```
In [1]: !pip install tensorflow
        !pip install matplotlib
        !pip install ipywidgets
```

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Requirement already satisfied: tensorflow in c:\users\fisay\anaconda3\lib\site-packag
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y\anaconda3\lib\site-packages (from tensorboard<2.16,>=2.15->tensorflow-intel==2.15.0
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Requirement already satisfied: Send2Trash>=1.8.0 in c:\users\fisay\anaconda3\lib\site
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5.0->ipywidgets) (1.15.1)
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kages (from beautifulsoup4->nbconvert>=5->notebook>=4.4.1->widgetsnbextension~=3.5.0-
>ipywidgets) (2.3.1)
Requirement already satisfied: webencodings in c:\users\fisay\anaconda3\lib\site-pack
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Requirement already satisfied: pycparser in c:\users\fisay\anaconda3\lib\site-package
s (from cffi>=1.0.1->argon2-cffi-bindings->argon2-cffi->notebook>=4.4.1->widgetsnbext
ension~=3.5.0->ipywidgets) (2.21)
```

In [2]:
```python
# Import necessary libraries
from tensorflow.keras.applications.vgg16 import VGG16, preprocess_input, decode_predic
from tensorflow.keras.preprocessing.image import load_img, img_to_array
from IPython.display import display
import numpy as np
import matplotlib.pyplot as plt
from PIL import Image, ImageFilter
import io
import ipywidgets as widgets
```

```
C:\Users\fisay\anaconda3\lib\site-packages\scipy\__init__.py:155: UserWarning: A NumP
y version >=1.18.5 and <1.25.0 is required for this version of SciPy (detected versio
n 1.26.3
  warnings.warn(f"A NumPy version >={np_minversion} and <{np_maxversion}"
WARNING:tensorflow:From C:\Users\fisay\anaconda3\lib\site-packages\keras\src\losses.p
y:2976: The name tf.losses.sparse_softmax_cross_entropy is deprecated. Please use tf.
compat.v1.losses.sparse_softmax_cross_entropy instead.
```

Introduction

This lab is designed to introduce you to the basics of deep learning by interacting with a pre-built model. You'll understand the workflow of a deep learning project, including data preprocessing, model architecture, and making predictions. The goal is to familiarize yourself with the basics of deep learning without writing any code.

In [3]:
```python
# Load the VGG16 model
model = VGG16(weights='imagenet')

# Display the model architecture
model.summary()
```

```
WARNING:tensorflow:From C:\Users\fisay\anaconda3\lib\site-packages\keras\src\backend.
py:1398: The name tf.executing_eagerly_outside_functions is deprecated. Please use t
f.compat.v1.executing_eagerly_outside_functions instead.

WARNING:tensorflow:From C:\Users\fisay\anaconda3\lib\site-packages\keras\src\layers\p
ooling\max_pooling2d.py:161: The name tf.nn.max_pool is deprecated. Please use tf.nn.
max_pool2d instead.

Model: "vgg16"
_____
 Layer (type)                Output Shape              Param #
=================================================================
 input_1 (InputLayer)        [(None, 224, 224, 3)]     0

 block1_conv1 (Conv2D)       (None, 224, 224, 64)      1792

 block1_conv2 (Conv2D)       (None, 224, 224, 64)      36928

 block1_pool (MaxPooling2D)  (None, 112, 112, 64)      0

 block2_conv1 (Conv2D)       (None, 112, 112, 128)     73856

 block2_conv2 (Conv2D)       (None, 112, 112, 128)     147584

 block2_pool (MaxPooling2D)  (None, 56, 56, 128)       0

 block3_conv1 (Conv2D)       (None, 56, 56, 256)       295168

 block3_conv2 (Conv2D)       (None, 56, 56, 256)       590080

 block3_conv3 (Conv2D)       (None, 56, 56, 256)       590080

 block3_pool (MaxPooling2D)  (None, 28, 28, 256)       0

 block4_conv1 (Conv2D)       (None, 28, 28, 512)       1180160

 block4_conv2 (Conv2D)       (None, 28, 28, 512)       2359808

 block4_conv3 (Conv2D)       (None, 28, 28, 512)       2359808

 block4_pool (MaxPooling2D)  (None, 14, 14, 512)       0

 block5_conv1 (Conv2D)       (None, 14, 14, 512)       2359808

 block5_conv2 (Conv2D)       (None, 14, 14, 512)       2359808

 block5_conv3 (Conv2D)       (None, 14, 14, 512)       2359808

 block5_pool (MaxPooling2D)  (None, 7, 7, 512)         0

 flatten (Flatten)           (None, 25088)             0

 fc1 (Dense)                 (None, 4096)              102764544

 fc2 (Dense)                 (None, 4096)              16781312

 predictions (Dense)         (None, 1000)              4097000

=================================================================
Total params: 138357544 (527.79 MB)
```

```
Trainable params: 138357544 (527.79 MB)
Non-trainable params: 0 (0.00 Byte)
```
_____

In [4]:
```python
# Load and preprocess an image
def load_and_preprocess_image(image_path):
    # Load the image
    img = load_img(image_path, target_size=(224, 224))

    # Convert the image to a numpy array
    img_array = img_to_array(img)

    # Expand dimensions to fit the model input
    img_array = np.expand_dims(img_array, axis=0)

    # Preprocess the image
    img_array = preprocess_input(img_array)

    return img, img_array

# Load and preprocess a sample image
sample_image, processed_image = load_and_preprocess_image('sample.jpg')

# Display the sample image
plt.imshow(sample_image)
plt.show()
```

```
---------------------------------------------------------------------------
FileNotFoundError                         Traceback (most recent call last)
~\AppData\Local\Temp\ipykernel_27932\3310510207.py in <module>
     16
     17 # Load and preprocess a sample image
---> 18 sample_image, processed_image = load_and_preprocess_image('sample.jpg')
     19
     20 # Display the sample image

~\AppData\Local\Temp\ipykernel_27932\3310510207.py in load_and_preprocess_image(image
_path)
      2 def load_and_preprocess_image(image_path):
      3     # Load the image
----> 4     img = load_img(image_path, target_size=(224, 224))
      5
      6     # Convert the image to a numpy array

~\anaconda3\lib\site-packages\keras\src\utils\image_utils.py in load_img(path, graysc
ale, color_mode, target_size, interpolation, keep_aspect_ratio)
    420         if isinstance(path, pathlib.Path):
    421             path = str(path.resolve())
--> 422         with open(path, "rb") as f:
    423             img = pil_image.open(io.BytesIO(f.read()))
    424     else:

FileNotFoundError: [Errno 2] No such file or directory: 'sample.jpg'
```

```
In [ ]:  # Make predictions
         predictions = model.predict(processed_image)

         # Decode and print the predictions
         decoded_predictions = decode_predictions(predictions, top=3)[0]
         print(decoded_predictions)
```

```
In [ ]:  # Upload button to load images
         upload = widgets.FileUpload()
         display(upload)

         # Button to make predictions
         predict_button = widgets.Button(description="Make Prediction")
         display(predict_button)

         # Function to handle button click
         def on_click(change):
             img_data = list(upload.value.values())[0]['content']
             img = Image.open(io.BytesIO(img_data))
             img = img.resize((224, 224))

             # Preprocess and predict
             img_array = img_to_array(img)
             img_array = np.expand_dims(img_array, axis=0)
             img_array = preprocess_input(img_array)
             predictions = model.predict(img_array)
             decoded_predictions = decode_predictions(predictions, top=3)[0]

             # Display predictions
             print(decoded_predictions)

         predict_button.on_click(on_click)
```

Conclusion and Discussion

Reflect on the lab activities. Discuss how the pre-trained model was able to make predictions, the role of data preprocessing, and the impact of input modifications on the model's predictions.

```
In [ ]:
```

```
In [ ]:
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In [ ]:
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In [ ]:
```