

```
In [1]: pip install tensorflow
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Requirement already satisfied: tensorflow in c:\users\reshma_koduri\anaconda3\lib\site-packages (2.16.1)
Requirement already satisfied: tensorflow-intel==2.16.1 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow) (2.16.1)
Requirement already satisfied: absl-py>=1.0.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (2.1.0)
Requirement already satisfied: astunparse>=1.6.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (1.6.3)
Requirement already satisfied: flatbuffers>=23.5.26 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (24.3.25)
Requirement already satisfied: gast!=0.5.0,!0.5.1,!0.5.2,>=0.2.1 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (0.5.4)
Requirement already satisfied: google-pasta>=0.1.1 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (0.2.0)
Requirement already satisfied: h5py>=3.10.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (3.11.0)
Requirement already satisfied: libclang>=13.0.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (18.1.1)
Requirement already satisfied: ml-dtypes~0.3.1 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (0.3.2)
Requirement already satisfied: opt-einsum>=2.3.2 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (3.3.0)
Requirement already satisfied: packaging in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (21.0)
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\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (3.20.3)
Requirement already satisfied: requests<3,>=2.21.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (2.26.0)
Requirement already satisfied: setuptools in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (69.5.1)
Requirement already satisfied: six>=1.12.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (1.16.0)
Requirement already satisfied: termcolor>=1.1.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (2.4.0)
Requirement already satisfied: typing-extensions>=3.6.6 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (4.11.0)
Requirement already satisfied: wrapt>=1.11.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (1.12.1)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (1.63.0)
Requirement already satisfied: tensorboard<2.17,>=2.16 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (2.16.2)
Requirement already satisfied: keras>=3.0.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (3.3.3)
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (0.31.0)
Requirement already satisfied: numpy<2.0.0,>=1.23.5 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorflow-intel==2.16.1->tensorflow) (1.26.4)
Requirement already satisfied: wheel<1.0,>=0.23.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from astunparse>=1.6.0->tensorflow-intel==2.16.1->tensorflow) (0.37.0)
Requirement already satisfied: rich in c:\users\reshma_koduri\anaconda3\lib\site-packages (from keras>=3.0.0->tensorflow-intel==2.16.1->tensorflow) (13.7.1)
Requirement already satisfied: namex in c:\users\reshma_koduri\anaconda3\lib\site-packages (from keras>=3.0.0->tensorflow-intel==2.16.1->tensorflow) (0.0.8)
Requirement already satisfied: optree in c:\users\reshma_koduri\anaconda3\lib\site-packages (from keras>=3.0.0->tensorflow-intel==2.16.1->tensorflow) (0.11.0)
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Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorflow-intel==2.16.1->tensorflow) (1.26.7)

Requirement already satisfied: certifi>=2017.4.17 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorflow-intel==2.16.1->tensorflow) (2021.10.8)

Requirement already satisfied: charset-normalizer~=2.0.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorflow-intel==2.16.1->tensorflow) (2.0.4)

Requirement already satisfied: idna<4,>=2.5 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorflow-intel==2.16.1->tensorflow) (3.2)

Requirement already satisfied: markdown>=2.6.8 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorboard<2.17,>=2.16->tensorflow-intel==2.16.1->tensorflow) (3.6)

Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorboard<2.17,>=2.16->tensorflow-intel==2.16.1->tensorflow) (0.7.2)

Requirement already satisfied: werkzeug>=1.0.1 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from tensorboard<2.17,>=2.16->tensorflow-intel==2.16.1->tensorflow) (2.0.2)

Requirement already satisfied: pyparsing>=2.0.2 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from packaging->tensorflow-intel==2.16.1->tensorflow) (3.0.4)

Requirement already satisfied: importlib-metadata>=4.4 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from markdown>=2.6.8->tensorboard<2.17,>=2.16->tensorflow-intel==2.16.1->tensorflow) (4.8.1)

Requirement already satisfied: markdown-it-py>=2.2.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from rich->keras>=3.0.0->tensorflow-intel==2.16.1->tensorflow) (3.0.0)

Requirement already satisfied: pygments<3.0.0,>=2.13.0 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from rich->keras>=3.0.0->tensorflow-intel==2.16.1->tensorflow) (2.17.2)

Requirement already satisfied: zipp>=0.5 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from importlib-metadata>=4.4->markdown>=2.6.8->tensorboard<2.17,>=2.16->tensorflow-intel==2.16.1->tensorflow) (3.6.0)

Requirement already satisfied: mdurl~=0.1 in c:\users\reshma_koduri\anaconda3\lib\site-packages (from markdown-it-py>=2.2.0->rich->keras>=3.0.0->tensorflow-intel==2.16.1->tensorflow) (0.1.2)

Note: you may need to restart the kernel to use updated packages.

DEPRECATION: pyodbc 4.0.0-unsupported has a non-standard version number. pip 24.1 will enforce this behaviour change. A possible replacement is to upgrade to a newer version of pyodbc or contact the author to suggest that they release a version with a conforming version number. Discussion can be found at <https://github.com/pypa/pip/issues/12063>

In [2]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import cv2
import os
from sklearn.model_selection import train_test_split
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropout
from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

In [12]:

```
for dirname, _, filenames in os.walk(r"C:\Users\reshma_koduri\Downloads\archive (12)"):
    for filename in filenames:
        print(os.path.join(dirname, filename))
```

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```

In [1]:

```

import os

# Path to the dataset
data_dir =(r"C:\Users\reshma_koduri\Downloads\archive (12)\Covid-19 CTs")
categories = ['Covid', 'NonCovid']

# Create Lists to hold data and Labels
data = []
labels = []

for category in categories:
    path = os.path.join(data_dir, category)
    class_num = categories.index(category)
    for img in os.listdir(path):

```

```

try:
    img_array = cv2.imread(os.path.join(path, img), cv2.IMREAD_GRAYSCALE)
    resized_array = cv2.resize(img_array, (224, 224))
    data.append(resized_array)
    labels.append(class_num)
except Exception as e:
    pass

```

```

-----
FileNotFoundError                                Traceback (most recent call last)
~\AppData\Local\Temp\ipykernel_19844\517563202.py in <module>
     12     path = os.path.join(data_dir, category)
     13     class_num = categories.index(category)
--> 14     for img in os.listdir(path):
     15         try:
     16             img_array = cv2.imread(os.path.join(path, img), cv2.IMREAD_GRAYSC
ALE)

FileNotFoundError: [WinError 3] The system cannot find the path specified: 'C:\\Users\\reshma_koduri\\Downloads\\archive (15)\\train\\Covid'

```

```

In [14]: print(f"Number of images loaded: {len(data)}")
        print(f"Number of labels loaded: {len(labels)}")

```

```

Number of images loaded: 680
Number of labels loaded: 680

```

```

In [15]: data = np.array(data).reshape(-1, 224, 224, 1)
        data = data / 255.0
        labels = np.array(labels)

```

```

In [28]: x_train, x_test, y_train, y_test = train_test_split(data, labels, test_size=0.2, ran

```

```

In [29]: model = Sequential([
        Conv2D(32, (3, 3), activation='relu', input_shape=(224, 224, 1)),
        MaxPooling2D((2, 2)),
        Conv2D(64, (3, 3), activation='relu'),
        MaxPooling2D((2, 2)),
        Conv2D(128, (3, 3), activation='relu'),
        MaxPooling2D((2, 2)),
        Flatten(),
        Dense(128, activation='relu'),
        Dropout(0.5),
        Dense(2, activation='softmax')
    ])

```

```

In [30]: model.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['ac

```

```

In [31]: datagen = 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"
    )

```

```
datagen.fit(x_train)
```

In [32]:

```
history = model.fit(datagen.flow(x_train, y_train, batch_size=32), epochs=20, valida
```

Epoch 1/20

```
17/17 ————— 16s 702ms/step - accuracy: 0.4709 - loss: 0.8097 - val_acc
uracy: 0.5441 - val_loss: 0.6941
```

Epoch 2/20

```
17/17 ————— 12s 681ms/step - accuracy: 0.5269 - loss: 0.6862 - val_acc
uracy: 0.6250 - val_loss: 0.6840
```

Epoch 3/20

```
17/17 ————— 13s 684ms/step - accuracy: 0.5891 - loss: 0.6688 - val_acc
uracy: 0.6029 - val_loss: 0.6630
```

Epoch 4/20

```
17/17 ————— 13s 707ms/step - accuracy: 0.5749 - loss: 0.6774 - val_acc
uracy: 0.5368 - val_loss: 0.7069
```

Epoch 5/20

```
17/17 ————— 13s 724ms/step - accuracy: 0.5201 - loss: 0.6883 - val_acc
uracy: 0.5147 - val_loss: 0.7022
```

Epoch 6/20

```
17/17 ————— 14s 768ms/step - accuracy: 0.5303 - loss: 0.6799 - val_acc
uracy: 0.5588 - val_loss: 0.6994
```

Epoch 7/20

```
17/17 ————— 14s 751ms/step - accuracy: 0.5668 - loss: 0.6733 - val_acc
uracy: 0.6544 - val_loss: 0.6693
```

Epoch 8/20

```
17/17 ————— 14s 748ms/step - accuracy: 0.5689 - loss: 0.6702 - val_acc
uracy: 0.5588 - val_loss: 0.6948
```

Epoch 9/20

```
17/17 ————— 14s 760ms/step - accuracy: 0.5336 - loss: 0.6847 - val_acc
uracy: 0.6397 - val_loss: 0.6819
```

Epoch 10/20

```
17/17 ————— 14s 726ms/step - accuracy: 0.5587 - loss: 0.6650 - val_acc
uracy: 0.6838 - val_loss: 0.6529
```

Epoch 11/20

```
17/17 ————— 14s 743ms/step - accuracy: 0.5624 - loss: 0.6691 - val_acc
uracy: 0.5368 - val_loss: 0.6818
```

Epoch 12/20

```
17/17 ————— 14s 752ms/step - accuracy: 0.5878 - loss: 0.6603 - val_acc
uracy: 0.6618 - val_loss: 0.6413
```

Epoch 13/20

```
17/17 ————— 14s 755ms/step - accuracy: 0.6418 - loss: 0.6266 - val_acc
uracy: 0.6250 - val_loss: 0.6552
```

Epoch 14/20

```
17/17 ————— 14s 768ms/step - accuracy: 0.6467 - loss: 0.6461 - val_acc
uracy: 0.6250 - val_loss: 0.6413
```

Epoch 15/20

```
17/17 ————— 14s 755ms/step - accuracy: 0.6636 - loss: 0.6434 - val_acc
uracy: 0.6691 - val_loss: 0.6418
```

Epoch 16/20

```
17/17 ————— 14s 742ms/step - accuracy: 0.6840 - loss: 0.6313 - val_acc
uracy: 0.6912 - val_loss: 0.6411
```

Epoch 17/20

```
17/17 ————— 14s 730ms/step - accuracy: 0.6193 - loss: 0.6461 - val_acc
uracy: 0.6324 - val_loss: 0.6400
```

Epoch 18/20

```
17/17 ————— 14s 747ms/step - accuracy: 0.6950 - loss: 0.6239 - val_acc
uracy: 0.6912 - val_loss: 0.6128
```

Epoch 19/20

```
17/17 ————— 14s 761ms/step - accuracy: 0.6791 - loss: 0.6212 - val_acc
uracy: 0.6618 - val_loss: 0.6566
```

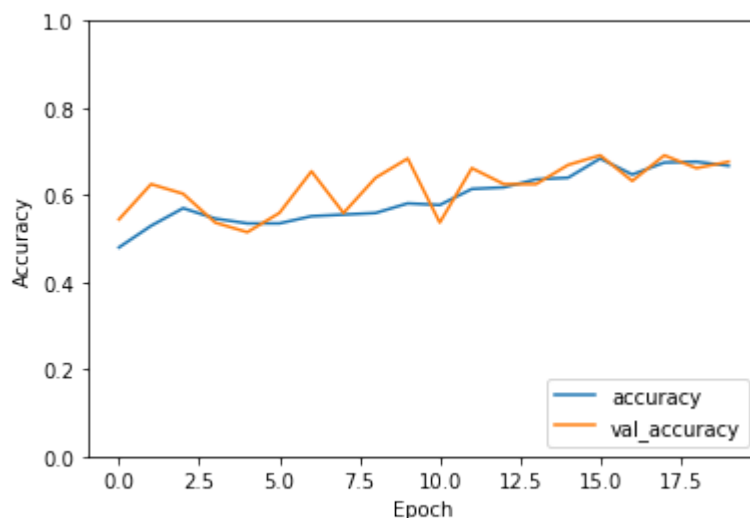
Epoch 20/20

17/17 ————— 14s 738ms/step - accuracy: 0.6566 - loss: 0.6109 - val_accuracy: 0.6765 - val_loss: 0.6088

In [33]: `model.evaluate(x_test, y_test)`

5/5 ————— 1s 145ms/step - accuracy: 0.6621 - loss: 0.6168
Out[33]: [0.6088278889656067, 0.6764705777168274]

In [34]: `plt.plot(history.history['accuracy'], label='accuracy')
plt.plot(history.history['val_accuracy'], label = 'val_accuracy')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.ylim([0, 1])
plt.legend(loc='lower right')
plt.show()`



In [35]: `model.save('covid19_cnn_model.h5')`

WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or `keras.saving.save_model(model)`. This file format is considered legacy. We recommend using instead the native Keras format, e.g. `model.save('my_model.keras')` or `keras.saving.save_model(model, 'my_model.keras')`.

In [3]: `from tensorflow.keras.models import load_model
model = load_model('covid19_cnn_model.h5')

Predict on a new image
new_image = cv2.imread(r"C:\Users\reshma_koduri\OneDrive\Desktop\2041.png", cv2.IMREAD_GRAYSCALE)
new_image = cv2.resize(new_image, (224, 224))
new_image = np.array(new_image).reshape(-1, 224, 224, 1)
new_image = new_image / 255.0

prediction = model.predict(new_image)
print("Prediction:", categories[np.argmax(prediction)])`

WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be built. `model.compile_metrics` will be empty until you train or evaluate the model.
1/1 ————— 0s 172ms/step

NameError Traceback (most recent call last)
~\AppData\Local\Temp\ipykernel_9384\3950450575.py in <module>
9

```
10 prediction = model.predict(new_image)
---> 11 print("Prediction:", categories[np.argmax(prediction)])
```

NameError: name 'categories' is not defined

In []:

In []: