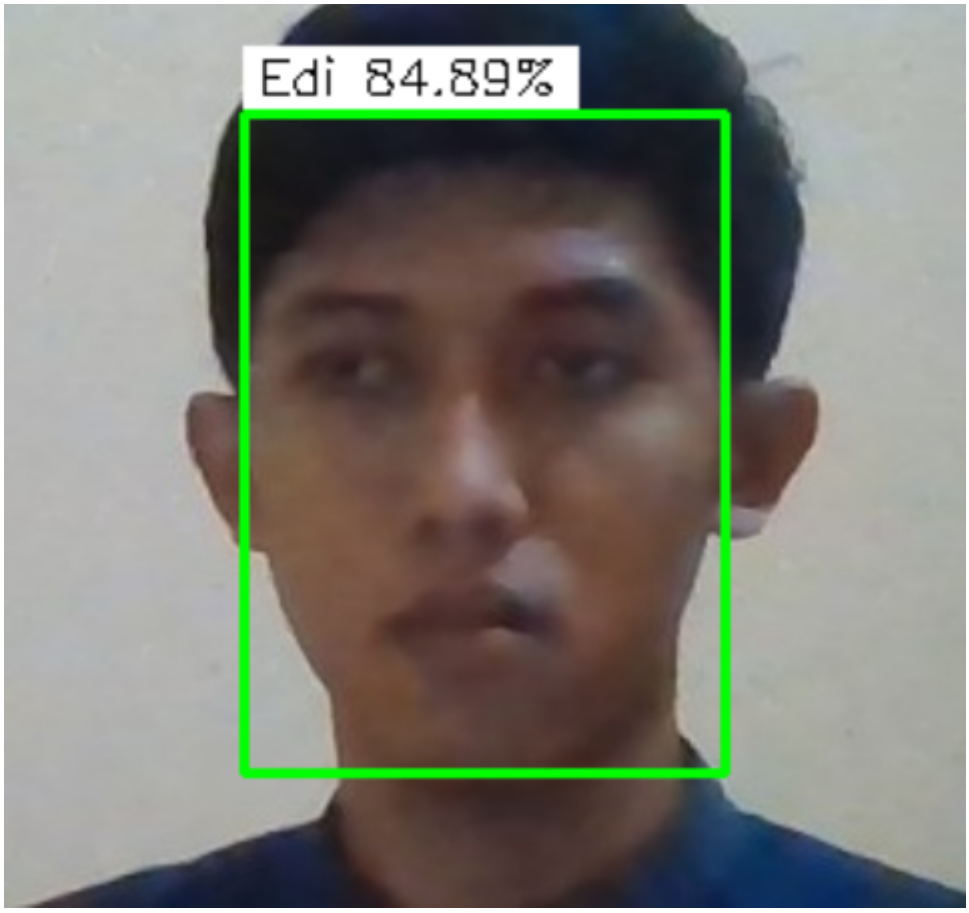
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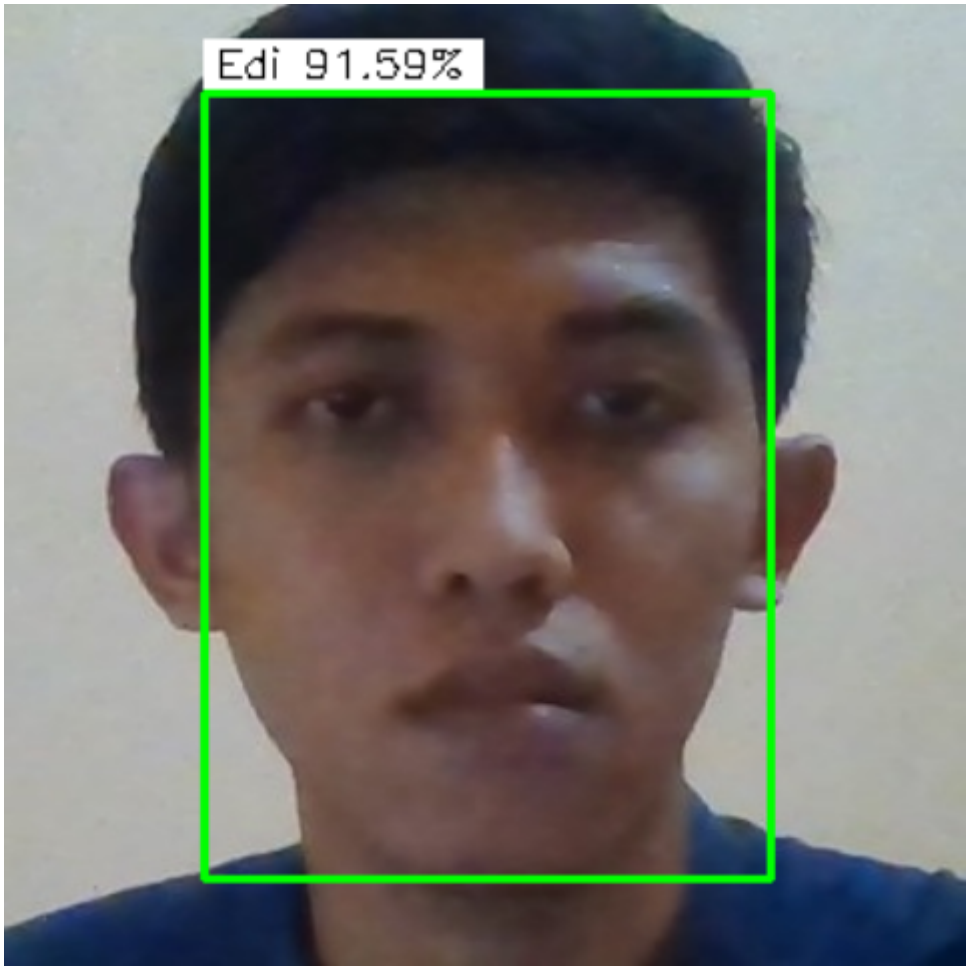
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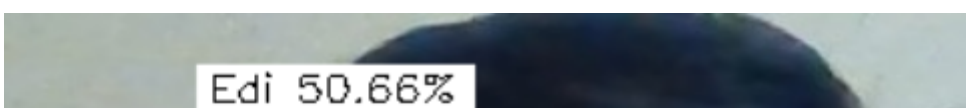
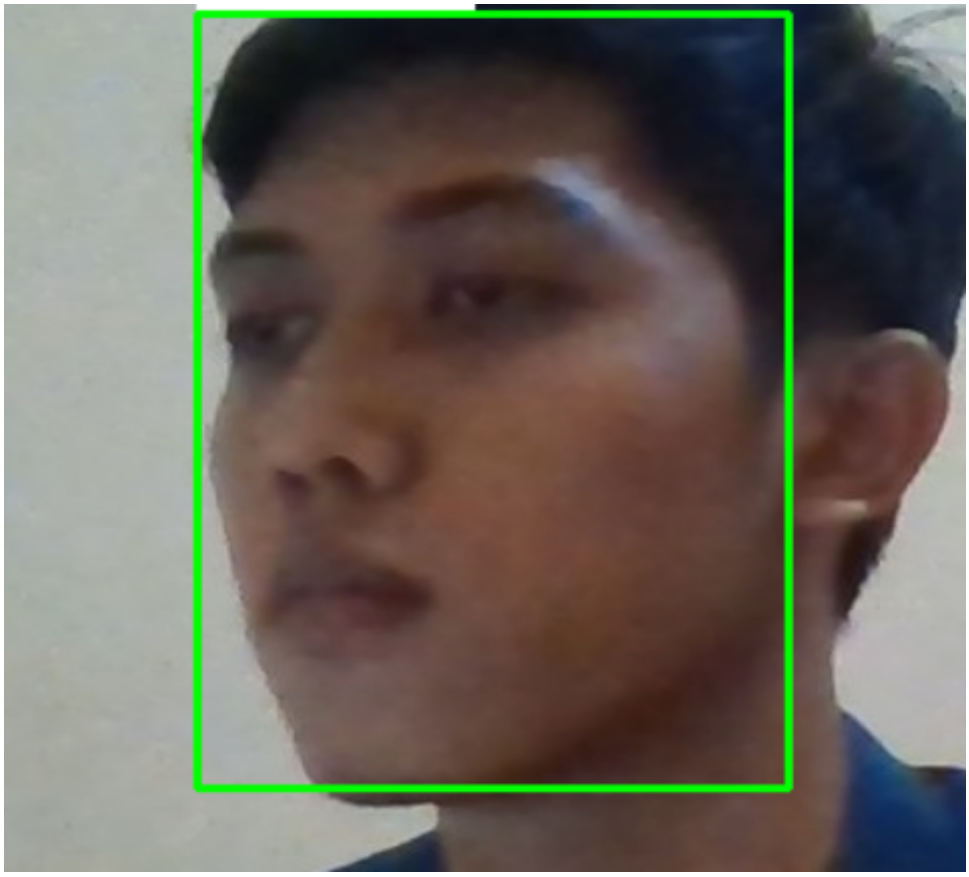

Edi 50.66%

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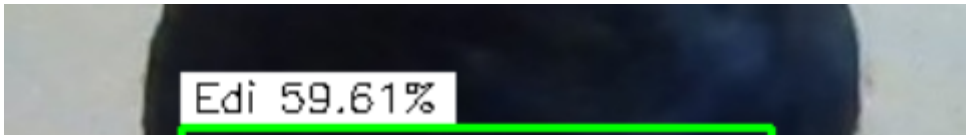
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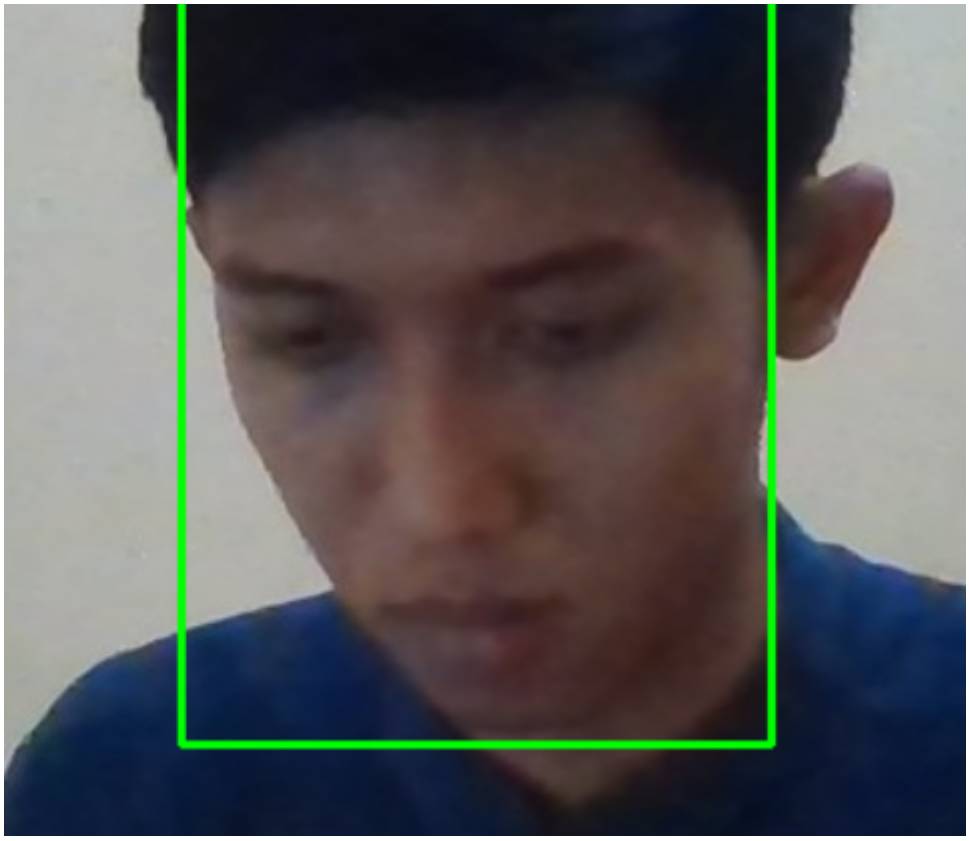

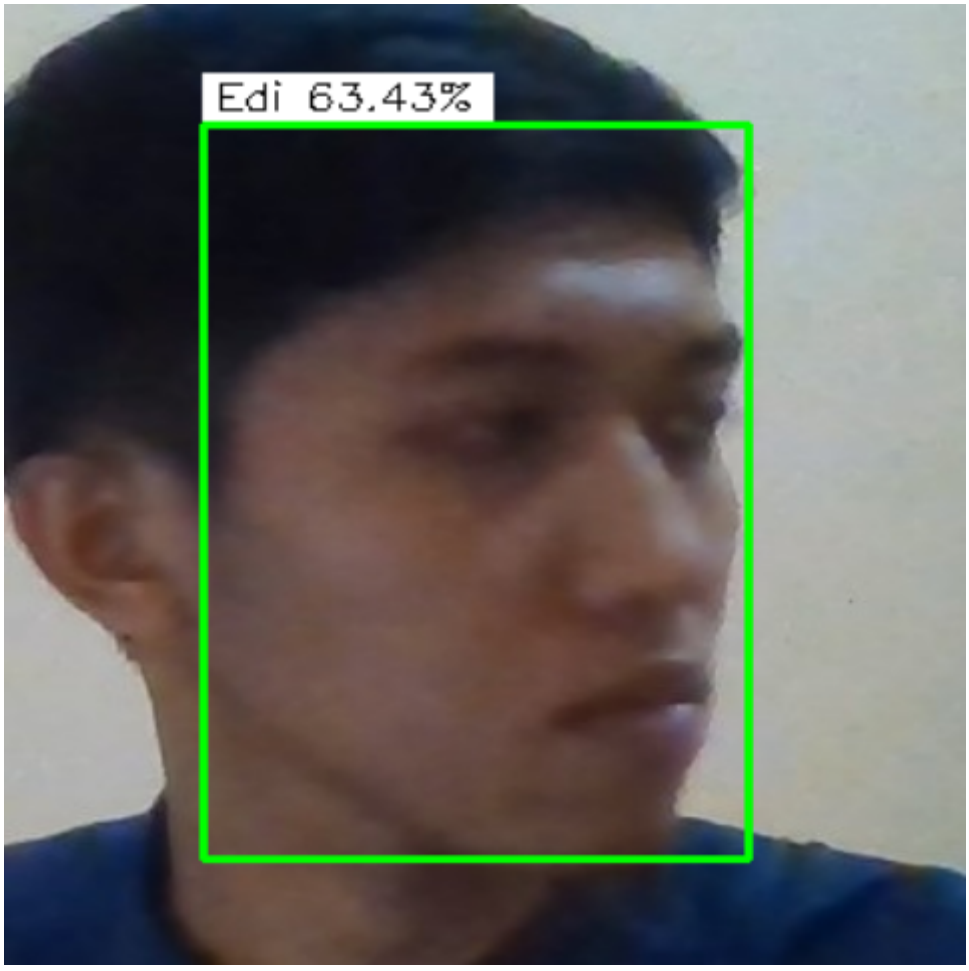
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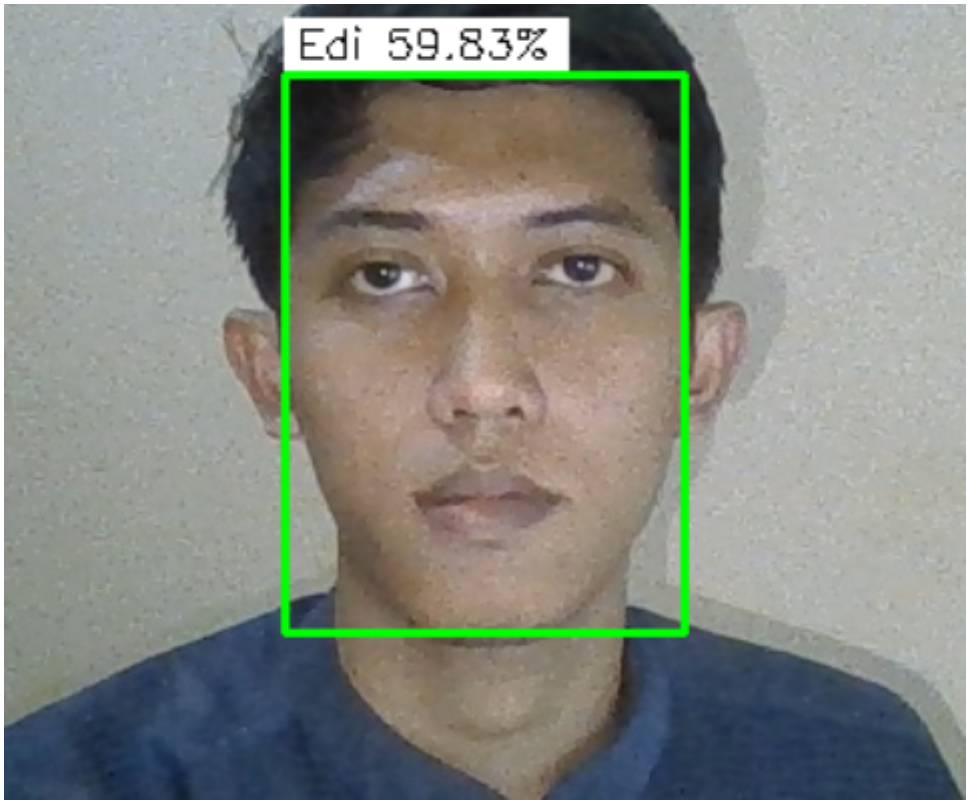
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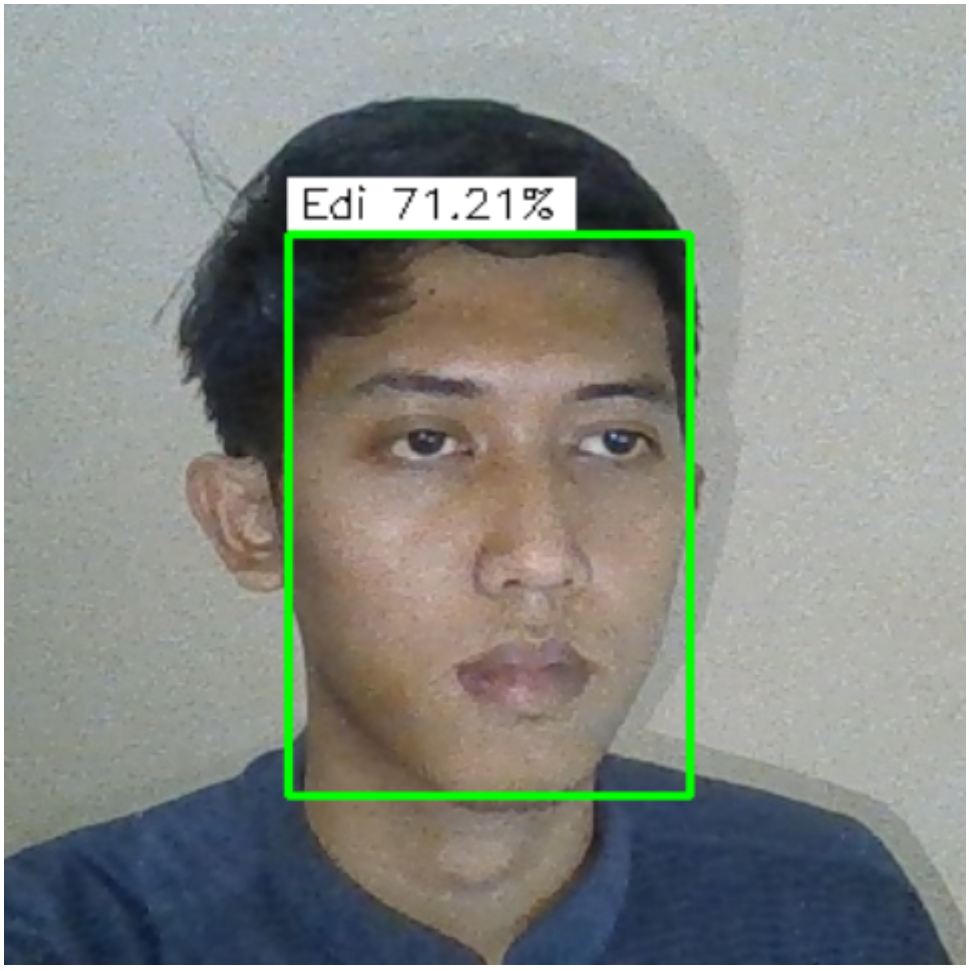
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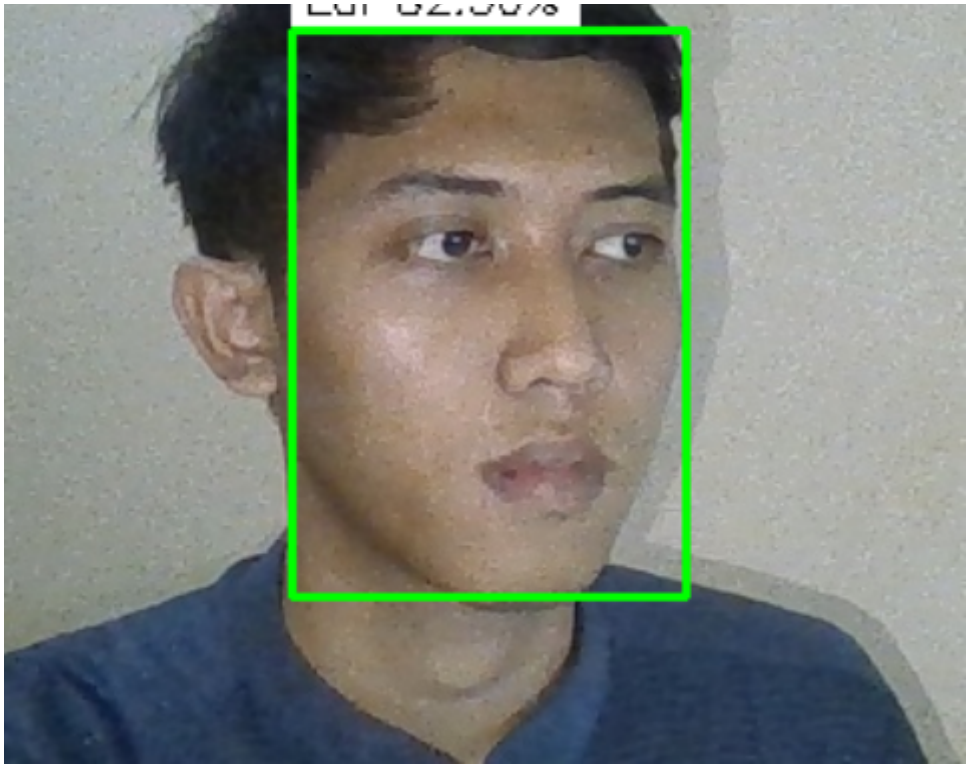
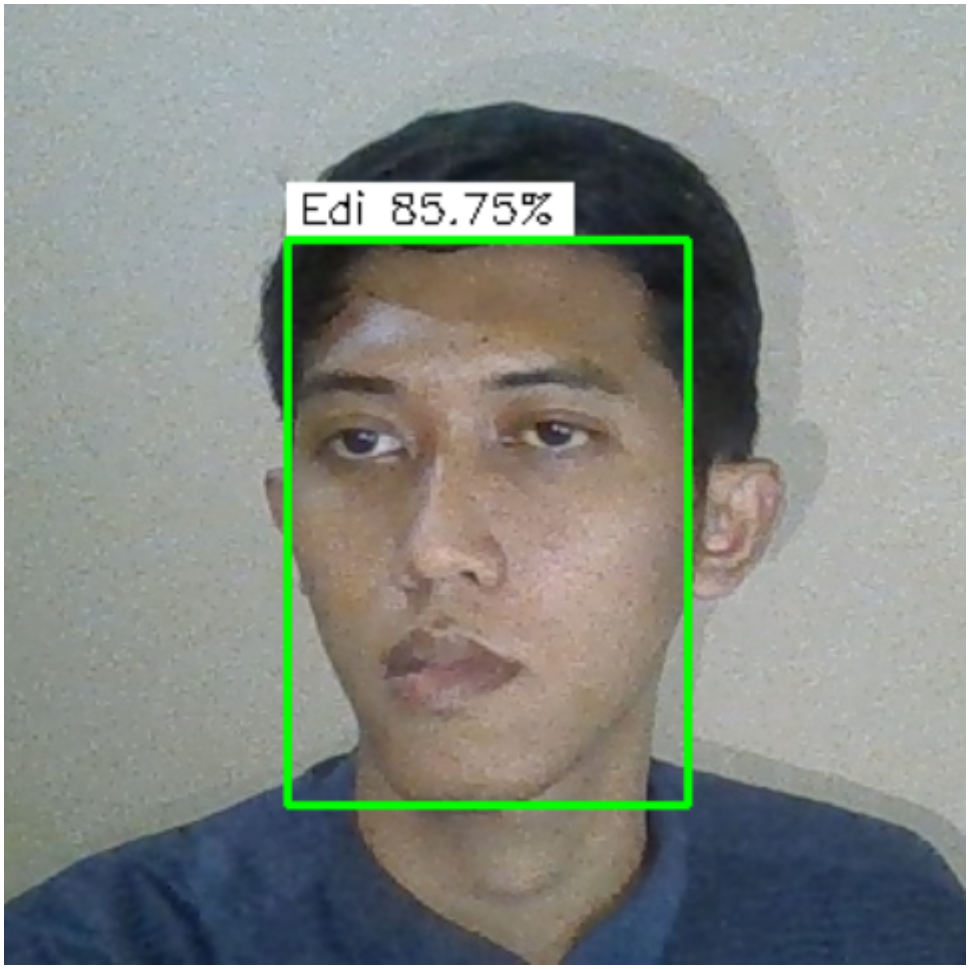
Edi 82.50%

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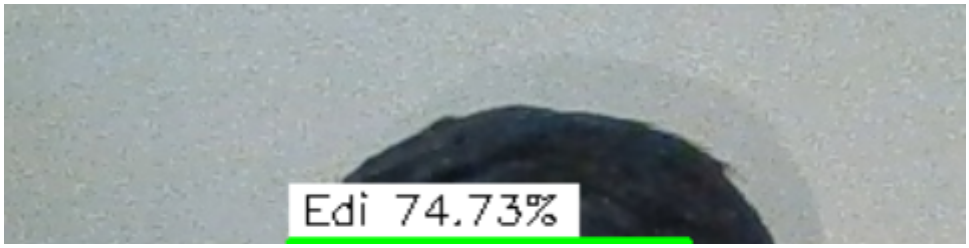
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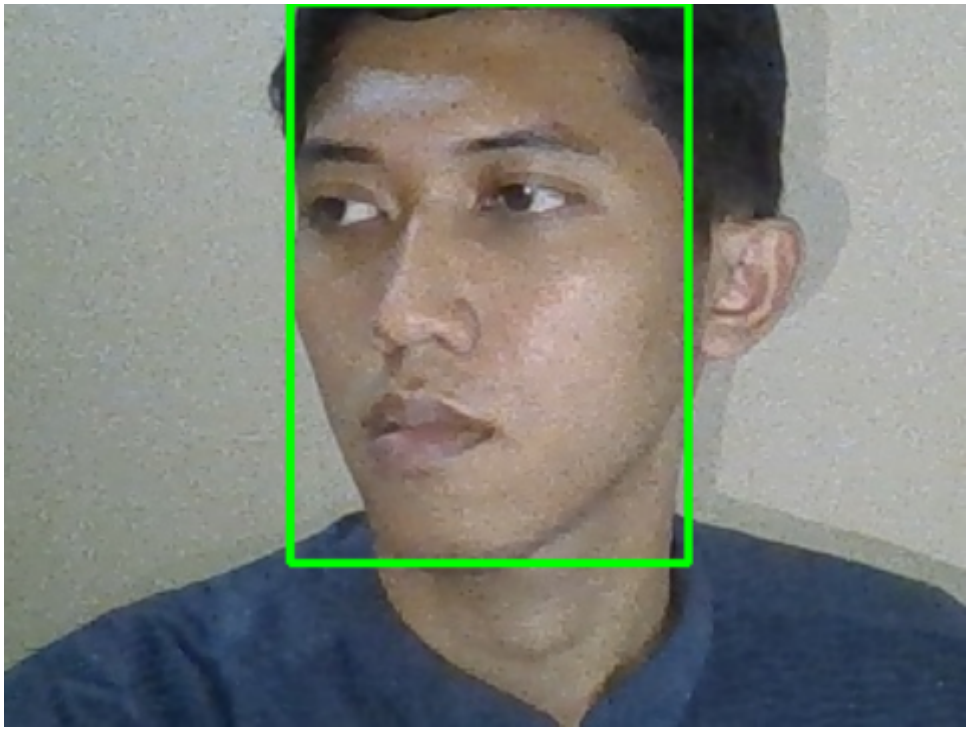

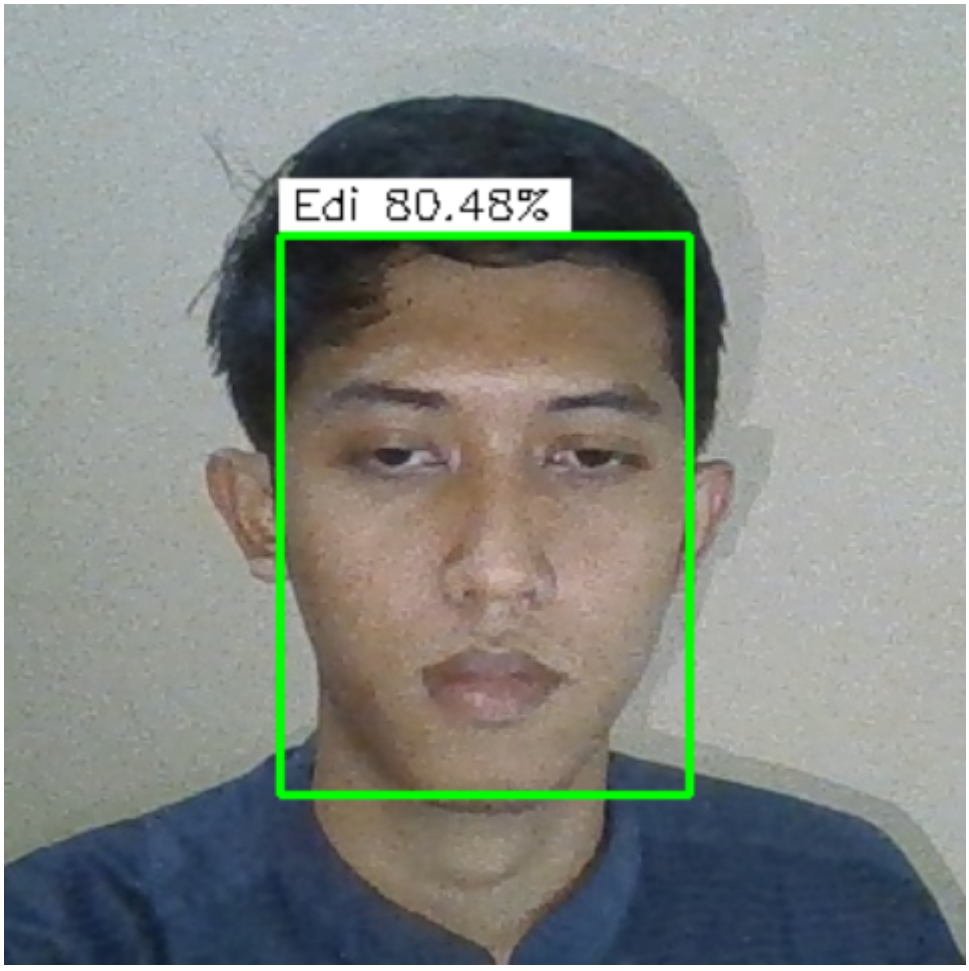
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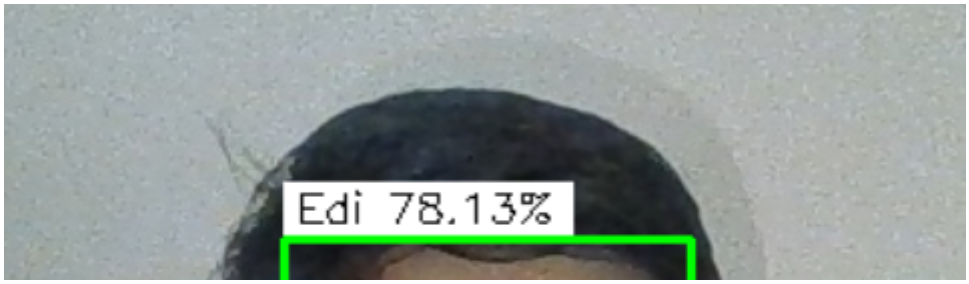
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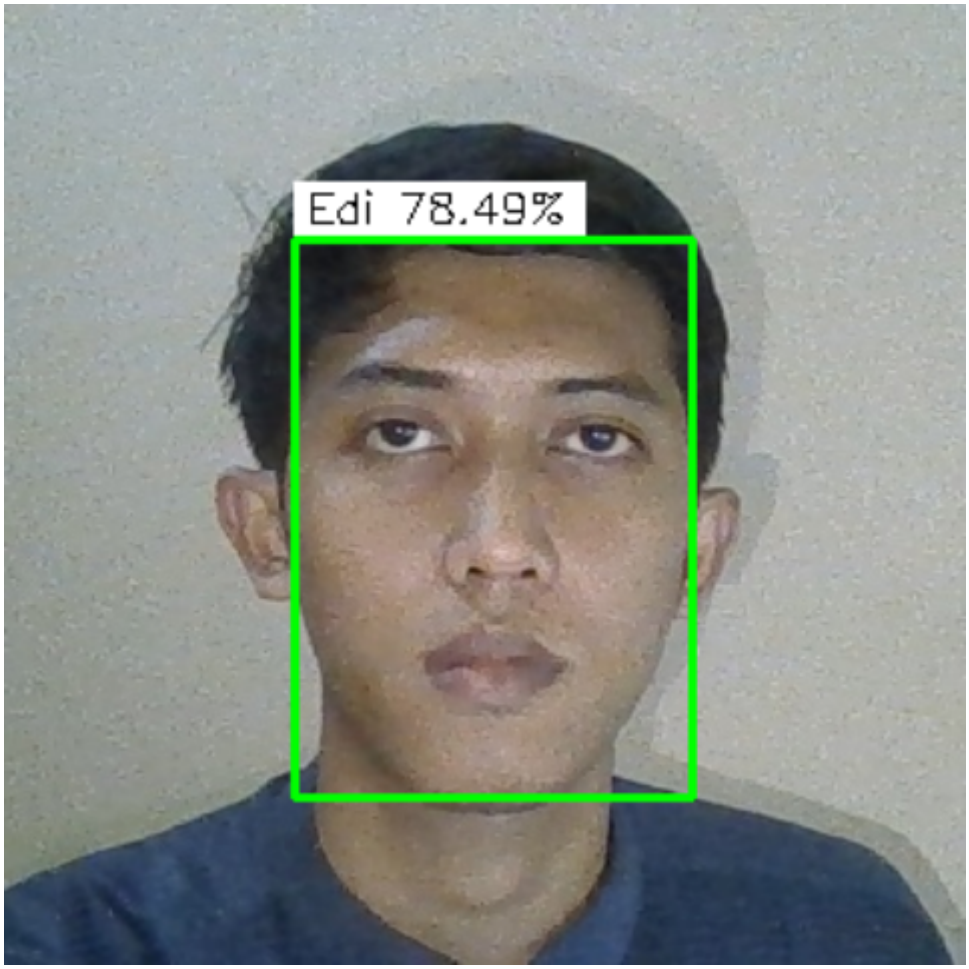


```
from tensorflow.keras.applications.mobilenet_v2 import preprocess_input
from tensorflow.keras.preprocessing.image import img_to_array
```

```
from tensorflow.keras.preprocessing import image
from tensorflow.keras.applications import imagenet_utils
from tensorflow.keras.models import load_model
from google.colab.patches import cv2_imshow
import numpy as np
import imutils
import time
import cv2
import os
from os import listdir
from os.path import isfile, join

prototxt_path = "/content/drive/MyDrive/FaceRecog/ssd_face.prototxt"
weights_path = "/content/drive/MyDrive/FaceRecog/ssd_face.caffemodel"

faceNet = cv2.dnn.readNet(prototxt_path, weights_path)

# load the face mask detector model from disk
model_recog = load_model('/content/drive/MyDrive/FaceRecog/new_dataset/result/result20/fac

# path = "/content/drive/MyDrive/FaceRecog/new_dataset/test/edi/"
path = "/content/drive/MyDrive/FaceRecog/new_dataset/test/unknown/"

many_file_in_dict = len(os.listdir(path))
image_file = os.listdir(path)
# print(image_file)

for count in range(many_file_in_dict):
  path_image = os.path.join(path+image_file[count])
  input_image = cv2.imread(path_image)

  # cv2_imshow(input_image)

  (h, w) = input_image.shape[:2]
  blob = cv2.dnn.blobFromImage(input_image, 1.0, (224, 224), (104.0, 177.0, 123.0))

  faceNet.setInput(blob)
  detections = faceNet.forward()

  # faces = []
  pred = {"0", "1"}

  for i in range(0, detections.shape[2]):
    confidence = detections[0, 0, i, 2]
    box = detections[0, 0, i, 3:7] * np.array([w, h, w, h])
    (startX, startY, endX, endY) = box.astype("int")

    if confidence > 0.5:
      (startX, startY) = (max(0, startX), max(0, startY))
      (endX, endY) = (min(w - 1, endX), min(h - 1, endY))

      face_detect = cv2.cvtColor(input_image, cv2.COLOR_BGR2RGB)
      face_detect = cv2.resize(face_detect, (224, 224))
      face_detect = img_to_array(face_detect)
      face_detect = preprocess_input(face_detect)
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      face_detect = np.expand_dims(face_detect, axis=0)

      preds = model_recog.predict(face_detect)
      label_percent = str("{:.2f}%".format((max(max(preds)))*100))

      preds = np.argmax(preds)

      # facial = pred[str(preds)]

      if preds == 0:
        label = "Edi"
        color = (0, 255, 0)
      if preds == 1:
        label = "Unknown"
        color = (0, 0, 255)

      label_full = label+" "+label_percent
      label_size = cv2.getTextSize(label_full, cv2.FONT_HERSHEY_SIMPLEX, 0.5, 1)
      cv2.rectangle(input_image, (startX, startY), (endX, endY), color, 2)
      cv2.rectangle(input_image, (startX, startY - 20), ((startX + label_size[0][0]) + 10,
      cv2.putText(input_image, label_full, (startX + 4, startY - 6), cv2.FONT_HERSHEY_SIMF

  image_resize = cv2.resize(input_image, (480, 480))
  # print(preds)
  cv2_imshow(image_resize)
  cv2.imwrite("/content/drive/MyDrive/FaceRecog/new_dataset/result/result20/test"+str(cour
  time.sleep(1)
  print('\n')
```


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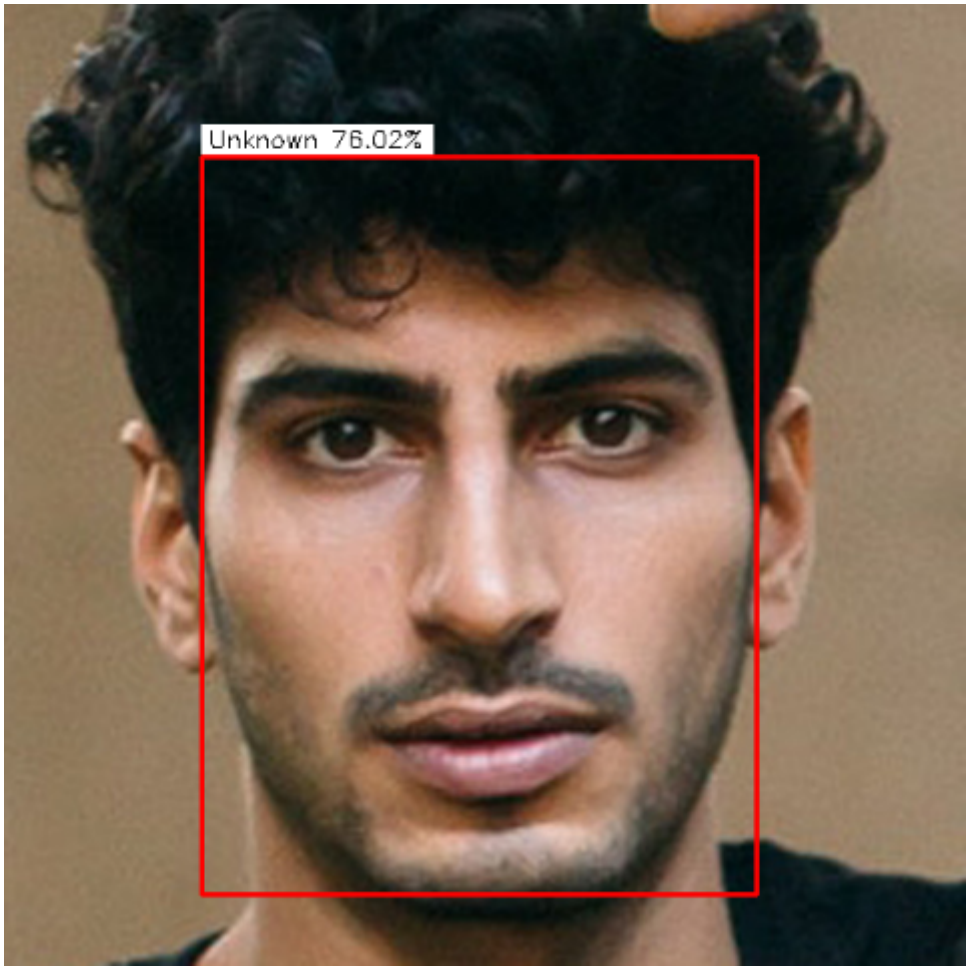
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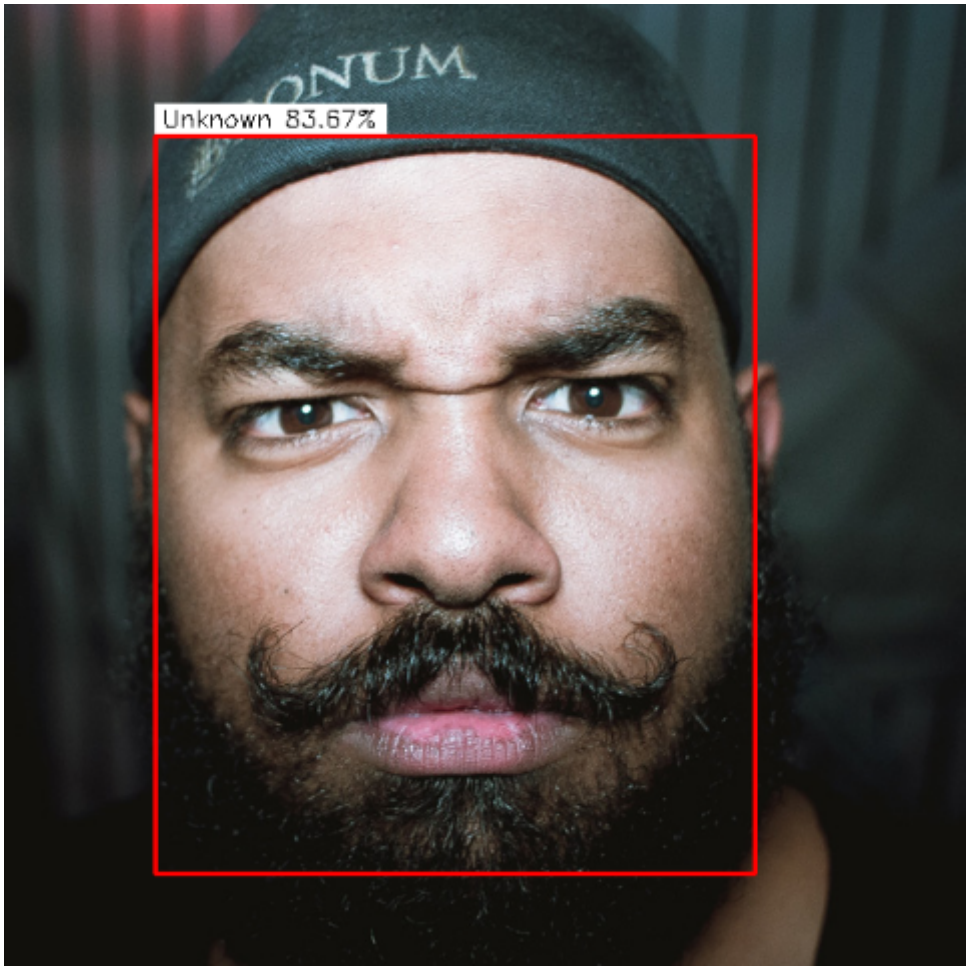
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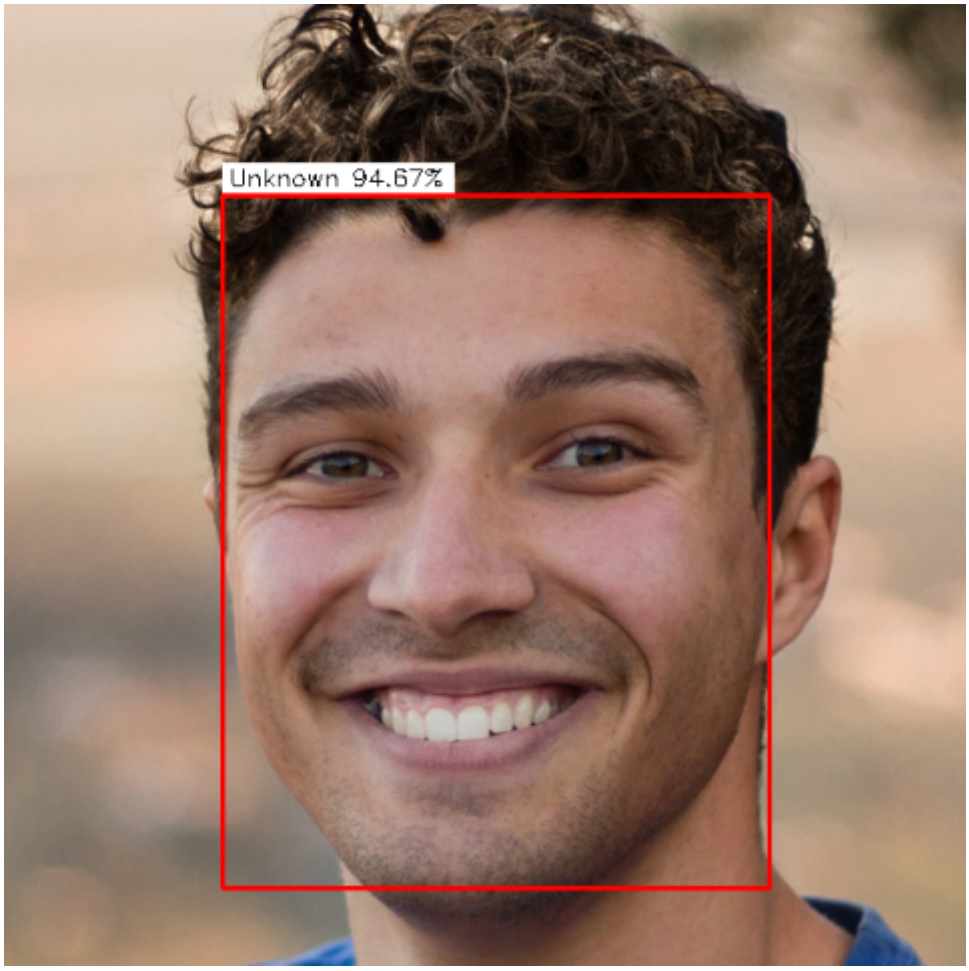
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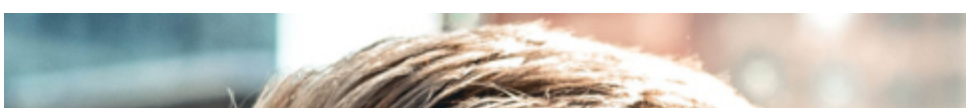

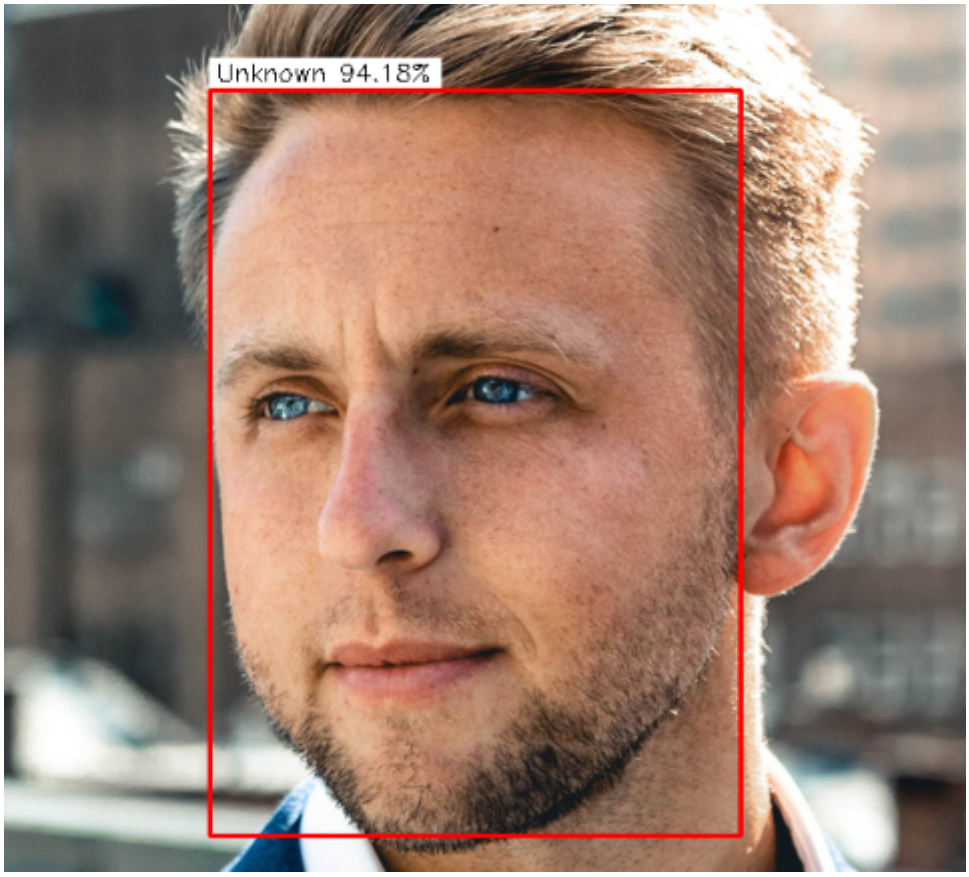
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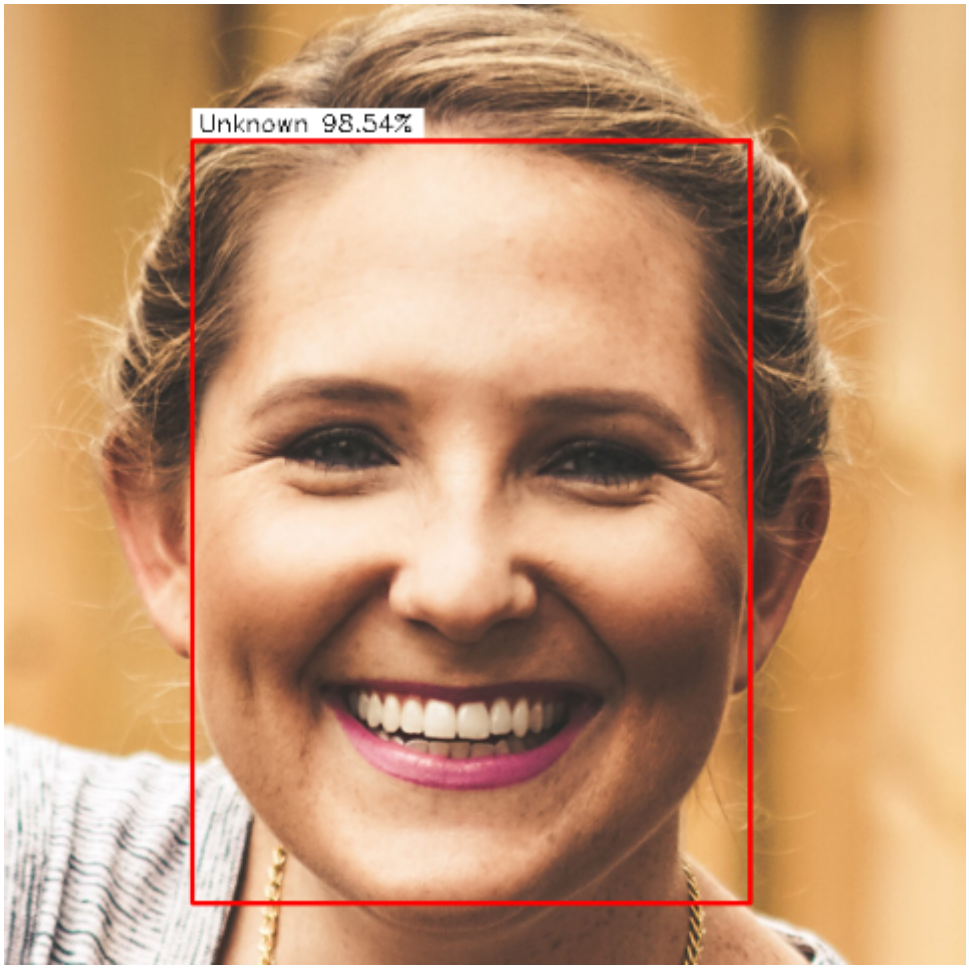
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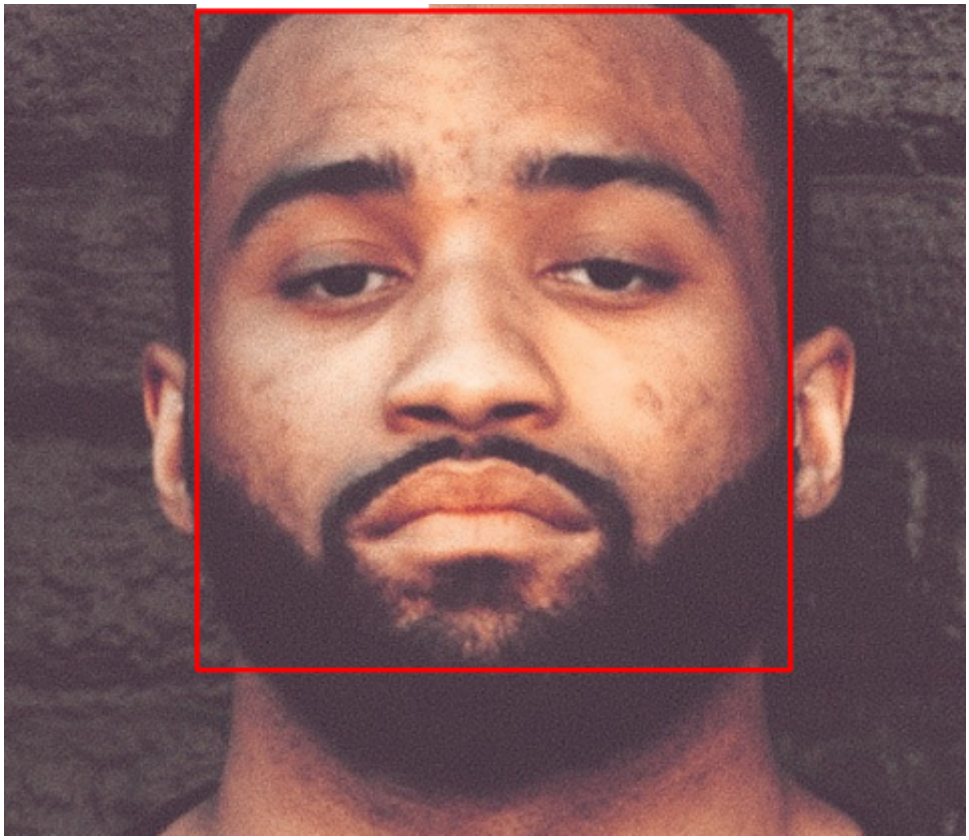

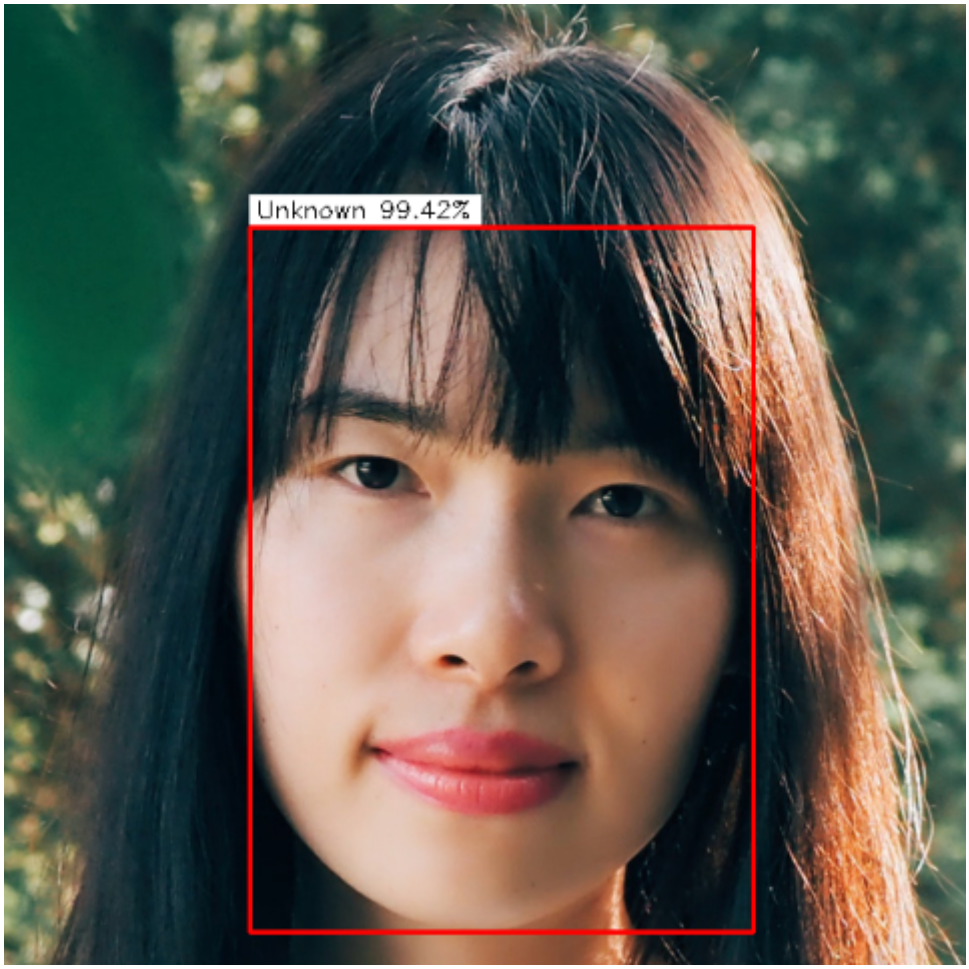
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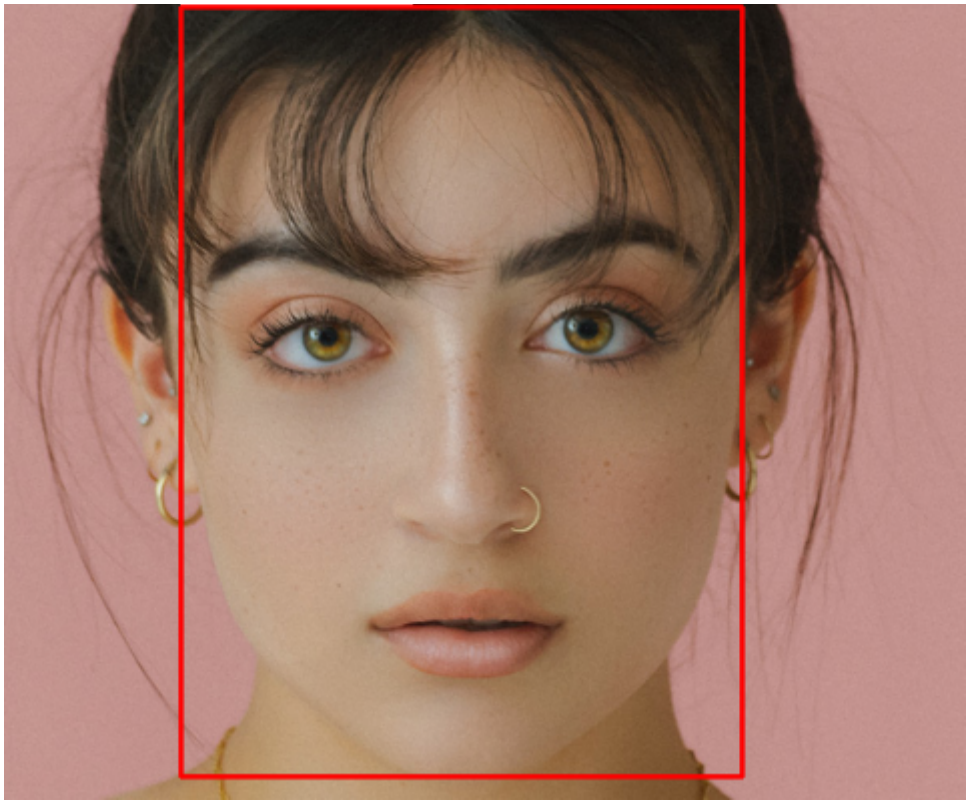

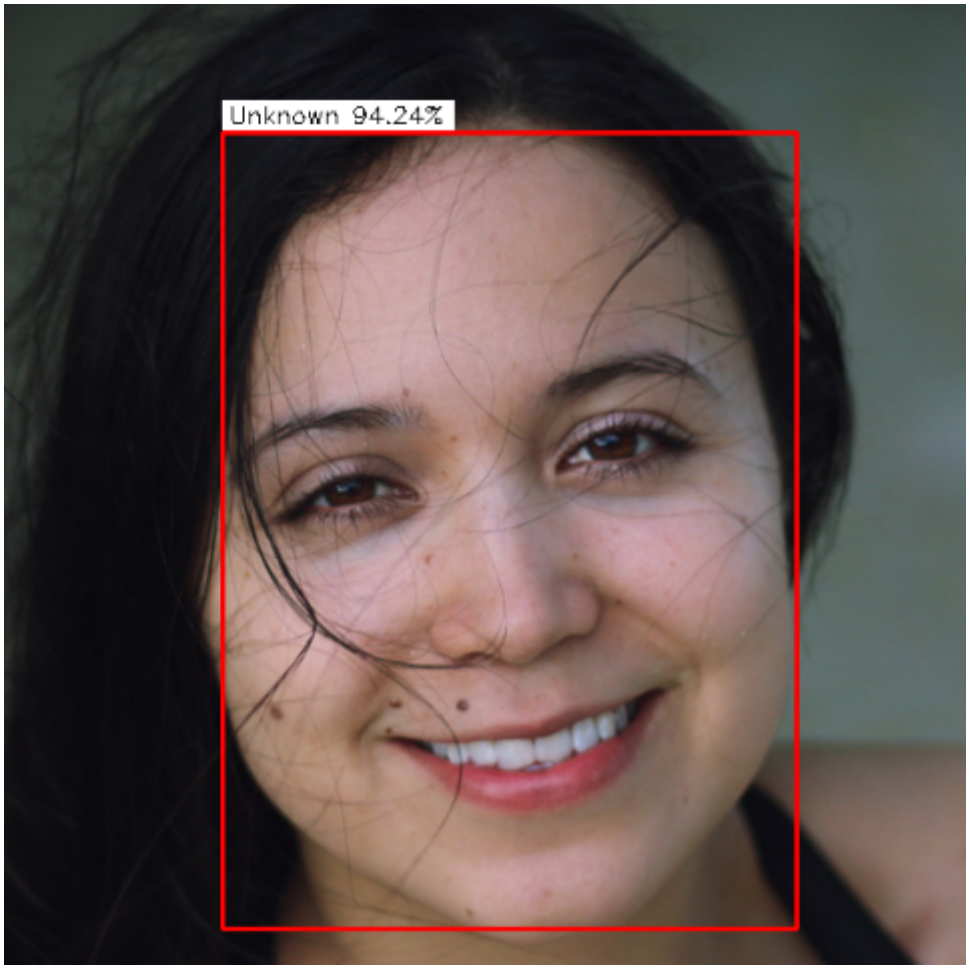
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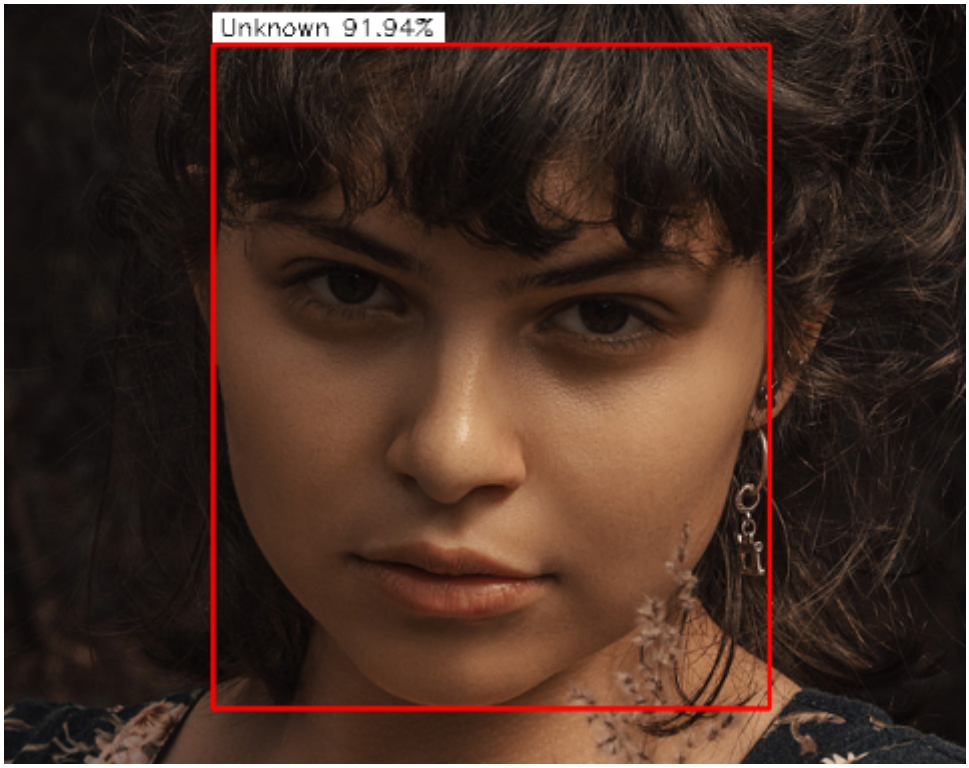
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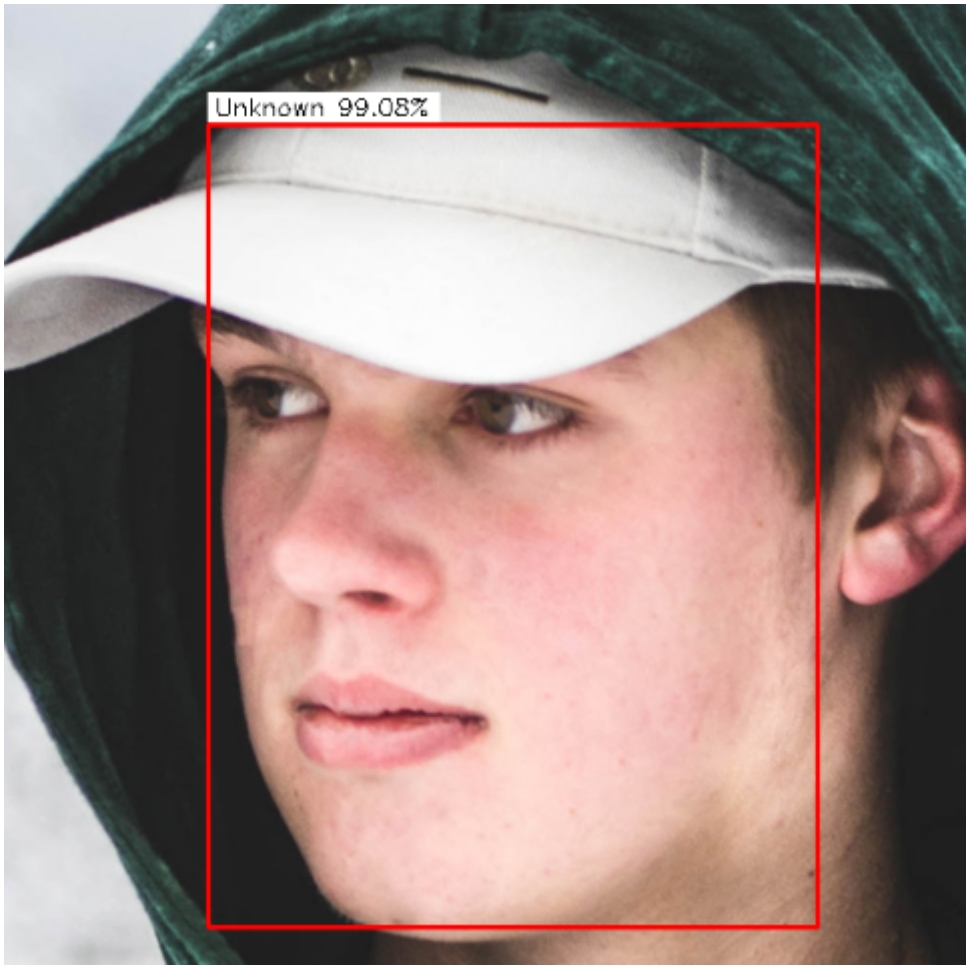
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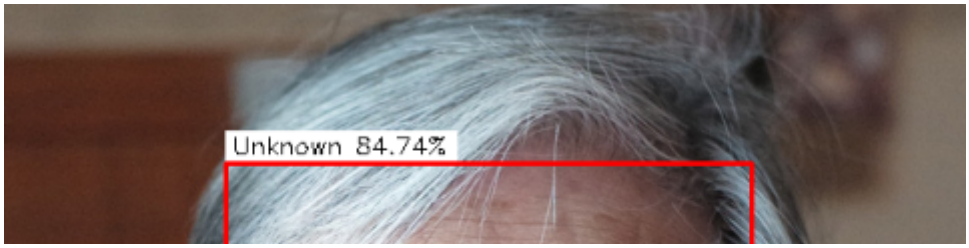
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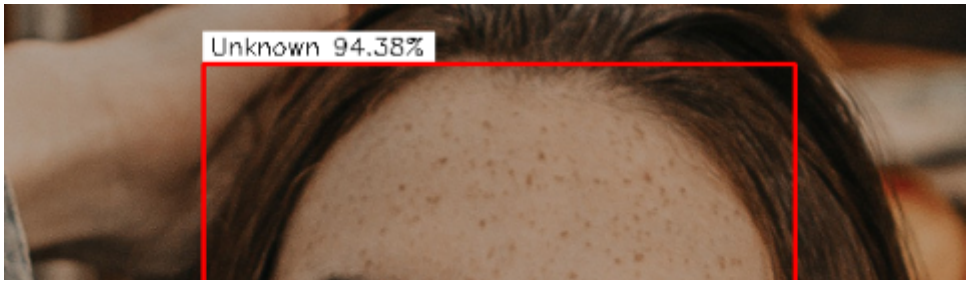
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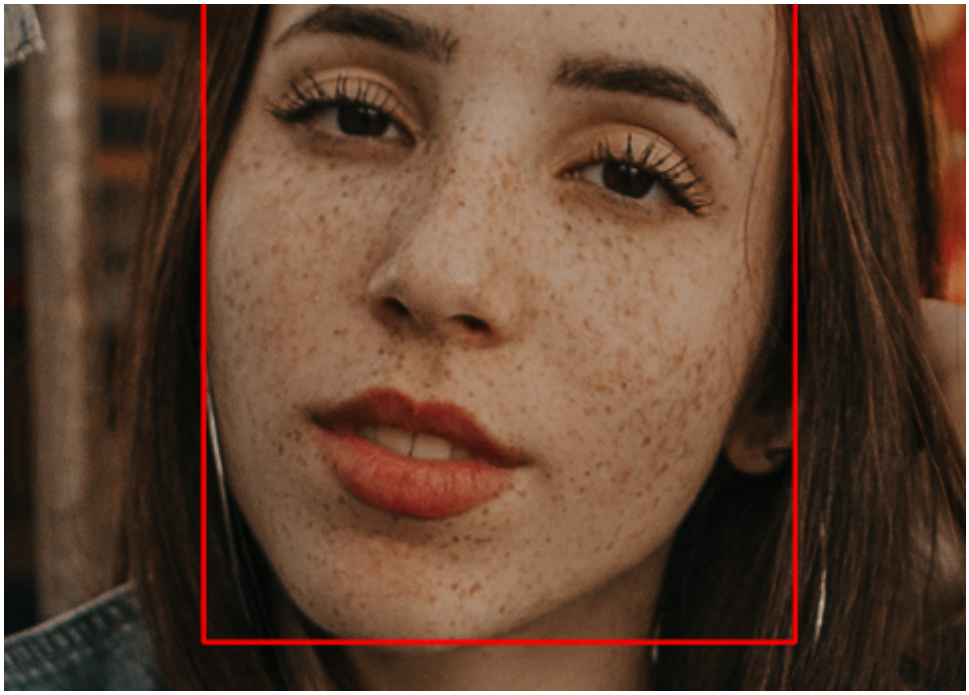

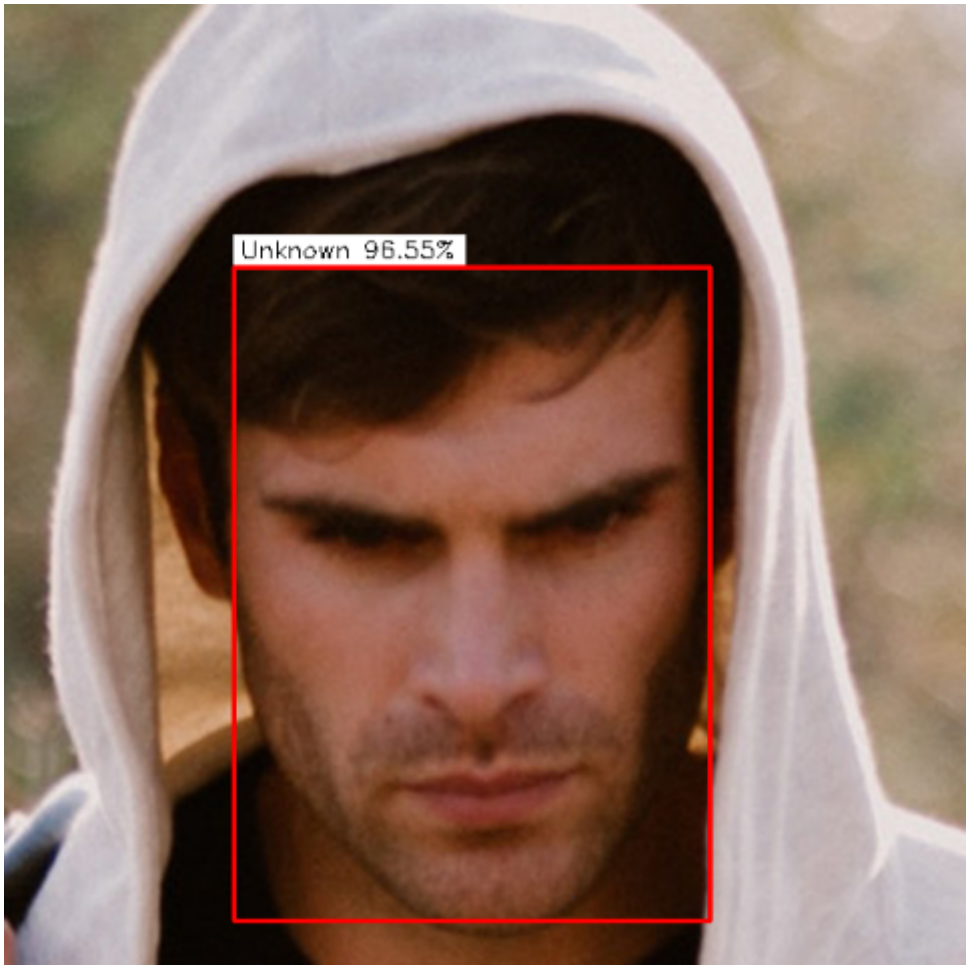
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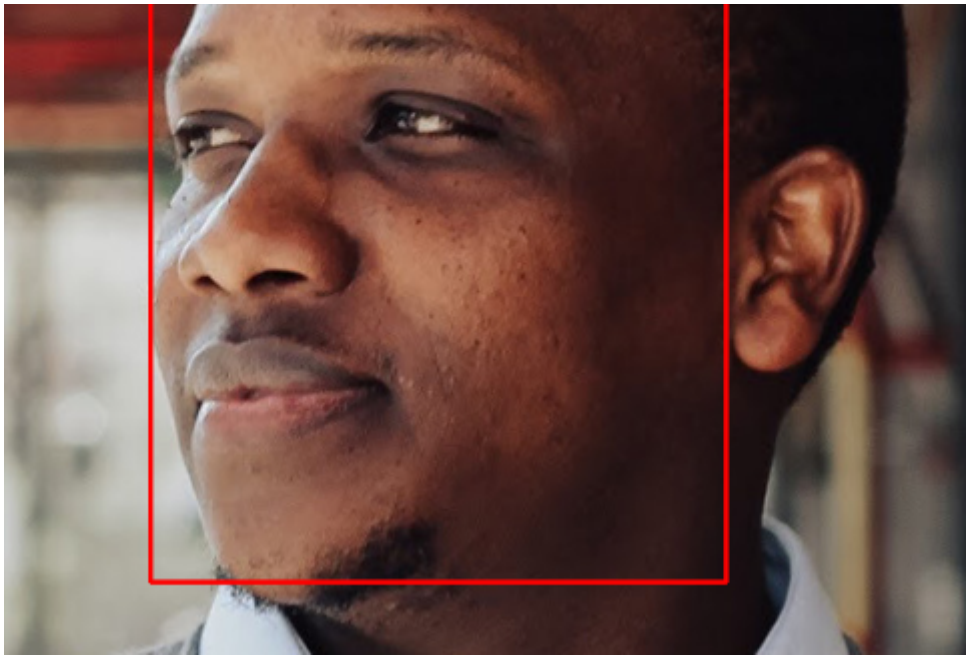

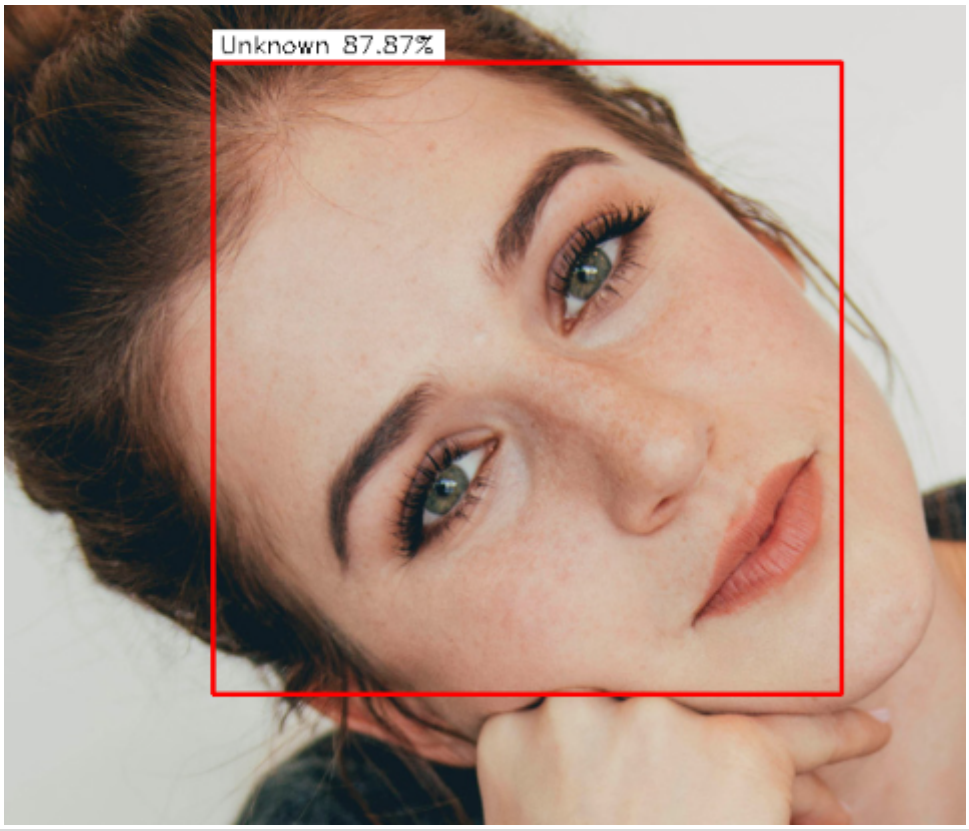
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