In [8]:
```
pip install tensorflow
```

```
Requirement already satisfied: tensorflow in c:\users\rohan\anaconda3\lib\site-packages (2.12.0)
Requirement already satisfied: tensorflow-intel==2.12.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow) (2.12.0)
Requirement already satisfied: packaging in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow)
(22.0)
Requirement already satisfied: setuptools in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow)
(65.6.3)
Requirement already satisfied: google-pasta>=0.1.1 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->te
nsorflow) (0.2.0)
Requirement already satisfied: astunparse>=1.6.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tens
orflow) (1.6.3)
Requirement already satisfied: tensorflow-estimator<2.13,>=2.12.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-in
tel==2.12.0->tensorflow) (2.12.0)
Requirement already satisfied: typing-extensions>=3.6.6 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.
0->tensorflow) (4.4.0)
Requirement already satisfied: absl-py>=1.0.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tensorf
low) (1.4.0)
Requirement already satisfied: wrapt<1.15,>=1.11.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->te
nsorflow) (1.14.1)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->te
nsorflow) (1.54.2)
Requirement already satisfied: tensorboard<2.13,>=2.12 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0
->tensorflow) (2.12.3)
Requirement already satisfied: keras<2.13,>=2.12.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->te
nsorflow) (2.12.0)
Requirement already satisfied: h5py>=2.9.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tensorflo
w) (3.7.0)
Requirement already satisfied: libclang>=13.0.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tenso
rflow) (16.0.0)
Requirement already satisfied: opt-einsum>=2.3.2 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tens
orflow) (3.3.0)
Requirement already satisfied: numpy<1.24,>=1.22 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tens
orflow) (1.23.5)
Requirement already satisfied: six>=1.12.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tensorflo
w) (1.16.0)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4.21.4,!=4.21.5,<5.0.0dev,>=3.20.3 in c:\users\rohan\a
naconda3\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (4.23.2)
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-
intel==2.12.0->tensorflow) (0.31.0)
Requirement already satisfied: flatbuffers>=2.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tenso
rflow) (23.5.26)
Requirement already satisfied: gast<=0.4.0,>=0.2.1 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->te
nsorflow) (0.4.0)
Requirement already satisfied: termcolor>=1.1.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tenso
rflow) (2.3.0)
Requirement already satisfied: jax>=0.3.15 in c:\users\rohan\anaconda3\lib\site-packages (from tensorflow-intel==2.12.0->tensorflo
w) (0.4.12)
```

```
Requirement already satisfied: wheel<1.0,>=0.23.0 in c:\users\rohan\anaconda3\lib\site-packages (from astunparse>=1.6.0->tensorflow
-intel==2.12.0->tensorflow) (0.38.4)
Requirement already satisfied: scipy>=1.7 in c:\users\rohan\anaconda3\lib\site-packages (from jax>=0.3.15->tensorflow-intel==2.12.0
->tensorflow) (1.10.0)
Requirement already satisfied: ml-dtypes>=0.1.0 in c:\users\rohan\anaconda3\lib\site-packages (from jax>=0.3.15->tensorflow-intel==
2.12.0->tensorflow) (0.2.0)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorboar
d<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (0.7.0)
Requirement already satisfied: werkzeug>=1.0.1 in c:\users\rohan\anaconda3\lib\site-packages (from tensorboard<2.13,>=2.12->tensorf
low-intel==2.12.0->tensorflow) (2.2.2)
Requirement already satisfied: requests<3,>=2.21.0 in c:\users\rohan\anaconda3\lib\site-packages (from tensorboard<2.13,>=2.12->ten
sorflow-intel==2.12.0->tensorflow) (2.28.1)
Requirement already satisfied: google-auth-oauthlib<1.1,>=0.5 in c:\users\rohan\anaconda3\lib\site-packages (from tensorboard<2.13,
>=2.12->tensorflow-intel==2.12.0->tensorflow) (1.0.0)
Requirement already satisfied: markdown>=2.6.8 in c:\users\rohan\anaconda3\lib\site-packages (from tensorboard<2.13,>=2.12->tensorf
low-intel==2.12.0->tensorflow) (3.4.1)
Requirement already satisfied: google-auth<3,>=1.6.3 in c:\users\rohan\anaconda3\lib\site-packages (from tensorboard<2.13,>=2.12->t
ensorflow-intel==2.12.0->tensorflow) (2.19.1)
Requirement already satisfied: pyasn1-modules>=0.2.1 in c:\users\rohan\anaconda3\lib\site-packages (from google-auth<3,>=1.6.3->ten
sorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (0.2.8)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in c:\users\rohan\anaconda3\lib\site-packages (from google-auth<3,>=1.6.3->te
nsorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (5.3.1)
Requirement already satisfied: urllib3<2.0 in c:\users\rohan\anaconda3\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard<
2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (1.26.14)
Requirement already satisfied: rsa<5,>=3.1.4 in c:\users\rohan\anaconda3\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard
<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (4.9)
Requirement already satisfied: requests-oauthlib>=0.7.0 in c:\users\rohan\anaconda3\lib\site-packages (from google-auth-oauthlib<1.
1,>=0.5->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (1.3.1)
Requirement already satisfied: charset-normalizer<3,>=2 in c:\users\rohan\anaconda3\lib\site-packages (from requests<3,>=2.21.0->te
nsorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (2.0.4)
Requirement already satisfied: idna<4,>=2.5 in c:\users\rohan\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorboard<2.
13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (3.4)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\rohan\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorbo
ard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (2023.5.7)
Requirement already satisfied: MarkupSafe>=2.1.1 in c:\users\rohan\anaconda3\lib\site-packages (from werkzeug>=1.0.1->tensorboard<
2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (2.1.1)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in c:\users\rohan\anaconda3\lib\site-packages (from pyasn1-modules>=0.2.1->goog
le-auth<3,>=1.6.3->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (0.4.8)
Requirement already satisfied: oauthlib>=3.0.0 in c:\users\rohan\anaconda3\lib\site-packages (from requests-oauthlib>=0.7.0->google
-auth-oauthlib<1.1,>=0.5->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (3.2.2)
Note: you may need to restart the kernel to use updated packages.
```

In [53]:
```
import matplotlib.pyplot as plt
import numpy as np
import tensorflow as tf
import pathlib
from tensorflow import keras
import tensorflow.keras
from tensorflow.keras import layers
from tensorflow.keras.models import Sequential
import tkinter as tk
from tkinter import filedialog
```

In [54]:
```
data_dir = "D:\machine learning code\\face mask detection\Face Mask Dataset\Train"
data_dir = pathlib.Path(data_dir)
```

In [55]:
```
batch_size = 16
img_height = 64
img_width = 64
```

In [56]:
```
# Reading Training images from the directory
train_ds = tf.keras.preprocessing.image_dataset_from_directory(
    data_dir, validation_split = 0.2, subset = "training", seed = 123,
    image_size = (img_height, img_width), batch_size = batch_size)
```

```
Found 10011 files belonging to 2 classes.
Using 8009 files for training.
```

In [57]:
```
# Reading validation images from the directory
val_ds = tf.keras.preprocessing.image_dataset_from_directory(
    data_dir, validation_split = 0.2, subset = "validation", seed = 123,
    image_size = (img_height, img_width), batch_size = batch_size)
```

```
Found 10011 files belonging to 2 classes.
Using 2002 files for validation.
```

In [58]:
```
class_names = train_ds.class_names
print(class_names)
```

```
['WithMask', 'WithoutMask']
```

In [59]:
```
#Memory optimization and speed up execution
AUTOTUNE = tf.data.experimental.AUTOTUNE
train_ds = train_ds.cache().shuffle(1000).prefetch(buffer_size = AUTOTUNE)
val_ds = val_ds.cache().prefetch(buffer_size = AUTOTUNE)
```

In [60]:
```
num_class = 2
```

In [61]:
```
#Definning CNN
model = Sequential([
    layers.experimental.preprocessing.Rescaling(1./255, input_shape = (img_height, img_width, 3)),
    layers.Conv2D(16,(3,3), padding = 'same', activation = 'relu'),
    layers.MaxPooling2D(),
    layers.Conv2D(32,(3,3), padding='same', activation='relu'),
    layers.MaxPooling2D(),
    layers.Conv2D(64, (3,3), padding='same', activation='relu'),
    layers.MaxPooling2D(),
    layers.Dropout(0.2),
    layers.Flatten(),
    layers.Dense(64, activation = 'relu'),
    layers.Dense(num_class)
])

noepochs = 7
```

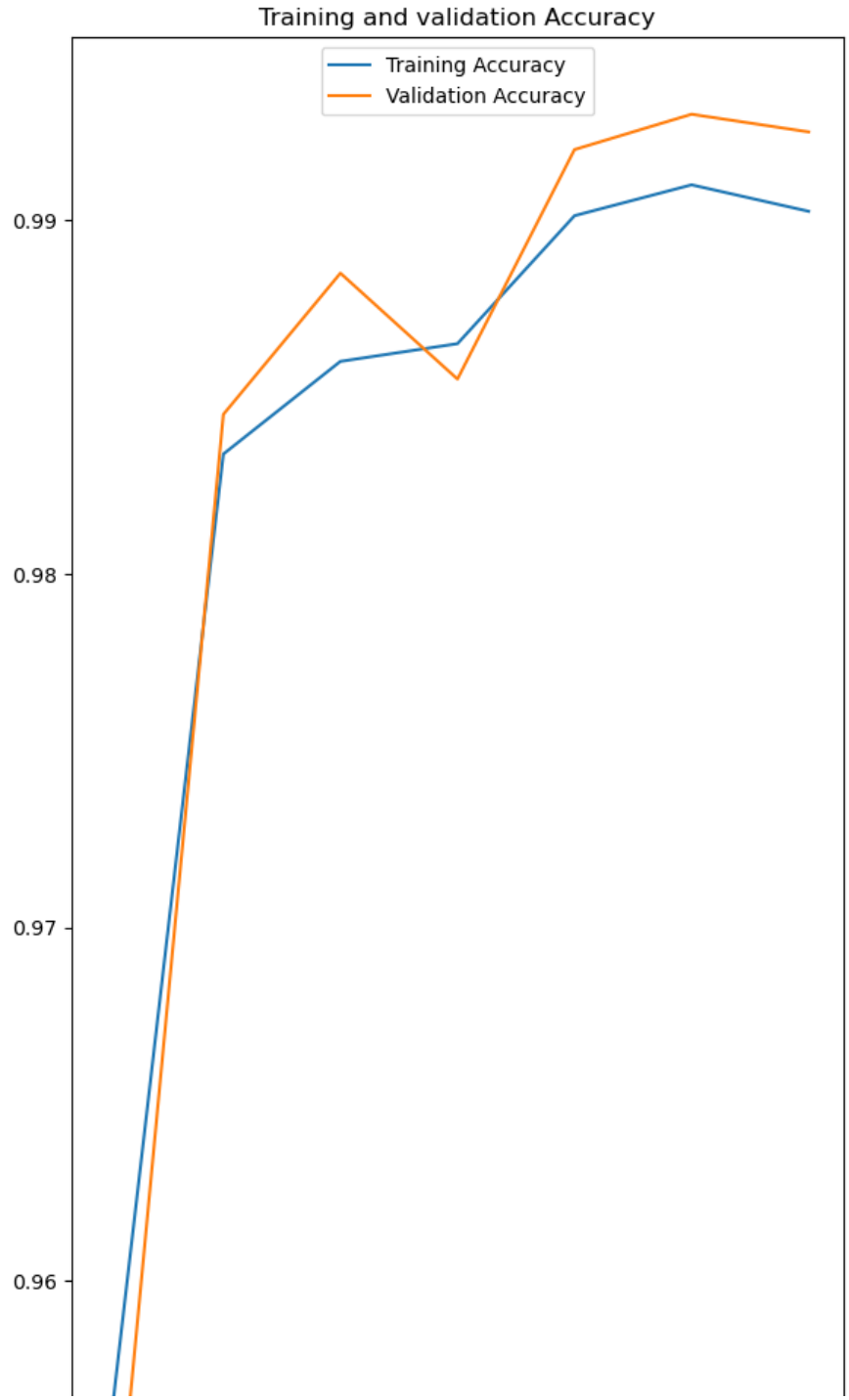
In [62]:
```
model.compile(optimizer = 'adam', loss = tf.keras.losses.SparseCategoricalCrossentropy(from_logits = True),
                  metrics = ['accuracy'])
#training the model
mymodel = model.fit(train_ds, validation_data = val_ds, epochs = noepochs)
```

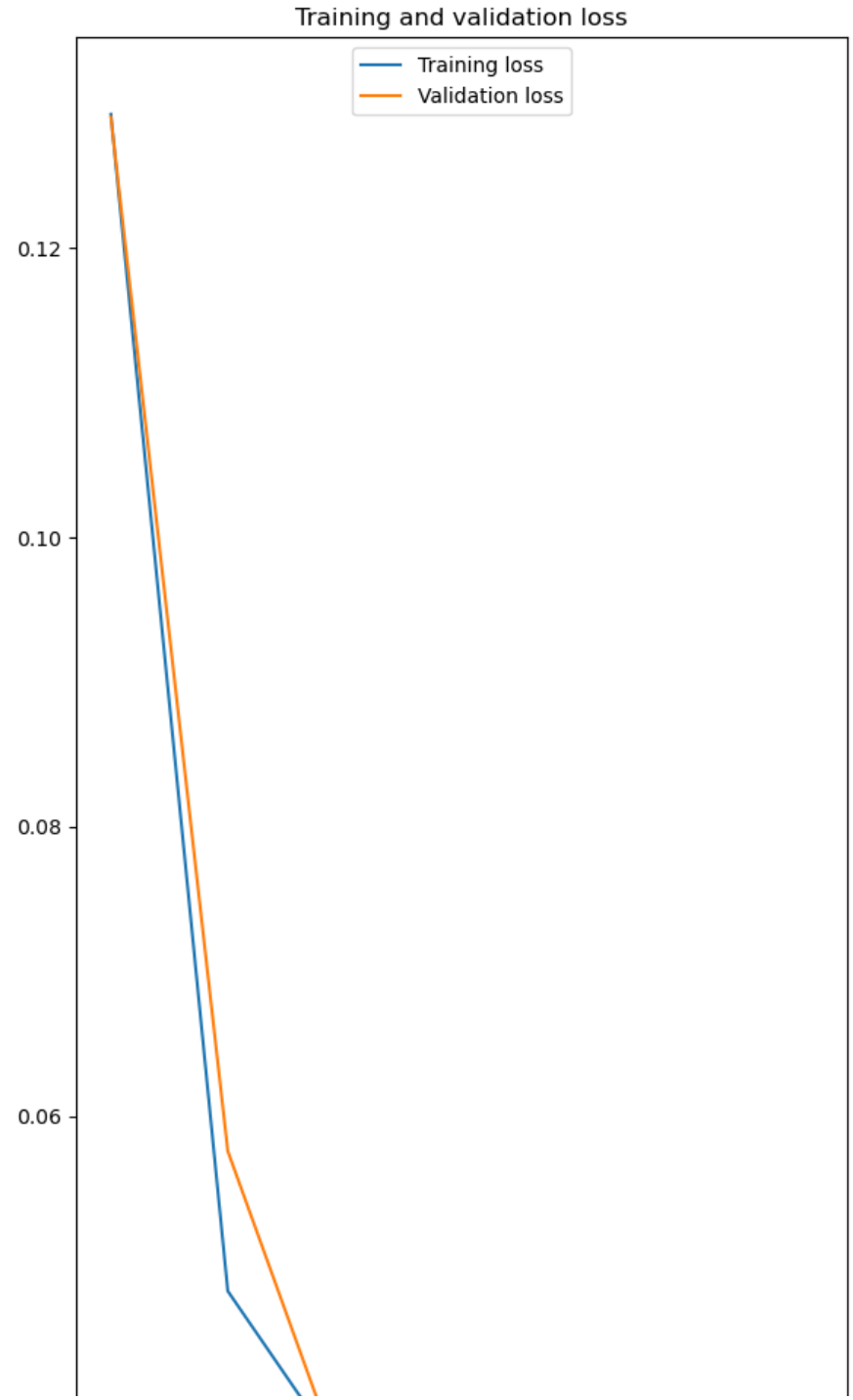
```
Epoch 1/7
501/501 [==============================] - 18s 29ms/step - loss: 0.1292 - accuracy: 0.9549 - val_loss: 0.1290 - val_accuracy: 0.949
6
Epoch 2/7
501/501 [==============================] - 14s 28ms/step - loss: 0.0479 - accuracy: 0.9834 - val_loss: 0.0576 - val_accuracy: 0.984
5
Epoch 3/7
501/501 [==============================] - 14s 28ms/step - loss: 0.0361 - accuracy: 0.9860 - val_loss: 0.0352 - val_accuracy: 0.988
5
Epoch 4/7
501/501 [==============================] - 14s 28ms/step - loss: 0.0374 - accuracy: 0.9865 - val_loss: 0.0361 - val_accuracy: 0.985
5
Epoch 5/7
501/501 [==============================] - 14s 28ms/step - loss: 0.0269 - accuracy: 0.9901 - val_loss: 0.0319 - val_accuracy: 0.992
0
Epoch 6/7
501/501 [==============================] - 14s 28ms/step - loss: 0.0267 - accuracy: 0.9910 - val_loss: 0.0268 - val_accuracy: 0.993
0
Epoch 7/7
501/501 [==============================] - 14s 28ms/step - loss: 0.0239 - accuracy: 0.9903 - val_loss: 0.0231 - val_accuracy: 0.992
5
```

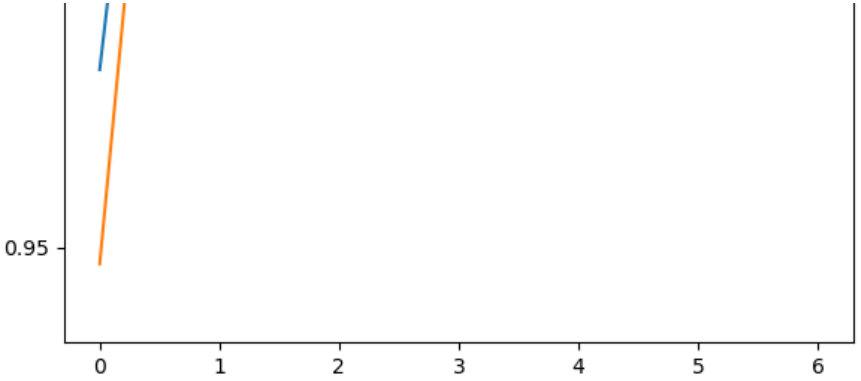
In [63]:
```
acc = mymodel.history['accuracy']
val_acc = mymodel.history['val_accuracy']
loss = mymodel.history['loss']
val_loss = mymodel.history['val_loss']
epochs_range = range(noepochs)
```

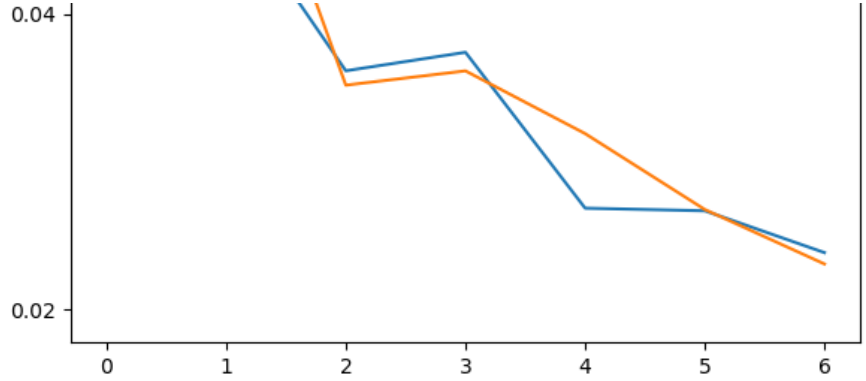
In [64]:
```
plt.figure(figsize=(15, 15)) #creates figure for the plot
plt.subplot(1, 2, 1)
plt.plot(epochs_range, acc, label = 'Training Accuracy')
plt.plot(epochs_range, val_acc, label = 'Validation Accuracy')
plt.legend(loc = 'upper center')
plt.title('Training and validation Accuracy')

plt.subplot(1, 2, 2)
plt.plot(epochs_range, loss, label = 'Training loss')
plt.plot(epochs_range, val_loss, label = 'Validation loss')
plt.legend(loc = 'upper center')
plt.title('Training and validation loss')
plt.show()
```


Training and validation Accuracy
Training Accuracy
Validation Accuracy
0.99
0.98
0.97
0.96


Training and validation loss
Training loss
Validation loss
0.12
0.10
0.08
0.06





In [65]:
```
# Function to test single image
def recogout():
    root = tk.Tk()
    root.withdraw()
    img_path = filedialog.askopenfilename()
    img = keras.preprocessing.image.load_img(img_path, target_size = (img_height, img_width))
    img_array = keras.preprocessing.image.img_to_array(img)
    img_array = tf.expand_dims(img_array, 0)
    predictions = model.predict(img_array)
    score = tf.nn.softmax(predictions[0])

    print("This image most likely belongs to {} with a {:.2f} percent confidence."
          .format(class_names[np.argmax(score)], 100*np.max(score)))
```

In [66]:
```
from tkinter import *
import tkinter as tk
from tkinter import filedialog
```

In [71]:
```
recogout()
```

```
1/1 [==============================] - 0s 31ms/step
This image most likely belongs to WithoutMask with a 80.95 percent confidence.
```

In [ ]: