EXPERIMENT NO – 6

Build a Convolution Neural Network for simple image (dogs and Cats) Classification

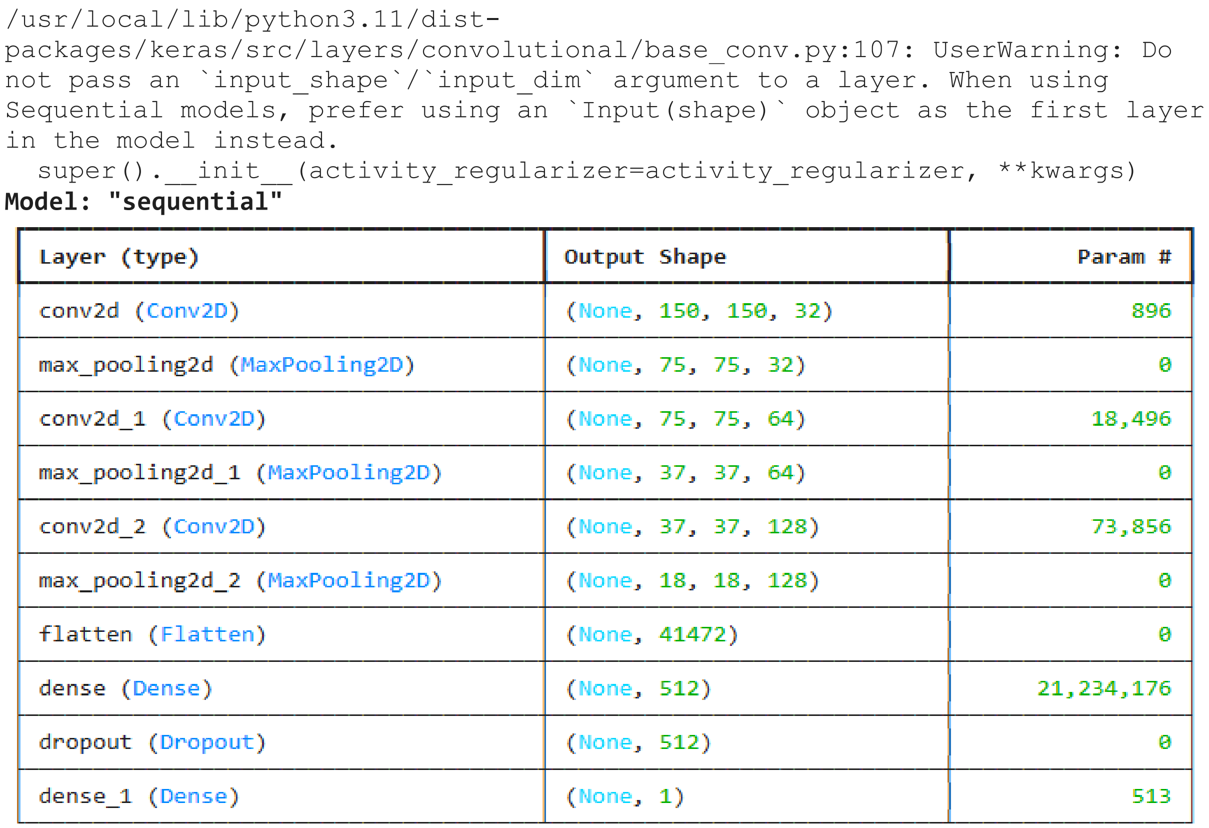
Image classification is the task of categorizing images into different classes based on their content. In this case, we want to build a model that can distinguish between images of dogs and cats.

Program:

```
# Install unrar if not installed

!apt-get install unrar -y


# Extract the dataset

!unrar x "/content/dogs-vs-cats.rar" "/content/dogs-vs-cats/"


# Verify extraction

!ls "/content/dogs-vs-cats/"

import tensorflow as tf

from tensorflow.keras.preprocessing.image import ImageDataGenerator


# Define dataset directory

dataset_dir = "/content/dogs-vs-cats/"


# Define image size & batch size

IMG_SIZE = (150, 150)

BATCH_SIZE = 32


# Data augmentation for training set

train_datagen = ImageDataGenerator(

    rescale=1.0/255,

    rotation_range=20,

    width_shift_range=0.2,

    height_shift_range=0.2,

    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    validation_split=0.2  # 80% train, 20% validation
)

# Load training & validation datasets
train_generator = train_datagen.flow_from_directory(
    dataset_dir,
    target_size=IMG_SIZE,
    batch_size=BATCH_SIZE,
    class_mode='binary',  # Since it's a binary classification (dogs vs cats)
    subset='training'
)

val_generator = train_datagen.flow_from_directory(
    dataset_dir,
    target_size=IMG_SIZE,
    batch_size=BATCH_SIZE,
    class_mode='binary',
    subset='validation'
)
```

```
Found 4 images belonging to 1 classes.
Found 1 images belonging to 1 classes.
```

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropout

# Build the CNN Model
model = Sequential([
    Conv2D(32, (3,3), activation='relu', input_shape=(150, 150, 3), strides=(1,1), padding="same"),
    MaxPooling2D((2,2), strides=(2,2)),
    Conv2D(64, (3,3), activation='relu', padding="same"),
    MaxPooling2D((2,2), strides=(2,2)),

    Conv2D(128, (3,3), activation='relu', padding="same"),
    MaxPooling2D((2,2), strides=(2,2)),

    Flatten(),
    Dense(512, activation='relu'),
    Dropout(0.5),
    Dense(1, activation='sigmoid')  # Binary classification (dog or cat)
])

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

# Model Summary
model.summary()
```



```
/usr/local/lib/python3.11/dist-
packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do
not pass an `input_shape`/`input_dim` argument to a layer. When using
Sequential models, prefer using an `Input(shape)` object as the first layer
in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
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 │
├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤
│ flatten (Flatten)                    │ (None, 41472)               │               0 │
├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤
│ dense (Dense)                        │ (None, 512)                 │      21,234,176 │
├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤
│ dropout (Dropout)                    │ (None, 512)                 │               0 │
├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤
│ dense_1 (Dense)                      │ (None, 1)                   │             513 │
└──────────────────────────────────────┴─────────────────────────────┴─────────────────┘
```

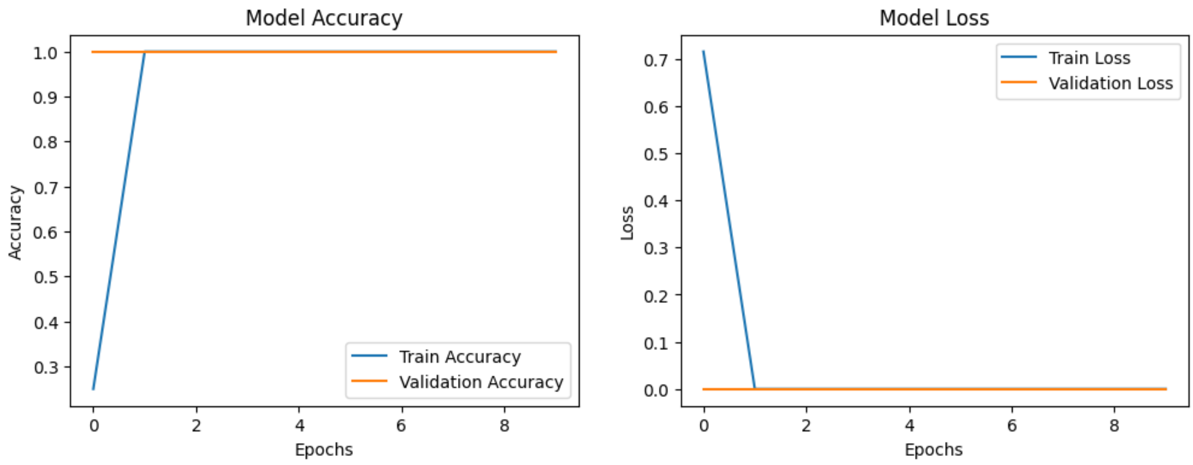
```
Total params: 21,327,937 (81.36 MB)
 Trainable params: 21,327,937 (81.36 MB)
 Non-trainable params: 0 (0.00 B)
```

```
# Train the model

history = model.fit(

   train_generator,

   validation_data=val_generator,

   epochs=10

)
```

```
/usr/local/lib/python3.11/dist-packages/keras/src/trainers/data_adapters/py_dataset_adapter.py:121: UserWarning: Your `PyDataset` class should call `super().__init__(**kwargs)` in its constructor. `**kwargs` can include `workers`, `use_multiprocessing`, `max_queue_size`. Do not pass these arguments to `fit()`, as they will be ignored.
  self._warn_if_super_not_called()
Epoch 1/10
1/1 ━━━━━━━━━━━━━━━━━━━━ 5s 5s/step - accuracy: 0.2500 - loss: 0.7157 - val_accuracy: 1.0000 - val_loss: 2.0281e-10
Epoch 2/10
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 1s/step - accuracy: 1.0000 - loss: 1.9600e-06 - val_accuracy: 1.0000 - val_loss: 1.3092e-19
Epoch 3/10
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 871ms/step - accuracy: 1.0000 - loss: 2.0541e-09 - val_accuracy: 1.0000 - val_loss: 3.1983e-30
Epoch 4/10
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 815ms/step - accuracy: 1.0000 - loss: 3.4824e-15 - val_accuracy: 1.0000 - val_loss: 0.0000e+00
Epoch 5/10
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 1s/step - accuracy: 1.0000 - loss: 2.6508e-18 - val_accuracy: 1.0000 - val_loss: 0.0000e+00
Epoch 6/10
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 749ms/step - accuracy: 1.0000 - loss: 1.0666e-25 - val_accuracy: 1.0000 - val_loss: 0.0000e+00
Epoch 7/10
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 1s/step - accuracy: 1.0000 - loss: 3.3210e-28 - val_accuracy: 1.0000 - val_loss: 0.0000e+00
Epoch 8/10
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 1s/step - accuracy: 1.0000 - loss: 7.4800e-27 - val_accuracy: 1.0000 - val_loss: 0.0000e+00
Epoch 9/10
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 750ms/step - accuracy: 1.0000 - loss: 2.5529e-36 - val_accuracy: 1.0000 - val_loss: 0.0000e+00
Epoch 10/10
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 745ms/step - accuracy: 1.0000 - loss: 0.0000e+00 - val_accuracy: 1.0000 - val_loss: 0.0000e+00
```

```
import matplotlib.pyplot as plt


# Plot Accuracy & Loss

plt.figure(figsize=(12, 4))
```

```
# Accuracy

plt.subplot(1, 2, 1)

plt.plot(history.history['accuracy'], label='Train Accuracy')

plt.plot(history.history['val_accuracy'], label='Validation Accuracy')

plt.xlabel('Epochs')

plt.ylabel('Accuracy')

plt.legend()

plt.title('Model Accuracy')


# Loss

plt.subplot(1, 2, 2)

plt.plot(history.history['loss'], label='Train Loss')

plt.plot(history.history['val_loss'], label='Validation Loss')

plt.xlabel('Epochs')

plt.ylabel('Loss')

plt.legend()

plt.title('Model Loss')


plt.show()
```



```
import numpy as np

from tensorflow.keras.preprocessing import image

import matplotlib.pyplot as plt # Import matplotlib.pyplot
```

```
def predict_image(img_path):
    img = image.load_img(img_path, target_size=(150, 150))
    img_array = image.img_to_array(img) / 255.0
    img_array = np.expand_dims(img_array, axis=0)


    prediction = model.predict(img_array)[0][0]
    if prediction > 0.5:
        label = "Dog"  # Define label
        confidence = prediction # Define confidence
        print(f"The image is a Dog ({prediction:.2f})")
    else:
        label = "Cat" # Define label
        confidence = 1 - prediction # Define confidence
        print(f"The image is a Cat ({1 - prediction:.2f})")
    # Display the image, indented correctly
    plt.imshow(image.load_img(img_path))
    plt.axis("off")
    plt.title(f"Prediction: {label} ({confidence:.2f})")
    plt.show()

# Example Usage
predict_image("/content/240_F_97589769_t45CqXyzjz0KXwoBZT9PRaWGHRk5hQqQ.jpg")
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 121ms/step
The image is a Cat (1.00)
```