16/9/25

7. Build a CNN to classify cat and dog.

AIM:

To build a CNN model to classify cats and dogs in a image.

Objective:

*Data preparation: Organize and preprocess a large dataset of cats and dogs images including resizing and normalizing.

*Model Architecture: Design a CNN architecture using a sequence of convolutional and pooling layers to extract features, followed by dense layer of classification.

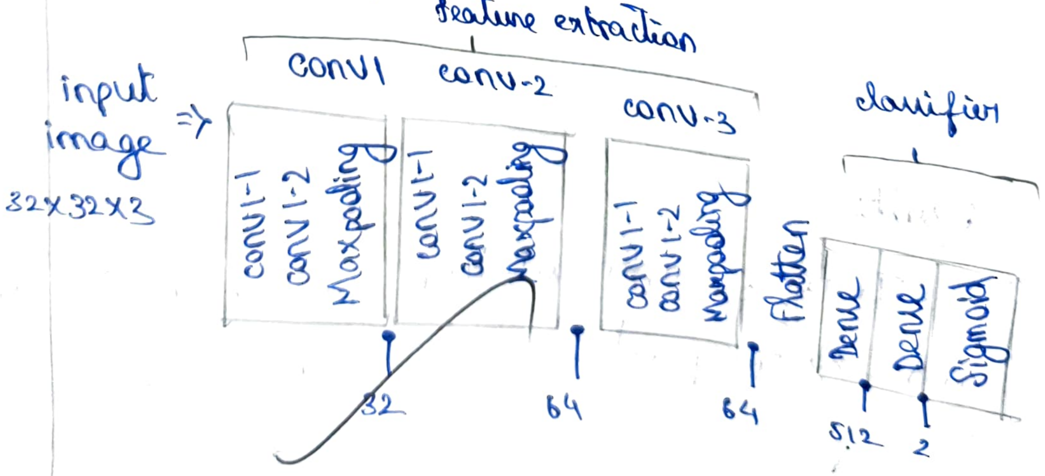
*Training & Validation: Train the model on preprocessed data and evaluate its performance on separate validation set to prevent overfitting and ensure good generalization.

*Performance evaluation: Access the final models accuracy, precision and recall on unseen test set to measure its effectiveness.

Output :

```
Epoch 1/5 :

200/200 - 150s 750ms/step - loss - 6.854
        accuracy : 0.5512, val loss : 0.643, valacc - 0.625
Epoch 2/5

200/200 - loss : 0.6351 , accuracy : 0.6915 , val loss : 0.6911
        val_acc : 0.6805

Epoch 3/5 :

200/200 - loss : 0.5987 , accuracy : 0.6800 , val loss : 0.564
                val.accuracy : 0.7025
Epoch 4/5 :

200/200 - loss : 0.5521 - accuracy : 0.7206 , val loss : 0.5212
    val_accuracy : 0.7910
Epoch 5/5 :

200/200 - loss : 0.5110 - accuracy : 0.7810 , valloss : 0.4950
    val accuray : 0.7600
```

Structure diagram:



PseudoCode:

```
function createcnn():
    model = Sequential ()
    model.add(conv2D(32, (3,3), act='relu')
    model.add (Maxpooling2D(poolsize=(2,2))
    model.add (conv2D (64,(3,3), act='relu'))
    model.add (Maxpooling2D (poolsize=(2,2)
    model.add(conv2D(128,(3,3) act='relu'),
    model.add (Maxpooling2D(poolsize=(2,2))
    model.add (Flatten())
    model(Dense (512, act='relu'))
    model.add (Dense (1, act='sigmoid')
    return model
main():
    model = createcnn()
    model. compile (opt='adam", loss='bi-ce'
                    metrices= ['accuracy'])
    model.fit (
        train_generator
        stepsperepoch = train_generator. samples
        epochs= epochs

    model.save ('cat_dog.h5')

main()
```

Observation

*Positive trend: loss and val_loss are constantly decreasing, while accuracy and val_accuracy are increasing with each epoch.

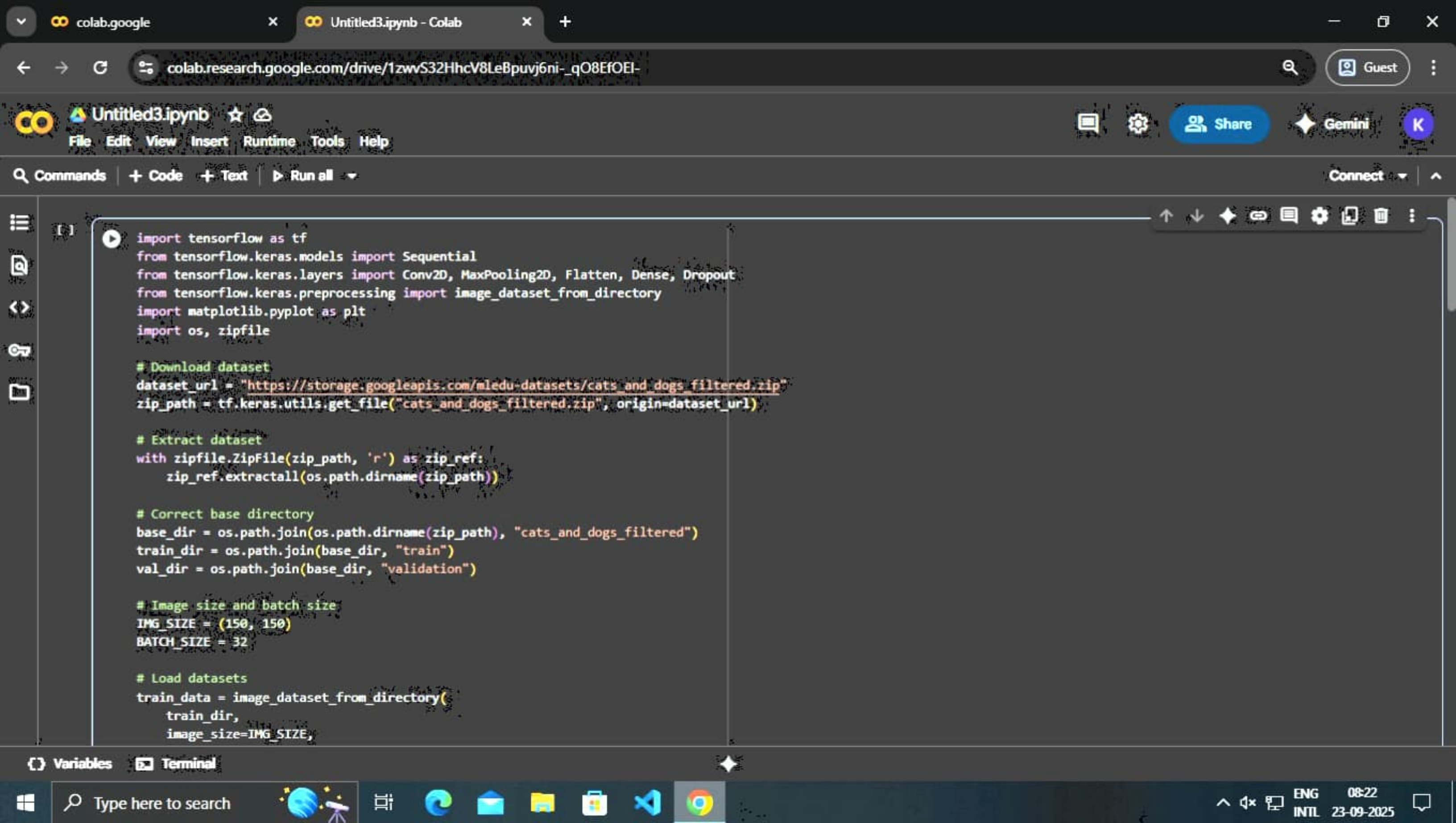
* Limited performance: Final validation accuracy of around 76% is decent for a binary class classification

*No overfitting: Val performance is improving in the lockstep.

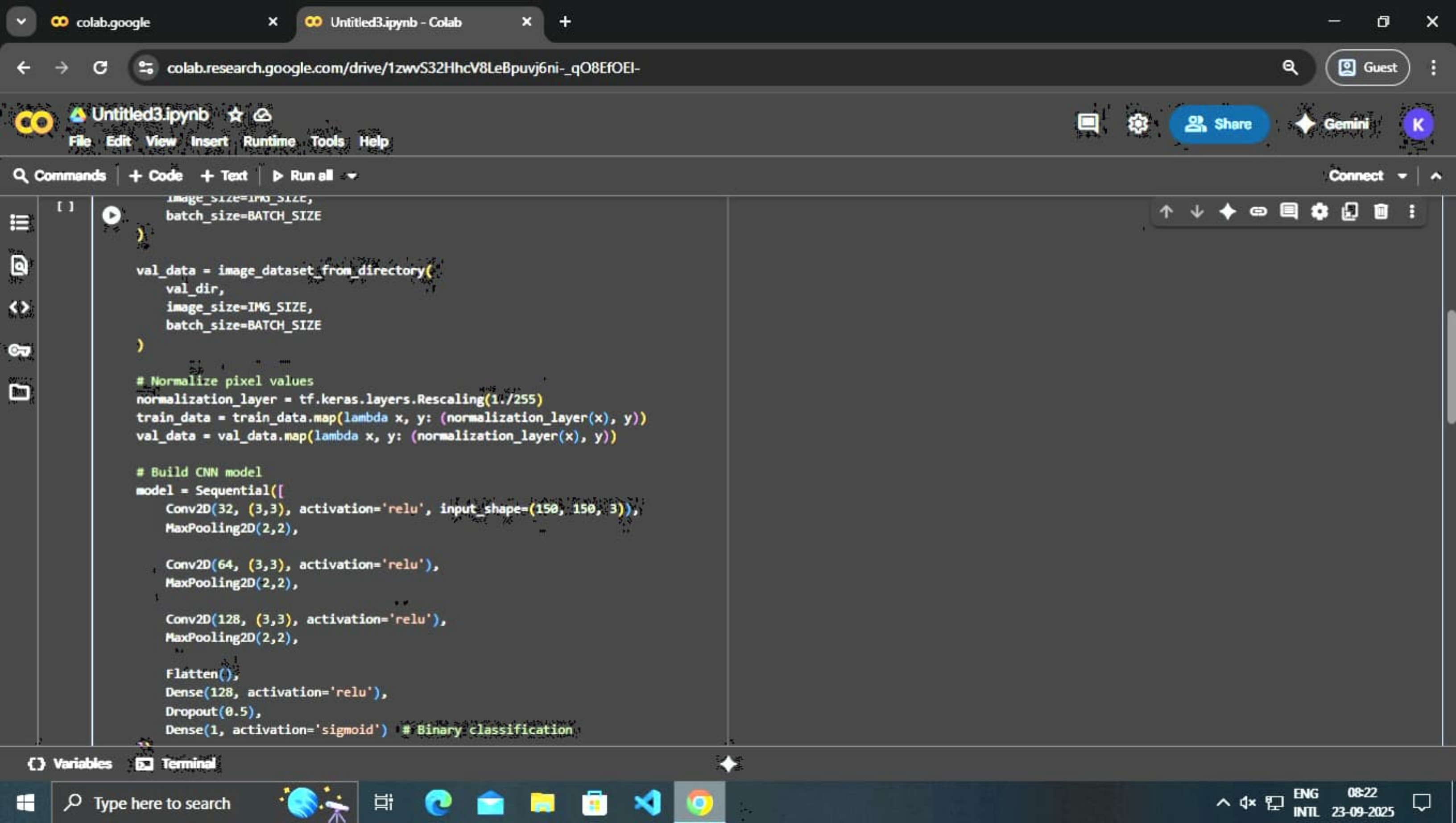
conclusion

Result:

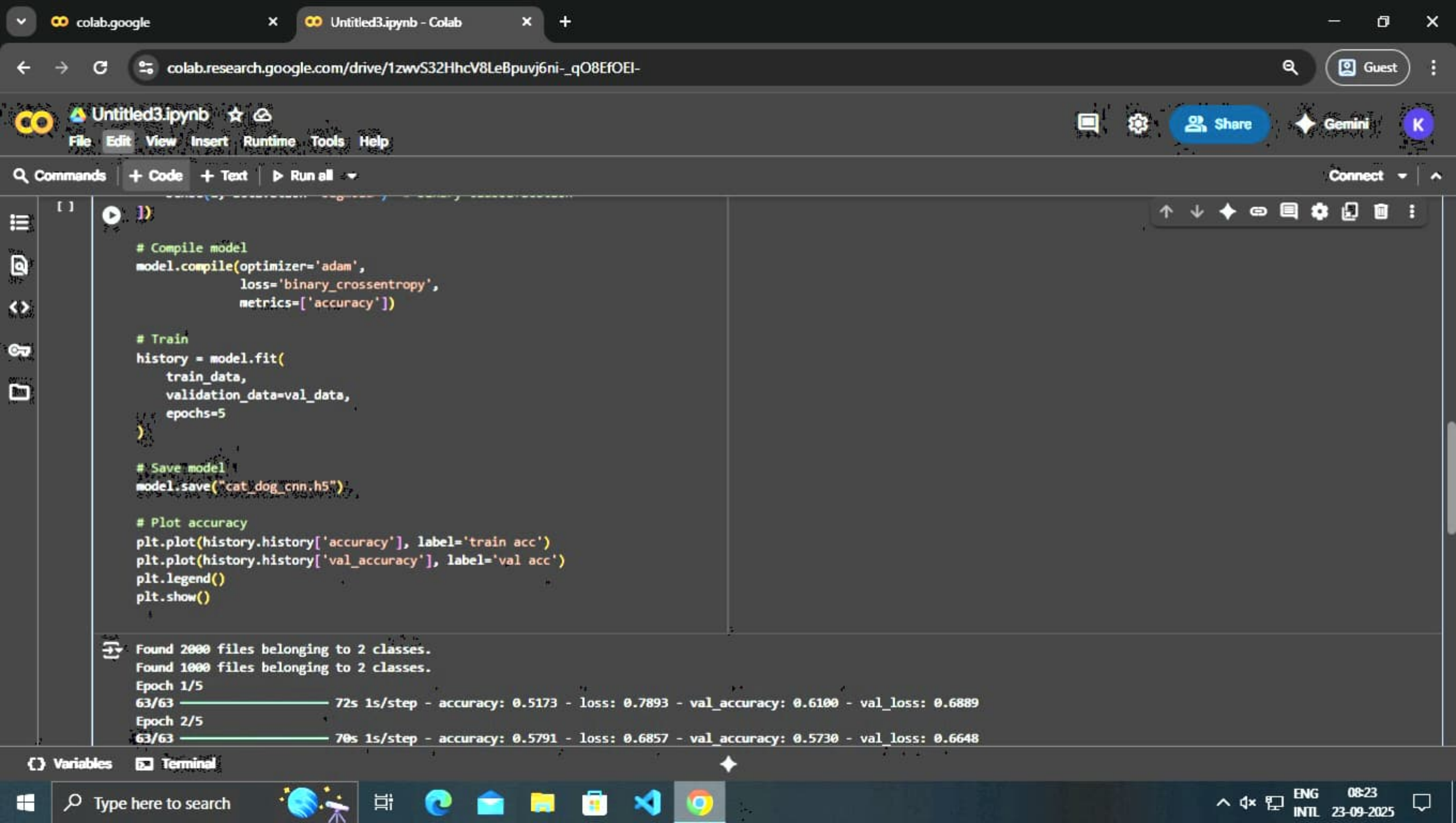
Implemented a dog vs cat classifier sucessfully.



```
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropout
from tensorflow.keras.preprocessing import image_dataset_from_directory
import matplotlib.pyplot as plt
import os, zipfile

# Download dataset
dataset_url = "https://storage.googleapis.com/mledu-datasets/cats_and_dogs_filtered.zip"
zip_path = tf.keras.utils.get_file("cats_and_dogs_filtered.zip", origin=dataset_url)

# Extract dataset
with zipfile.ZipFile(zip_path, 'r') as zip_ref:
    zip_ref.extractall(os.path.dirname(zip_path))

# Correct base directory
base_dir = os.path.join(os.path.dirname(zip_path), "cats_and_dogs_filtered")
train_dir = os.path.join(base_dir, "train")
val_dir = os.path.join(base_dir, "validation")

# Image size and batch size
IMG_SIZE = (150, 150)
BATCH_SIZE = 32

# Load datasets
train_data = image_dataset_from_directory(
    train_dir,
    image_size=IMG_SIZE,
```

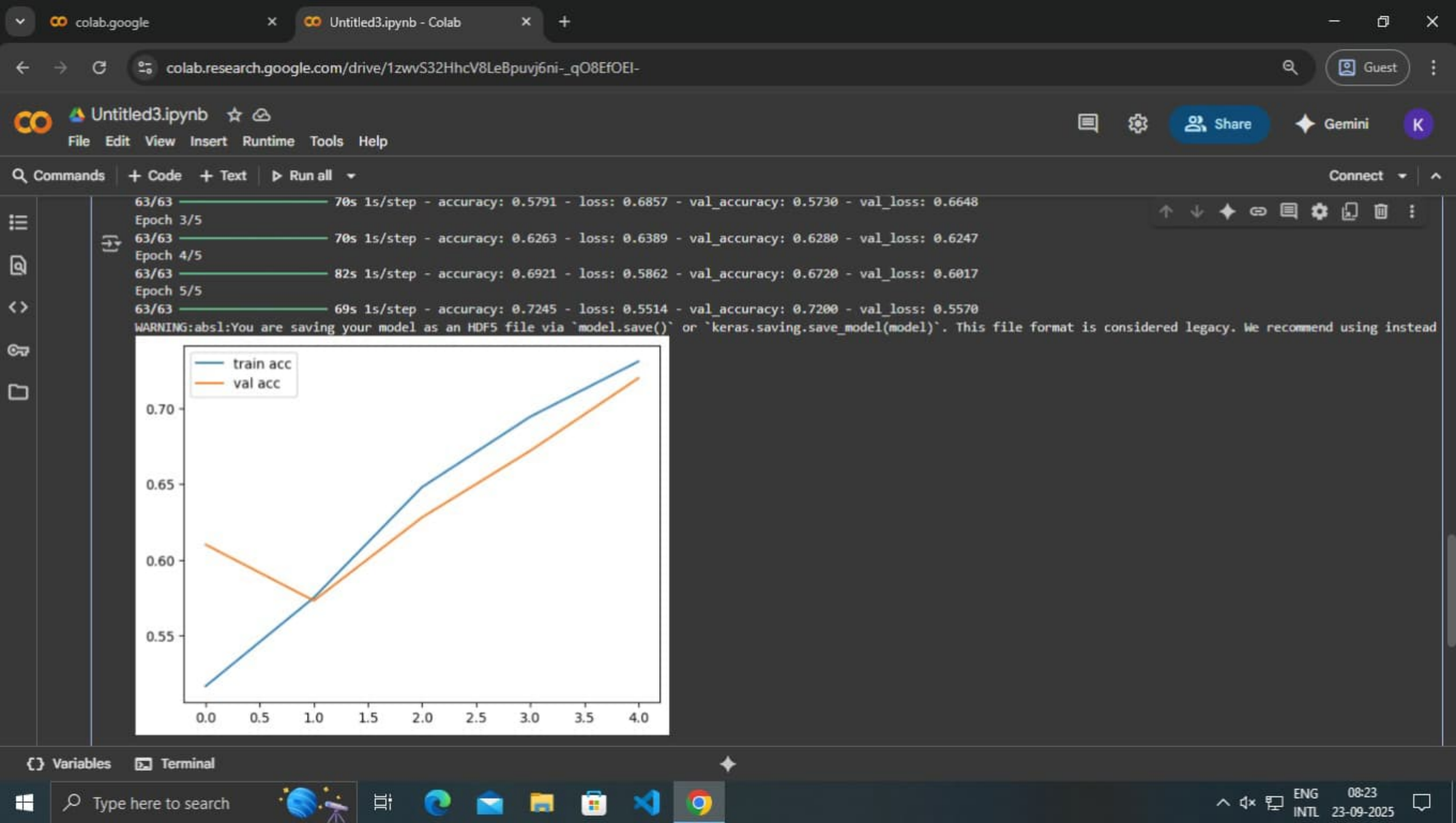


```
    image_size=IMG_SIZE,
    batch_size=BATCH_SIZE
)

val_data = image_dataset_from_directory(
    val_dir,
    image_size=IMG_SIZE,
    batch_size=BATCH_SIZE
)

# Normalize pixel values
normalization_layer = tf.keras.layers.Rescaling(1./255)
train_data = train_data.map(lambda x, y: (normalization_layer(x), y))
val_data = val_data.map(lambda x, y: (normalization_layer(x), y))

# Build CNN model
model = Sequential([
    Conv2D(32, (3,3), activation='relu', input_shape=(150, 150, 3)),
    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(1, activation='sigmoid')  # Binary classification
```



```
    Dense(1, activation='sigmoid')  # binary classification
])

# Compile model
model.compile(optimizer='adam',
              loss='binary_crossentropy',
              metrics=['accuracy'])

# Train
history = model.fit(
    train_data,
    validation_data=val_data,
    epochs=5
)

# Save model
model.save("cat_dog_cnn.h5")

# Plot accuracy
plt.plot(history.history['accuracy'], label='train acc')
plt.plot(history.history['val_accuracy'], label='val acc')
plt.legend()
plt.show()
```

```
Found 2000 files belonging to 2 classes.
Found 1000 files belonging to 2 classes.
Epoch 1/5
63/63 ━━━━━━━━━━━━━━━━━━━━ 72s 1s/step - accuracy: 0.5173 - loss: 0.7893 - val_accuracy: 0.6100 - val_loss: 0.6889
Epoch 2/5
63/63 ━━━━━━━━━━━━━━━━━━━━ 70s 1s/step - accuracy: 0.5791 - loss: 0.6857 - val_accuracy: 0.5730 - val_loss: 0.6648
```



```
63/63 ━━━━━━━━━━━━━━━━━━━━ 70s 1s/step - accuracy: 0.5791 - loss: 0.6857 - val_accuracy: 0.5730 - val_loss: 0.6648
Epoch 3/5
63/63 ━━━━━━━━━━━━━━━━━━━━ 70s 1s/step - accuracy: 0.6263 - loss: 0.6389 - val_accuracy: 0.6280 - val_loss: 0.6247
Epoch 4/5
63/63 ━━━━━━━━━━━━━━━━━━━━ 82s 1s/step - accuracy: 0.6921 - loss: 0.5862 - val_accuracy: 0.6720 - val_loss: 0.6017
Epoch 5/5
63/63 ━━━━━━━━━━━━━━━━━━━━ 69s 1s/step - accuracy: 0.7245 - loss: 0.5514 - val_accuracy: 0.7200 - val_loss: 0.5570
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
```