

✓ Covid 19 Prediction Using X-RAY Images

✓ STEP 1: Importing Required Libraries

```
1 from tensorflow.keras.models import Sequential
2 from tensorflow.keras.layers import Conv2D, MaxPool2D, Dropout, Flatten, Dense
3 from tensorflow.keras.optimizers import Adam
4 from tensorflow.keras.preprocessing.image import ImageDataGenerator
5 import numpy as np
6 import pandas as pd
7 import matplotlib.pyplot as plt
```

✓ STEP 2: Cloning Required Dataset

```
1 !git clone https://github.com/RishitToteja/Chest-X-ray-Images-Data-Set.git
```

 fatal: destination path 'Chest-X-ray-Images-Data-Set' already exists and is not an empty directory.

```
1 import os
2
3 main_dir = "/content/Chest-X-ray-Images-Data-Set/DataSet/Data"
4
5 # Assigning Train And Test Directory
6 train_dir = os.path.join(main_dir, "train")
7 test_dir = os.path.join(main_dir, "test")
8
9 # Assigning Directory For COVID AND NORMAL Images Directory
10 train_covid_dir = os.path.join(train_dir, "COVID19")
11 train_normal_dir = os.path.join(train_dir, "NORMAL")
12
13 test_covid_dir = os.path.join(test_dir, "COVID19")
14 test_normal_dir = os.path.join(test_dir, "NORMAL")
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✓ STEP 3: Performing Data Visualizations

```
1 import matplotlib.image as mpimg
2
3 rows = 4
4 columns = 4
5
6 fig = plt.gcf()
7 fig.set_size_inches(12,12)
8
9 covid_img = [os.path.join(train_covid_dir, filename) for filename in train_covid_names[0:8]]
10 normal_img = [os.path.join(train_normal_dir, filename) for filename in train_normal_names[0:8]]
11
12 print(covid_img)
13 print(normal_img)
14
15 merged_img = covid_img + normal_img
16
17 for i, img_path in enumerate(merged_img):
18     title = img_path.split("/", 6)[6]
19     plot = plt.subplot(rows, columns, i+1)
20     plot.axis("Off")
21     img = mpimg.imread(img_path)
22     plot.set_title(title, fontsize = 11)
23     plt.imshow(img, cmap= "gray")
```

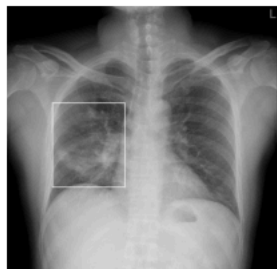
```
24
25 plt.show()
```

```
↳ ['/content/Chest-X-ray-Images-Data-Set/DataSet/Data/train/COVID19/COVID19(81).jpg', '/content/Chest-X-ray-Images-Data-Set/Da
 ['/content/Chest-X-ray-Images-Data-Set/DataSet/Data/train/NORMAL/NORMAL(207).jpg', '/content/Chest-X-ray-Images-Data-Set/Dat
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COVID19/COVID19(81).jpg



COVID19/COVID19(514).jpg



COVID19/COVID-19 (161).jpg



COVID19/COVID-19 (156).jpg



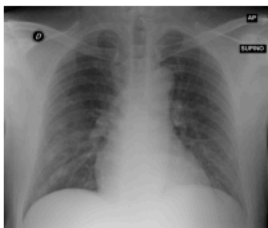
COVID19/COVID19(108).jpg



COVID19/COVID19(306).jpg



COVID19/COVID19(141).jpg



COVID19/COVID19(548).jpg



NORMAL/NORMAL(207).jpg



NORMAL/NORMAL(891).jpg



NORMAL/NORMAL(175).jpg



NORMAL/NORMAL(653).jpg



NORMAL/NORMAL(1507).jpg



NORMAL/NORMAL(1296).jpg



NORMAL/NORMAL(515).jpg



NORMAL/NORMAL(176).jpg



✓ Step 4: Data Preprocessing And Augmentation

```
1 # Creating Training, Testing And Validation Batches
2
3 dgen_train = ImageDataGenerator(rescale = 1./255,
4                                 validation_split = 0.2,
5                                 zoom_range = 0.2,
6                                 horizontal_flip = True)
7
8 dgen_validation = ImageDataGenerator(rescale = 1./255,
9                                     )
10
11 dgen_test = ImageDataGenerator(rescale = 1./255,
12                               )
13
14 train_generator = dgen_train.flow_from_directory(train_dir,
15                                                  target_size = (150, 150),
```

```

16         subset = 'training',
17         batch_size = 32,
18         class_mode = 'binary')
19 validation_generator = dgen_train.flow_from_directory(train_dir,
20                                                     target_size = (150, 150),
21                                                     subset = "validation",
22                                                     batch_size = 32,
23                                                     class_mode = "binary")
24 test_generator = dgen_test.flow_from_directory(test_dir,
25                                               target_size = (150, 150),
26                                               batch_size = 32,
27                                               class_mode = "binary")

```

Found 1449 images belonging to 2 classes.
 Found 362 images belonging to 2 classes.
 Found 484 images belonging to 2 classes.

```

1 print("Class Labels are: ", train_generator.class_indices)
2 print("Image shape is : ", train_generator.image_shape)

```

Class Labels are: {'COVID19': 0, 'NORMAL': 1}
 Image shape is : (150, 150, 3)

✓ STEP 5: Building Convolutional Neural Network Model

```

1 from tensorflow.keras.layers import Conv2D, MaxPooling2D
2
3 model = Sequential()
4
5 # 1) CONVOLUTIONAL LAYER - 1
6 model.add(Conv2D(32, (5,5), padding = "same", activation = "relu", input_shape = train_generator.image_shape))
7
8 # 2) POOLING LAYER - 1
9 model.add(MaxPooling2D(pool_size=(2,2)))
10
11 # 3) DROPOUT LAYER - 2
12 model.add(Dropout(0.5))
13
14 # 4) CONVOLUTIONAL LAYER - 2
15 model.add(Conv2D(64, (5,5), padding = "same", activation = "relu"))
16
17 # 5) POOLING LAYER - 2
18 model.add(MaxPooling2D(pool_size=(2,2)))
19
20 # 6) DROPOUT LAYER - 2
21 model.add(Dropout(0.5))
22
23 # 7) FLATTENING LAYER TO 2D SHAPE
24 model.add(Flatten())
25
26 # 8) ADDING A DENSE LAYER
27 model.add(Dense(256, activation = 'relu'))
28
29 # 9 DROPOUT LAYER - 3
30 model.add(Dropout(0.5))
31
32 # 10) FINAL OUTPUT LAYER
33 model.add(Dense(1, activation = 'sigmoid'))
34
35 ### PRINTING MODEL SUMMARY
36 model.summary()

```

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 150, 150, 32)	2432
max_pooling2d (MaxPooling2D)	(None, 75, 75, 32)	0
dropout (Dropout)	(None, 75, 75, 32)	0
conv2d_1 (Conv2D)	(None, 75, 75, 64)	51264
max_pooling2d_1 (MaxPooling2D)	(None, 37, 37, 64)	0

```

2D)

dropout_1 (Dropout)          (None, 37, 37, 64)          0
flatten (Flatten)            (None, 87616)                0
dense (Dense)                 (None, 256)                  22429952
dropout_2 (Dropout)          (None, 256)                  0
dense_1 (Dense)               (None, 1)                    257

=====
Total params: 22,483,905
Trainable params: 22,483,905
Non-trainable params: 0

```

```

1 # from tensorflow.keras.layers import Conv2D, MaxPooling2D
2 # from tensorflow.keras.models import Sequential
3
4 # model = Sequential()
5
6 # # 1) CONVOLUTIONAL LAYER - 1
7 # model.add(Conv2D(32, (5, 5), padding="same", activation="relu", input_shape=(150, 150, 3)))
8
9 # # 2) POOLING LAYER - 1
10 # model.add(MaxPooling2D(pool_size=(2, 2)))
11
12 # # 3) DROPOUT LAYER - 2
13 # model.add(Dropout(0.5))
14
15 # # 4) CONVOLUTIONAL LAYER - 2
16 # model.add(Conv2D(64, (5, 5), padding="same", activation="relu"))
17
18 # # 5) POOLING LAYER - 2
19 # model.add(MaxPooling2D(pool_size=(2, 2)))
20
21 # # 6) DROPOUT LAYER - 2
22 # model.add(Dropout(0.5))
23
24 # # 7) FLATTENING LAYER TO 2D SHAPE
25 # model.add(Flatten())
26
27 # # 8) ADDING A DENSE LAYER
28 # model.add(Dense(256, activation='relu'))
29
30 # # 9) DROPOUT LAYER - 3
31 # model.add(Dropout(0.5))
32
33 # # 10) FINAL OUTPUT LAYER
34 # model.add(Dense(1, activation='sigmoid'))
35
36 # ### PRINTING MODEL SUMMARY
37 # model.summary()
38

```


✓ Step 6: Compiling And Training the Model

```

1 # Compiling the Model
2
3 model.compile(Adam(learning_rate = 0.001), loss = 'binary_crossentropy', metrics = ['accuracy'])

1 # TRAINING THE MODEL
2 history = model.fit(train_generator,
3                     epochs = 10,
4                     validation_data = validation_generator)

```

 Epoch 1/10
 46/46 [=====] - 187s 4s/step - loss: 0.7851 - accuracy: 0.8054 - val_loss: 0.3996 - val_accuracy: 0
 Epoch 2/10
 46/46 [=====] - 188s 4s/step - loss: 0.2249 - accuracy: 0.9103 - val_loss: 0.3222 - val_accuracy: 0
 Epoch 3/10
 46/46 [=====] - 186s 4s/step - loss: 0.1875 - accuracy: 0.9262 - val_loss: 0.2728 - val_accuracy: 0
 Epoch 4/10

```

46/46 [=====] - 181s 4s/step - loss: 0.1282 - accuracy: 0.9524 - val_loss: 0.1640 - val_accuracy: 0
Epoch 5/10
46/46 [=====] - 185s 4s/step - loss: 0.1283 - accuracy: 0.9648 - val_loss: 0.1382 - val_accuracy: 0
Epoch 6/10
46/46 [=====] - 184s 4s/step - loss: 0.1101 - accuracy: 0.9600 - val_loss: 0.1236 - val_accuracy: 0
Epoch 7/10
46/46 [=====] - 180s 4s/step - loss: 0.1228 - accuracy: 0.9600 - val_loss: 0.1377 - val_accuracy: 0
Epoch 8/10
46/46 [=====] - 184s 4s/step - loss: 0.1111 - accuracy: 0.9586 - val_loss: 0.0948 - val_accuracy: 0
Epoch 9/10
46/46 [=====] - 188s 4s/step - loss: 0.1151 - accuracy: 0.9572 - val_loss: 0.1055 - val_accuracy: 0
Epoch 10/10
46/46 [=====] - 184s 4s/step - loss: 0.0921 - accuracy: 0.9669 - val_loss: 0.0858 - val_accuracy: 0

```

▼ Step 7: Performance Evaluation

```

1 # KEYS OF HISTORY OBJECT
2 history.history.keys()

```

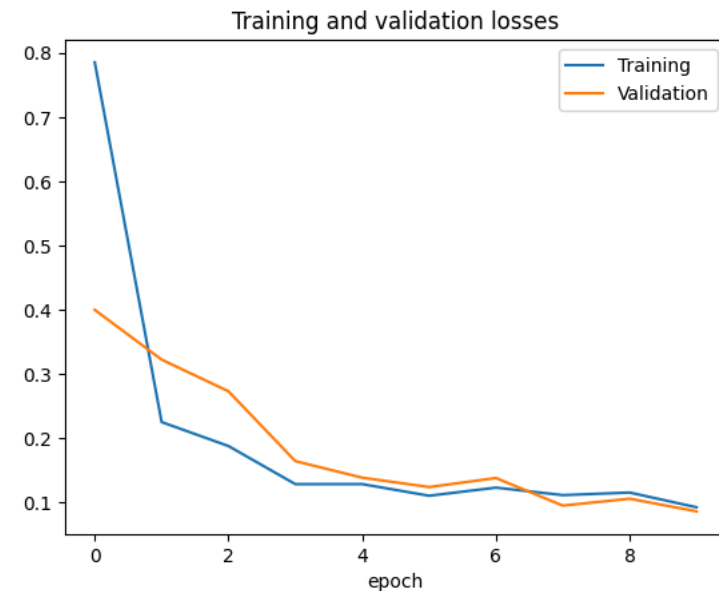
```
dict_keys(['loss', 'accuracy', 'val_loss', 'val_accuracy'])
```

```

1 # PLOT GRAPH BETWEEN TRAINING AND VALIDATION LOSS
2 plt.plot(history.history['loss'])
3 plt.plot(history.history['val_loss'])
4 plt.legend(['Training', 'Validation'])
5 plt.title("Training and validation losses")
6 plt.xlabel('epoch')

```

```
Text(0.5, 0, 'epoch')
```

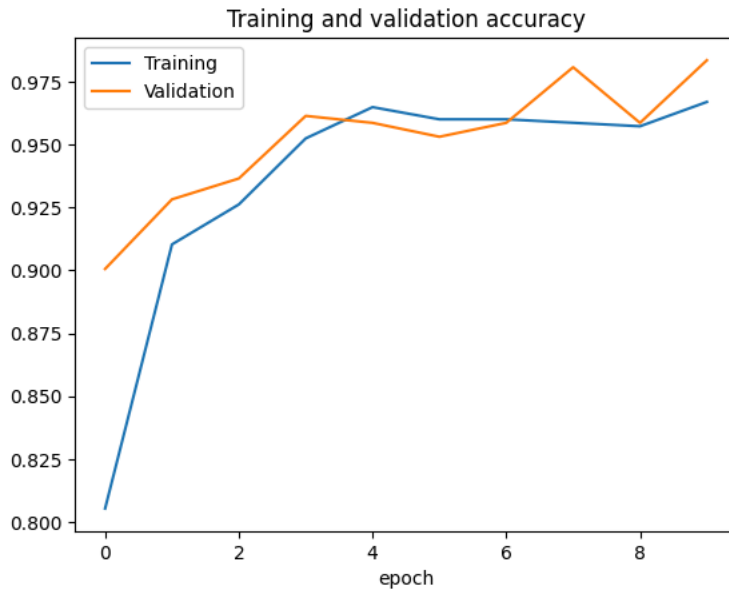


```

1 # PLOT GRAPH BETWEEN TRAINING AND VALIDATION ACCURACY
2 plt.plot(history.history['accuracy'])
3 plt.plot(history.history['val_accuracy'])
4 plt.legend(['Training', 'Validation'])
5 plt.title("Training and validation accuracy")
6 plt.xlabel('epoch')

```

Text(0.5, 0, 'epoch')



```
1 # GETTING TEST ACCURACY AND LOSS
2
3 test_loss, test_acc = model.evaluate(test_generator)
4 print("Test Set Loss : ", test_loss)
5 print("Test Set Accuracy : ", test_acc)
```

16/16 [=====] - 23s 1s/step - loss: 0.1193 - accuracy: 0.9525
 Test Set Loss : 0.11932843923568726
 Test Set Accuracy : 0.952479362487793

Step 8: Prediction on new data (Upload files)

```
1 !pip install pillow
```

Looking in indexes: <https://pypi.org/simple>, <https://us-python.pkg.dev/colab-wheels/public/simple/>
 Requirement already satisfied: pillow in /usr/local/lib/python3.10/dist-packages (8.4.0)

```
1 from google.colab import files
2 from PIL import Image
3 import numpy as np
4
5 uploaded = files.upload()
6
7 for filename in uploaded.keys():
8     img_path = '/content/' + filename
9     img = Image.open(img_path)
10    img = img.resize((150, 150)) # Resize the image if needed
11    images = np.array(img)
12    images = np.expand_dims(images, axis=0) # Add an additional dimension
13    prediction = model.predict(images)
14
15    if prediction == 0:
16        print("The report is COVID-19 Positive")
17    else:
18        print("The report is COVID-19 Negative")
19
```

Choose Files No file chosen Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.
 Saving 1-s2.0-S0140673620303706-fx1_lrg.jpg to 1-s2.0-S0140673620303706-fx1_lrg.jpg
 1/1 [=====] - 0s 59ms/step
 The report is COVID-19 Positive

1 Start coding or generate with AI.

