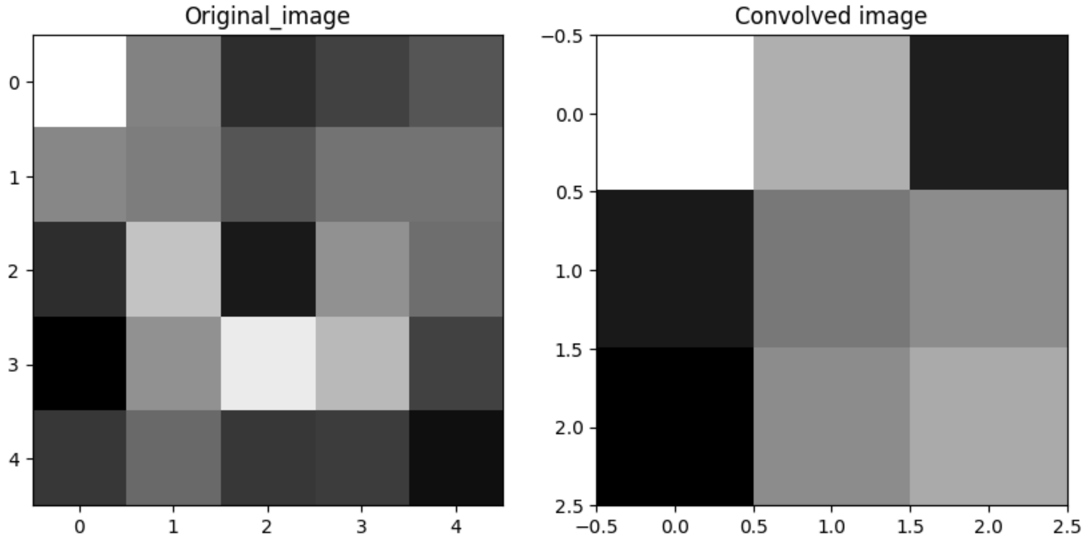
```
from google.colab import drive

# Mount google drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
import numpy as np
import matplotlib.pyplot as plt
from PIL import Image

# Functions to perform Convolution

def convolve2d(image,kernel):
  kernel_height, kernel_width = kernel.shape
  image_height, image_width = image.shape

  output_height = image_height - kernel_height + 1
  output_width = image_width - kernel_width + 1

  output = np.zeros((output_height, output_width))

  for i in range(output_height):
    for j in range(output_width):
      patch = image[i:i+kernel_height, j:j+kernel_width]
      output[i,j] = np.sum(patch * kernel)

  return output
```

```
image = np.random.rand(5,5)

# Define a kernel (eg Edge detection)
kernel = np.array([[1,0,-1],
                   [1,0,-1],
                  [1,0,-1]])


# Apply Convolution
convolved_image = convolve2d(image, kernel)

# Plot the results
fig, axes = plt.subplots(1,2, figsize=(10,15))
axes[0].imshow(image,cmap='gray')
axes[0].set_title('Original_image')
axes[1].imshow(convolved_image,cmap='gray')
axes[1].set_title('Convolved image')
```

```
Text(0.5, 1.0, 'Convolved image')
```

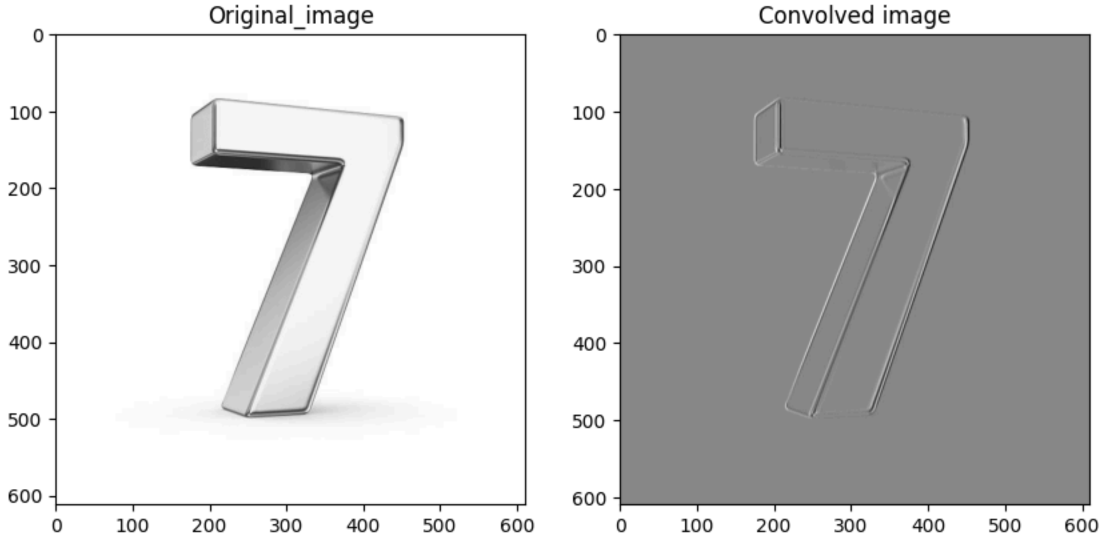


```
image
```

```
array([[0.96977315, 0.52261   , 0.19648263, 0.26917863, 0.34920583],
       [0.53793315, 0.49631649, 0.34864393, 0.46125906, 0.45243274],
       [0.20689311, 0.74861496, 0.13405042, 0.56532799, 0.43322481],
       [0.02388736, 0.57124993, 0.89357137, 0.71470292, 0.28222083],
       [0.23374291, 0.42218396, 0.23052234, 0.2525756 , 0.09118729]])
```

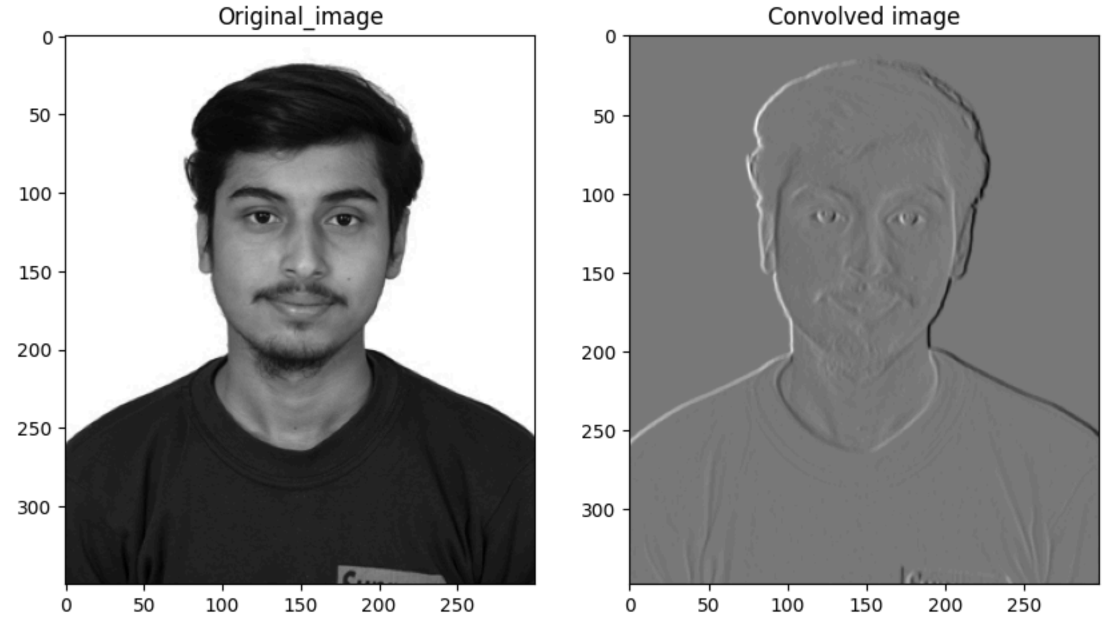
```
image_path = '/content/drive/MyDrive/40_datascience_project/Day2 Dog Breed Prediction/7.jpg'
image = Image.open(image_path).convert('L') #Convert to grayscale
image = np.array(image)

# image = np.random.rand(5,5)

# Define a kernel (eg Edge detection)
kernel = np.array([[1,0,-1],
                   [1,0,-1],
                  [1,0,-1]])


# Apply Convolution
convolved_image = convolve2d(image, kernel)

# Plot the results
fig, axes = plt.subplots(1,2, figsize=(10,15))
axes[0].imshow(image,cmap='gray')
axes[0].set_title('Original_image')
axes[1].imshow(convolved_image,cmap='gray')
axes[1].set_title('Convolved image')
```

```
Text(0.5, 1.0, 'Convolved image')
```



```
image_path = '/content/drive/MyDrive/40_datascience_project/Day2 Dog Breed Prediction/biswash pp.jpg'
image = Image.open(image_path).convert('L') #Convert to grayscale
image = np.array(image)

# image = np.random.rand(5,5)

# Define a kernel (eg Edge detection)
kernel = np.array([[1,0,-1],
                   [1,0,-1],
                  [1,0,-1]])


# Apply Convolution
convolved_image = convolve2d(image, kernel)

# Plot the results
fig, axes = plt.subplots(1,2, figsize=(10,15))
axes[0].imshow(image,cmap='gray')
axes[0].set_title('Original_image')
axes[1].imshow(convolved_image,cmap='gray')
axes[1].set_title('Convolved image')
```

```
Text(0.5, 1.0, 'Convolved image')
```



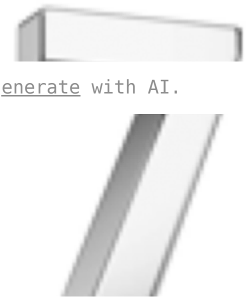
Convolution using Pytorch

```
import torch
import torch.nn as nn
from PIL import Image
import numpy as np
import matplotlib.pyplot as plt


# Load and preprocess the image
def load_image(image_path, image_size=(128, 128)):
    image = Image.open(image_path).convert('L')  # Convert to grayscale
    image = image.resize(image_size)             # Resize the image
    image = np.array(image)                      # Convert to numpy array
    image = torch.tensor(image, dtype=torch.float32)  # Convert to torch tensor
    image = image.unsqueeze(0).unsqueeze(0)      # Add channel and batch dimensions
    return image

# Path to the image
image_path = r"/content/drive/MyDrive/40_datascience_project/Day2 Dog Breed Prediction/7.jpg"

# Load the image
input_image = load_image(image_path)

# Print the shape of the image tensor
print("Input Image Shape:", input_image.shape)
```

```
Input Image Shape: torch.Size([1, 1, 128, 128])
```

```
# Define a convolution layer

conv_layer = nn.Conv2d(in_channels=1,out_channels=1, kernel_size=3, stride=1, padding=0)

# Set a specific filter to convolutional layer
conv_layer.weight = nn.Parameter(torch.tensor([[[[1,0,-1],
                                                [1,0,-1],
                                                [1,0,-1]]]], dtype=torch.float32))

# Perform convolution
conv_output = conv_layer(input_image)


# Perform Pooling
max_pooled_layer = nn.MaxPool2d(kernel_size=2, stride=2)
max_pooled_image = max_pooled_layer(conv_output)


# Print the shape of the output tensor
print("Output Image Shape:", conv_output.shape)

# Display the input image
plt.imshow(input_image[0, 0].numpy(), cmap='gray')
plt.title("Input Image")
plt.axis('off')
plt.show()
print("Input Image Shape:", input_image.shape)

# Display the convolved image
plt.imshow(conv_output[0, 0].detach().numpy(), cmap='gray')
plt.title("Conv Image")
plt.axis('off')
plt.show()
print("Conv Image Shape:", conv_output.shape)



# Display the Pooled image
plt.imshow(max_pooled_image[0, 0].detach().numpy(), cmap='gray')
plt.title("Pooling Image")
plt.axis('off')
plt.show()
print("Pooling Image Shape:", conv_output.shape)
```

```
Output Image Shape: torch.Size([1, 1, 126, 126])
```



Input Image

Start coding or generate with AI.