Dataset Download

```
!pip install -U -q kaggle
!mkdir -p ~/.kaggle
```

```
#Download your api kaggle.json from kaggle and upload it here
from google.colab import files
files.upload()
```

```
! mkdir ~/.kaggle
! cp kaggle.json ~/.kaggle/
```

```
mkdir: cannot create directory ‘/root/.kaggle’: File exists
```

```
! chmod 600 ~/.kaggle/kaggle.json
! kaggle datasets download -d raddar/tuberculosis-chest-xrays-shenzhen
```

```
Dataset URL: https://www.kaggle.com/datasets/raddar/tuberculosis-chest-xrays-shenzhen
License(s): unknown
Downloading tuberculosis-chest-xrays-shenzhen.zip to /content
100% 3.51G/3.51G [00:34<00:00, 196MB/s]
100% 3.51G/3.51G [00:34<00:00, 111MB/s]
```

```
#unziping the file
from zipfile import ZipFile
file_name = '/content/tuberculosis-chest-xrays-shenzhen.zip'

with ZipFile(file_name, 'r') as zip:
  zip.extractall()
  print('Done')
```

```
Done
```

Libraries

```
!pip install split-folders
```

```
Collecting split-folders
  Downloading split_folders-0.5.1-py3-none-any.whl.metadata (6.2 kB)
Downloading split_folders-0.5.1-py3-none-any.whl (8.4 kB)
Installing collected packages: split-folders
Successfully installed split-folders-0.5.1
```

```
import tensorflow as tf
from tensorflow.keras import Sequential
from tensorflow.keras.layers import Dense, Flatten, Conv2D, BatchNormalization, MaxPool2D, Dropout
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.preprocessing import image
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import cv2
import splitfolders
from glob import glob
```

Preprocessing

```
datainfo = pd.read_csv('/content/shenzhen_metadata.csv')
```

```
datainfo.head()
```

	study_id	sex	age	findings
0	CHNCXR_0001_0.png	Male	45	normal
1	CHNCXR_0002_0.png	Male	63	normal
2	CHNCXR_0003_0.png	Female	48	normal
3	CHNCXR_0004_0.png	Male	58	normal
4	CHNCXR_0005_0.png	Male	28	normal

Next steps: Generate code with datainfo | View recommended plots | New interactive sheet

```
normal = []
positive =  []
```

```
def extract_target(x):
  for i in range(len(x['study_id'])):
    if x['findings'][i] == 'normal':
      normal.append(x['study_id'][i])
    else:
      positive.append(x['study_id'][i])
```

```
extract_target(datainfo)
```

```
len(normal)
```

```
326
```

```
len(positive)
```

```
336
```

Creating Directories

```
!mkdir data
```

```
!mkdir data/normal
!mkdir data/positive
```

```
for i in range(len(normal)):
  path = '/content/images/images/' + normal[i]
  !mv $path /content/data/normal
```

```
for i in range(len(positive)):
  path = '/content/images/images/' + positive[i]
  !mv $path /content/data/positive
```

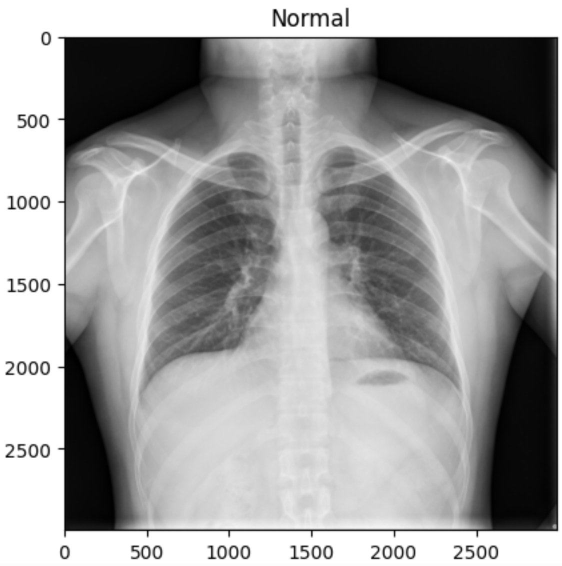
```
input_folder = "/content/data"
output = "/content/dataset" #where you want the split datasets saved. one will be created if none is set

splitfolders.ratio(input_folder, output=output, seed=42, ratio=(.8, .0, 0.2)) # ratio of split are in order of train/val/test. You can chang
```

```
Copying files: 662 files [00:37, 17.51 files/s]
```

Data Visualization

```
tuberculosis  = glob('/content/dataset/test/positive/*.png')
normal = glob('/content/dataset/test/normal/*.png')
```

```
plt.title('Normal')
plt.imshow(image.load_img(np.random.choice(normal)))
plt.show()
```



```
plt.title('Tuberculosis')
plt.imshow(image.load_img(np.random.choice(tuberculosis)))
plt.show()
```

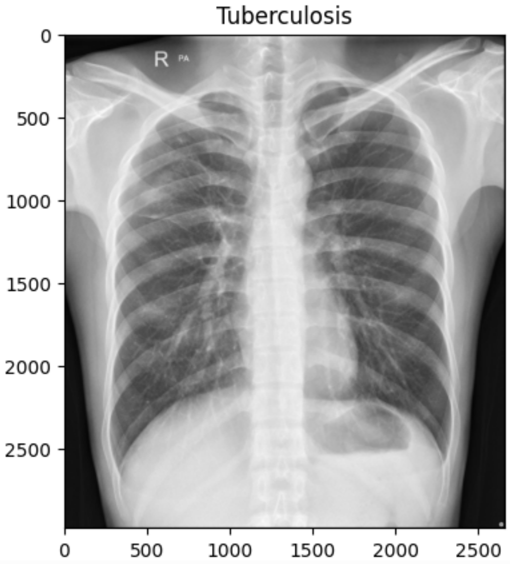


Image Processing and Data Partition into Train and Test

```
img_width = 150
img_height = 150

datagen = ImageDataGenerator(rescale=1/255.0)


train_data_gen = datagen.flow_from_directory(directory='/content/dataset/train',
                                             target_size = (img_width, img_height),
                                             class_mode = 'sparse')
test_data_gen = datagen.flow_from_directory(directory='/content/dataset/test',
                                            target_size = (img_width, img_height),
                                             class_mode = 'sparse',)
```

```
Found 528 images belonging to 2 classes.
Found 134 images belonging to 2 classes.
```

Deep Learning Model

```
model = Sequential()

#convolution
model.add(Conv2D(32, (3,3), input_shape = (img_width, img_height, 3), activation='relu', padding='same'))
model.add(MaxPool2D(2,2))

model.add(Conv2D(64, (3,3), activation='relu', padding='same'))
model.add(MaxPool2D(2,2))

model.add(Conv2D(128, (3,3), activation='relu', padding='same'))
model.add(MaxPool2D(2,2))

model.add(Conv2D(192, (3,3), activation='relu', padding='same'))
model.add(MaxPool2D(2,2))

#Dense
model.add(Flatten())

model.add(Dense(128, activation='relu'))
model.add(Dropout(0.4))


model.add(Dense(228, activation='relu'))
model.add(Dropout(0.3))

model.add(Dense(270, activation='relu'))
model.add(Dropout(0.3))



model.add(Dense(1, activation='sigmoid'))
```

```
/usr/local/lib/python3.11/dist-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not pass an `input_shape`/`inpu
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

```
model.compile(optimizer='Adam', loss='binary_crossentropy', metrics=['accuracy'])
```

```
# r = model.fit_generator(generator=train_data_gen,
#                                 steps_per_epoch=len(train_data_gen),
#                                 epochs=20,
#                                 validation_data= test_data_gen,
#                                 validation_steps = len(test_data_gen))
r = model.fit(train_data_gen, # Pass train_data_gen directly as the first argument
              steps_per_epoch=len(train_data_gen),
              epochs=20,
              validation_data=test_data_gen,
              validation_steps=len(test_data_gen))
```

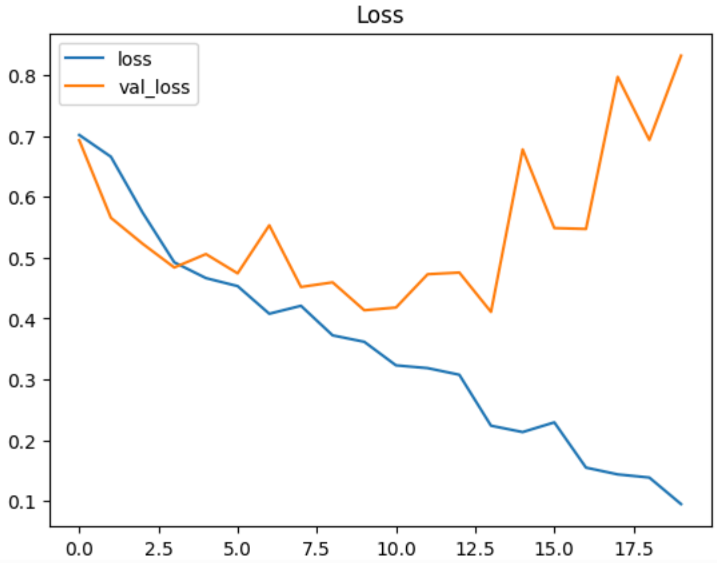
```
/usr/local/lib/python3.11/dist-packages/keras/src/trainers/data_adapters/py_dataset_adapter.py:121: UserWarning: Your `PyDataset` class
  self._warn_if_super_not_called()
Epoch 1/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 79s 4s/step - accuracy: 0.5769 - loss: 0.6976 - val_accuracy: 0.4925 - val_loss: 0.6930
Epoch 2/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 63s 3s/step - accuracy: 0.5373 - loss: 0.6855 - val_accuracy: 0.7313 - val_loss: 0.5655
Epoch 3/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 76s 3s/step - accuracy: 0.7742 - loss: 0.6167 - val_accuracy: 0.8209 - val_loss: 0.5228
Epoch 4/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 82s 3s/step - accuracy: 0.8152 - loss: 0.4965 - val_accuracy: 0.7910 - val_loss: 0.4838
Epoch 5/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 81s 3s/step - accuracy: 0.8290 - loss: 0.4332 - val_accuracy: 0.7985 - val_loss: 0.5058
Epoch 6/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 53s 3s/step - accuracy: 0.8345 - loss: 0.4737 - val_accuracy: 0.7910 - val_loss: 0.4741
Epoch 7/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 82s 3s/step - accuracy: 0.8062 - loss: 0.4610 - val_accuracy: 0.7985 - val_loss: 0.5531
Epoch 8/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 52s 3s/step - accuracy: 0.8410 - loss: 0.4358 - val_accuracy: 0.8060 - val_loss: 0.4517
Epoch 9/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 52s 3s/step - accuracy: 0.8382 - loss: 0.3900 - val_accuracy: 0.8134 - val_loss: 0.4593
Epoch 10/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 52s 3s/step - accuracy: 0.8601 - loss: 0.3374 - val_accuracy: 0.8209 - val_loss: 0.4134
Epoch 11/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 53s 3s/step - accuracy: 0.8995 - loss: 0.3006 - val_accuracy: 0.8060 - val_loss: 0.4179
Epoch 12/20
```

```
17/17 ━━━━━━━━━━━━━━━━━━━━ 92s 4s/step - accuracy: 0.8846 - loss: 0.2974 - val_accuracy: 0.7687 - val_loss: 0.4727
Epoch 13/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 63s 4s/step - accuracy: 0.8746 - loss: 0.3099 - val_accuracy: 0.7761 - val_loss: 0.4754
Epoch 14/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 62s 4s/step - accuracy: 0.9271 - loss: 0.2025 - val_accuracy: 0.8582 - val_loss: 0.4108
Epoch 15/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 52s 3s/step - accuracy: 0.9149 - loss: 0.2135 - val_accuracy: 0.7985 - val_loss: 0.6779
Epoch 16/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 52s 3s/step - accuracy: 0.9000 - loss: 0.2524 - val_accuracy: 0.8358 - val_loss: 0.5486
Epoch 17/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 82s 3s/step - accuracy: 0.9441 - loss: 0.1509 - val_accuracy: 0.8284 - val_loss: 0.5472
Epoch 18/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 53s 3s/step - accuracy: 0.9376 - loss: 0.1493 - val_accuracy: 0.7388 - val_loss: 0.7972
Epoch 19/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 52s 3s/step - accuracy: 0.9289 - loss: 0.1389 - val_accuracy: 0.8134 - val_loss: 0.6934
Epoch 20/20
17/17 ━━━━━━━━━━━━━━━━━━━━ 53s 3s/step - accuracy: 0.9465 - loss: 0.1159 - val_accuracy: 0.8284 - val_loss: 0.8320
```

Analysis/Evaluation

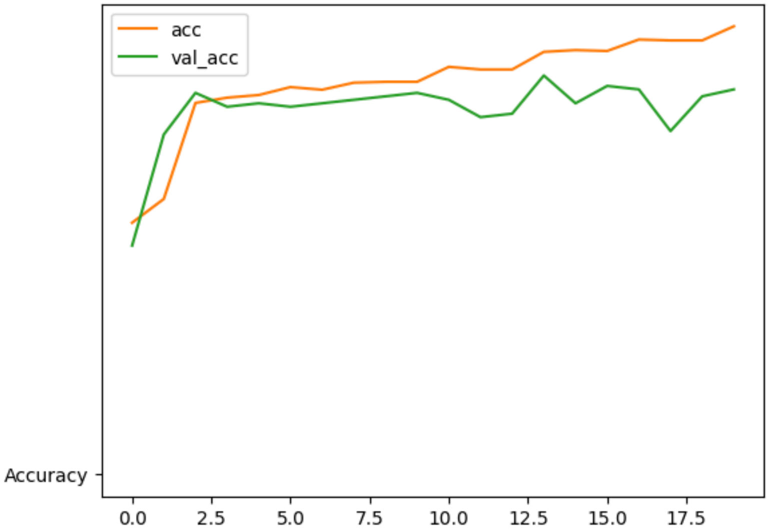
```
plt.title('Loss')
plt.plot(r.history['loss'], label='loss')
plt.plot(r.history['val_loss'], label='val_loss')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x7f34506a6e90>
```



```
plt.plot('Accuracy')
plt.plot(r.history['accuracy'], label='acc')
plt.plot(r.history['val_accuracy'], label='val_acc')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x7f3450456a50>
```



Saving the Model

```
model.save('Tuberculosis.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 consi
```

```
model = tf.keras.models.load_model("Tuberculosis.h5")
converter = tf.lite.TFLiteConverter.from_keras_model(model)
tflite_model = converter.convert()
open('Tuberculosis.tflite', 'wb').write(tflite_model)
```

```
WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be built. `model.compile_metrics` will be empty until you t
Saved artifact at '/tmp/tmplxiae4vd'. The following endpoints are available:

* Endpoint 'serve'
  args_0 (POSITIONAL_ONLY): TensorSpec(shape=(None, 150, 150, 3), dtype=tf.float32, name='input_layer')
Output Type:
  TensorSpec(shape=(None, 1), dtype=tf.float32, name=None)
Captures:
  139863167992656: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139863167992080: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139863167995920: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139863167993424: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139863167992272: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139862861378960: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139862861367056: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139862861378384: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139862861377232: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139862861373968: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139862861378768: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139862861378192: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139862861379344: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139862861376080: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139862861377616: TensorSpec(shape=(), dtype=tf.resource, name=None)
  139862861379920: TensorSpec(shape=(), dtype=tf.resource, name=None)
9593036
```

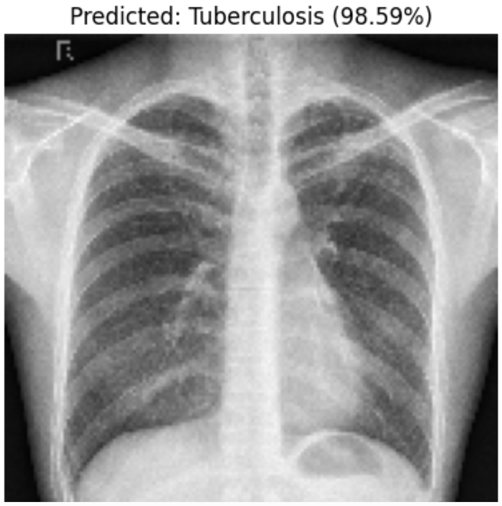
```
Start coding or generate with AI.
```

```
Start coding or generate with AI.
```

```
import tensorflow as tf
from tensorflow.keras.preprocessing import image
import numpy as np
import matplotlib.pyplot as plt
import os

# Load the trained model (assuming 'Tuberculosis.h5' is in the specified path)
```

```
model_path = '/content/Tuberculosis.h5' # Your provided path
try:
    model = tf.keras.models.load_model(model_path)
    print(f"Model '{model_path}' loaded successfully.")
    print("\n--- Model Summary (for confirmation) ---")
    model.summary()
    print("-------------------------------------------\n")
except Exception as e:
    print(f"Error loading model: {e}")
    print(f"Please ensure '{model_path}' is in the correct path and the model was saved properly.")
    model = None # Set model to None if loading fails

def predict_image(img_path, model, target_size=(150, 150), class_names=['Normal', 'Tuberculosis']): # <<< CHANGED TARGET_SIZE
    """
    Predicts the class of a single image (Normal or Tuberculosis).

    Args:
        img_path (str): Path to the image file.
        model (tf.keras.Model): The loaded Keras model.
        target_size (tuple): The input size the model expects (width, height).
        class_names (list): List of class names corresponding to model output.

    Returns:
        tuple: (predicted_class_name, confidence, raw_prediction_output)
    """
    if model is None:
        print("Model not loaded. Cannot make prediction.")
        return None, None, None

    img = image.load_img(img_path, target_size=target_size) # Image will be resized to (150, 150)
    img_array = image.img_to_array(img)
    img_array = np.expand_dims(img_array, axis=0) # Add batch dimension
    img_array = img_array / 255.0  # Normalize pixel values

    predictions = model.predict(img_array)

    # Assuming binary classification where the output is a single probability
    # for the 'Tuberculosis' class. Your last layer `dense_3` has (None, 1) output.
    tuberculosis_probability = predictions[0][0]

    if tuberculosis_probability > 0.5:
        predicted_class_name = 'Tuberculosis'
        confidence = tuberculosis_probability
    else:
        predicted_class_name = 'Normal'
        confidence = 1 - tuberculosis_probability

    print(f"Image: {os.path.basename(img_path)}")
    print(f"Raw prediction (Tuberculosis probability): {predictions[0]}")
    print(f"Predicted: {predicted_class_name} (Confidence: {confidence:.2%})")

    plt.imshow(img)
    plt.title(f"Predicted: {predicted_class_name} ({confidence:.2%})")
    plt.axis('off')
    plt.show()

    return predicted_class_name, confidence, predictions[0]

# --- Example Usage ---
# Use the path you confirmed is working
test_image_path = '/content/CHNCXR_0327_1.png' # Your specific test image path

if os.path.exists(test_image_path):
    print(f"\nAttempting prediction for: {test_image_path}")
    predicted_class, confidence, raw_output = predict_image(test_image_path, model)
else:
    print(f"\nError: Image not found at {test_image_path}. Please double-check the path and ensure it's uploaded.")
```

```
WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be built. `model.compile_metrics` will be empty until you t
Model '/content/Tuberculosis.h5' loaded successfully.

--- Model Summary (for confirmation) ---
Model: "sequential"
┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━┓
┃ Layer (type)                    ┃ Output Shape           ┃       Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━┩
│ conv2d (Conv2D)                 │ (None, 150, 150, 32)   │           896 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ max_pooling2d (MaxPooling2D)    │ (None, 75, 75, 32)     │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ conv2d_1 (Conv2D)               │ (None, 75, 75, 64)     │        18,496 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ max_pooling2d_1 (MaxPooling2D)  │ (None, 37, 37, 64)     │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ conv2d_2 (Conv2D)               │ (None, 37, 37, 128)    │        73,856 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ max_pooling2d_2 (MaxPooling2D)  │ (None, 18, 18, 128)    │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ conv2d_3 (Conv2D)               │ (None, 18, 18, 192)    │       221,376 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ max_pooling2d_3 (MaxPooling2D)  │ (None, 9, 9, 192)      │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ flatten (Flatten)               │ (None, 15552)          │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dense (Dense)                   │ (None, 128)            │     1,990,784 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dropout (Dropout)               │ (None, 128)            │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dense_1 (Dense)                 │ (None, 228)            │        29,412 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dropout_1 (Dropout)             │ (None, 228)            │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dense_2 (Dense)                 │ (None, 270)            │        61,830 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dropout_2 (Dropout)             │ (None, 270)            │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dense_3 (Dense)                 │ (None, 1)              │           271 │
└─────────────────────────────────┴────────────────────────┴───────────────┘
 Total params: 2,396,923 (9.14 MB)
 Trainable params: 2,396,921 (9.14 MB)
 Non-trainable params: 0 (0.00 B)
 Optimizer params: 2 (12.00 B)
-------------------------------------------


Attempting prediction for: /content/CHNCXR_0327_1.png
WARNING:tensorflow:6 out of the last 6 calls to <function TensorFlowTrainer.make_predict_function.<locals>.one_step_on_data_distributed
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 411ms/step
Image: CHNCXR_0327_1.png
Raw prediction (Tuberculosis probability): [0.9858899]
Predicted: Tuberculosis (Confidence: 98.59%)
```



```
import tensorflow as tf
from tensorflow.keras.preprocessing import image
import numpy as np
import matplotlib.pyplot as plt
import os

# Load the trained model (assuming 'Tuberculosis.h5' is in the specified path)
```

```
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    model.summary()
    print("------------------------------------------\n")
except Exception as e:
    print(f"Error loading model: {e}")
    print(f"Please ensure '{model_path}' is in the correct path and the model was saved properly.")
    model = None # Set model to None if loading fails

def predict_image(img_path, model, target_size=(150, 150), class_names=['Normal', 'Tuberculosis']): # <<< CHANGED TARGET_SIZE
    """
    Predicts the class of a single image (Normal or Tuberculosis).

    Args:
        img_path (str): Path to the image file.
        model (tf.keras.Model): The loaded Keras model.
        target_size (tuple): The input size the model expects (width, height).
        class_names (list): List of class names corresponding to model output.

    Returns:
        tuple: (predicted_class_name, confidence, raw_prediction_output)
    """
    if model is None:
        print("Model not loaded. Cannot make prediction.")
        return None, None, None

    img = image.load_img(img_path, target_size=target_size) # Image will be resized to (150, 150)
    img_array = image.img_to_array(img)
    img_array = np.expand_dims(img_array, axis=0) # Add batch dimension
    img_array = img_array / 255.0  # Normalize pixel values

    predictions = model.predict(img_array)

    # Assuming binary classification where the output is a single probability
    # for the 'Tuberculosis' class. Your last layer `dense_3` has (None, 1) output.
    tuberculosis_probability = predictions[0][0]

    if tuberculosis_probability > 0.5:
        predicted_class_name = 'Tuberculosis'
        confidence = tuberculosis_probability
    else:
        predicted_class_name = 'Normal'
        confidence = 1 - tuberculosis_probability

    print(f"Image: {os.path.basename(img_path)}")
    print(f"Raw prediction (Tuberculosis probability): {predictions[0]}")
    print(f"Predicted: {predicted_class_name} (Confidence: {confidence:.2%})")

    plt.imshow(img)
    plt.title(f"Predicted: {predicted_class_name} ({confidence:.2%})")
    plt.axis('off')
    plt.show()

    return predicted_class_name, confidence, predictions[0]

# --- Example Usage ---
# Use the path you confirmed is working
test_image_path = '/content/others (49).jpg' # Your specific test image path

if os.path.exists(test_image_path):
    print(f"\nAttempting prediction for: {test_image_path}")
    predicted_class, confidence, raw_output = predict_image(test_image_path, model)
else:
    print(f"\nError: Image not found at {test_image_path}. Please double-check the path and ensure it's uploaded.")
```

```
WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be built. `model.compile_metrics` will be empty until you t
Model '/content/Tuberculosis.h5' loaded successfully.

--- Model Summary (for confirmation) ---
Model: "sequential"
┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━┓
┃ Layer (type)                    ┃ Output Shape           ┃       Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━┩
│ conv2d (Conv2D)                 │ (None, 150, 150, 32)   │           896 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ max_pooling2d (MaxPooling2D)    │ (None, 75, 75, 32)     │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ conv2d_1 (Conv2D)               │ (None, 75, 75, 64)     │        18,496 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ max_pooling2d_1 (MaxPooling2D)  │ (None, 37, 37, 64)     │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ conv2d_2 (Conv2D)               │ (None, 37, 37, 128)    │        73,856 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ max_pooling2d_2 (MaxPooling2D)  │ (None, 18, 18, 128)    │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ conv2d_3 (Conv2D)               │ (None, 18, 18, 192)    │       221,376 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ max_pooling2d_3 (MaxPooling2D)  │ (None, 9, 9, 192)      │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ flatten (Flatten)               │ (None, 15552)          │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dense (Dense)                   │ (None, 128)            │     1,990,784 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dropout (Dropout)               │ (None, 128)            │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dense_1 (Dense)                 │ (None, 228)            │        29,412 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dropout_1 (Dropout)             │ (None, 228)            │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dense_2 (Dense)                 │ (None, 270)            │        61,830 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dropout_2 (Dropout)             │ (None, 270)            │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dense_3 (Dense)                 │ (None, 1)              │           271 │
└─────────────────────────────────┴────────────────────────┴───────────────┘
 Total params: 2,396,923 (9.14 MB)
 Trainable params: 2,396,921 (9.14 MB)
 Non-trainable params: 0 (0.00 B)
 Optimizer params: 2 (12.00 B)
-------------------------------------------


Attempting prediction for: /content/others (49).jpg
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 401ms/step
Image: others (49).jpg
Raw prediction (Tuberculosis probability): [2.9221052e-05]
Predicted: Normal (Confidence: 100.00%)
```