ASSIGNMENT-2

MARCH 19, 2021

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20MAI0082

Github Link :- https://github.com/rishabh5197/Deep-Learning-Assignments/tree/main/Assignment-2

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In [1]:

```
import matplotlib.pyplot as plt
```

In [2]:

```
def plotting(name,label):
    value=[]
    for i in range(-10,11):
        value.append(name(i))
    plt.figure(figsize=(16,8))
    plt.axhline(color="green")
    plt.axvline(color="orange")
    plt.plot(value,color="red",label=label)
    plt.grid()
    plt.legend()
    plt.title(label)
    plt.show()
```

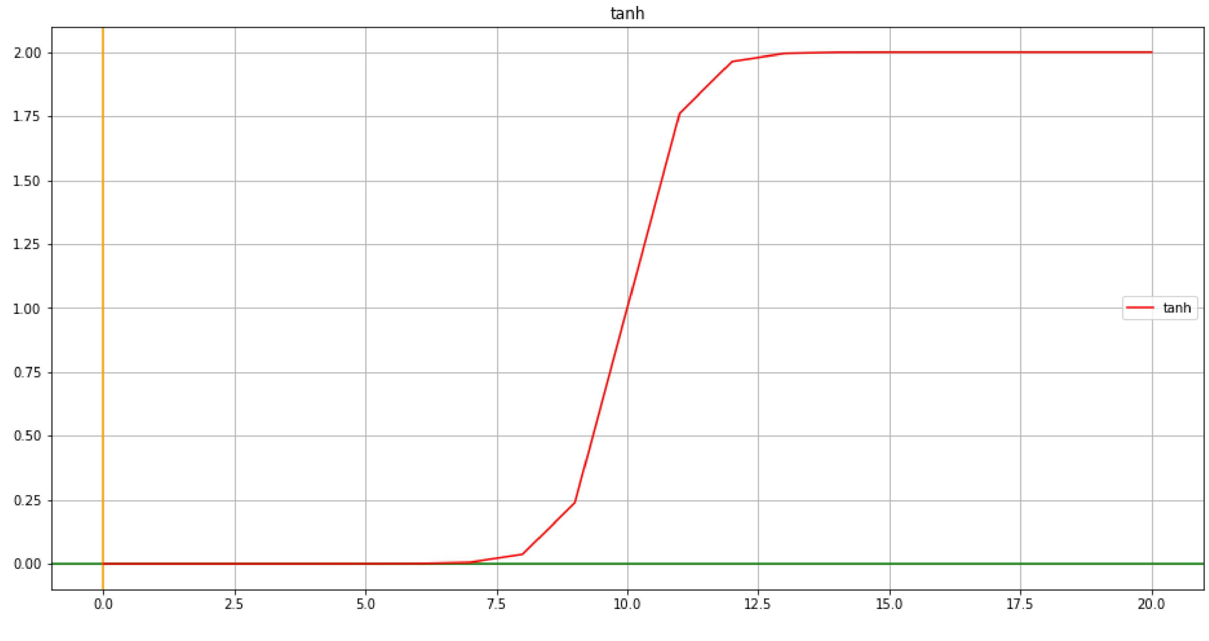
Initializing tanh activation function

In [3]:

```
def tanh(value):
    return 2/(1+2.7182818284590452353602874713527**(-2*value))
```

In [4]:

```
plotting(tanh,'tanh')
```



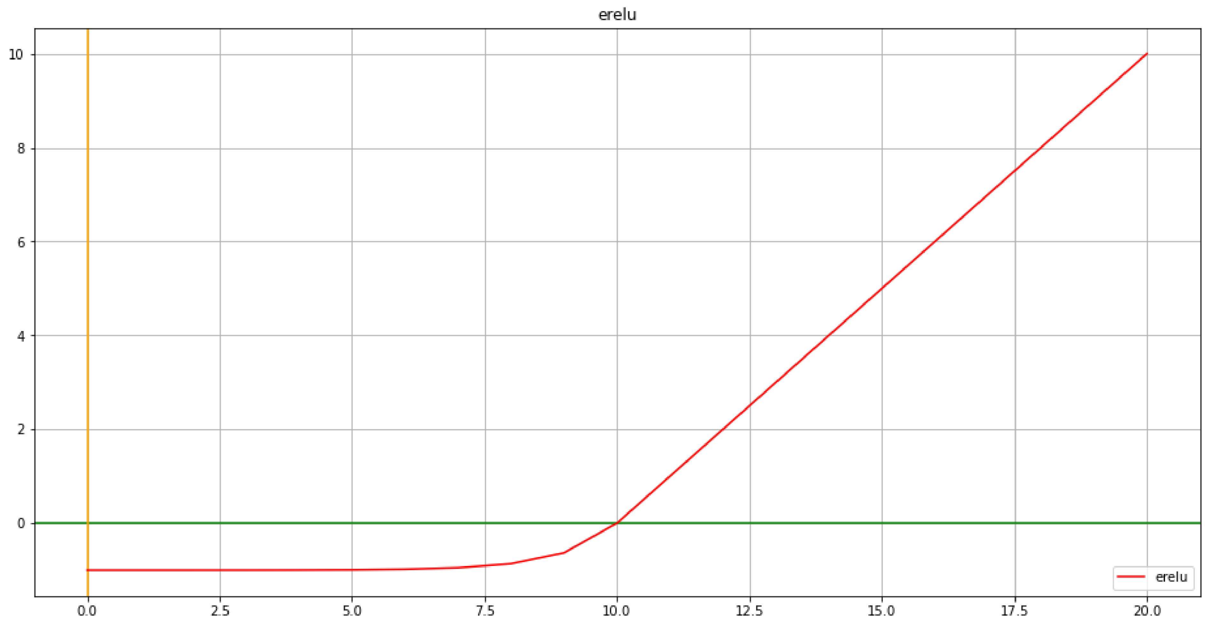
Initializing erelu activation function

In [5]:

```
def erelu(value,alpha=1):
    if value>0:
        return value
    else:
        return alpha*(2.71828182845904523536028747135**(value) - 1)
```

In [6]:

```
plotting(erelu,'erelu')
```



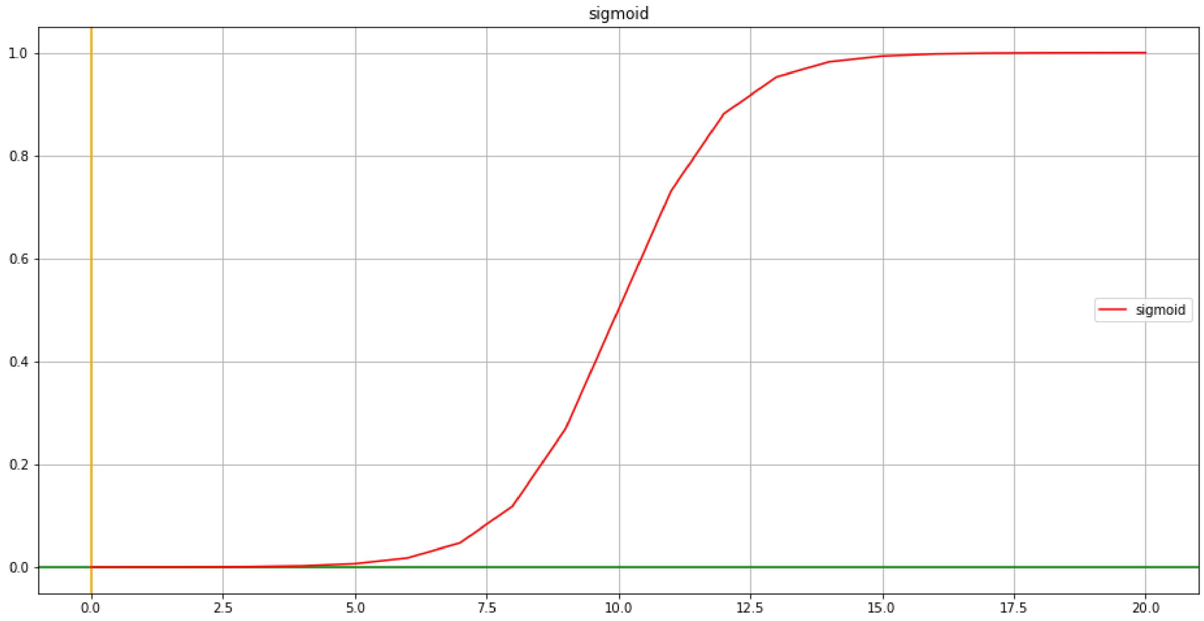
Initializing sigmoid activation function

In [7]:

```
def sigmoid(value):
    return 1/(1+2.71828182845904523536028747135**-(value))
```

In [8]:

```
plotting(sigmoid,'sigmoid')
```



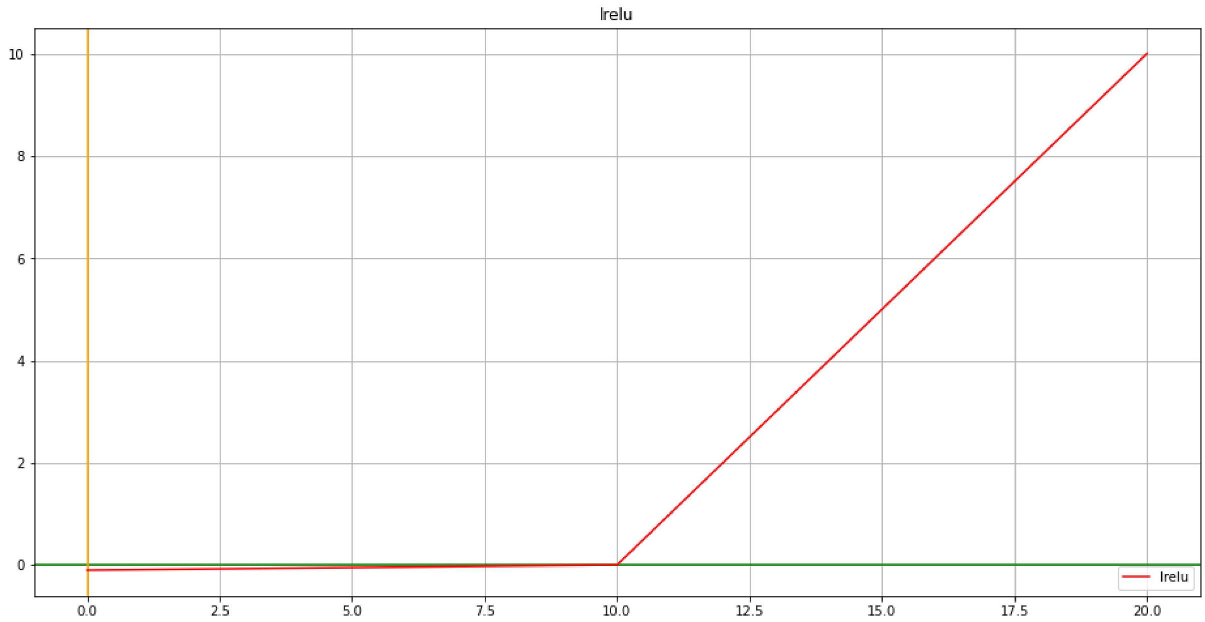
Initializing lrelu activation function

In [9]:

```
def lrelu(value):
    if value<0:
        return value*0.01
    else:
        return value
```

In [10]:

```
plotting(lrelu,"lrelu")
```



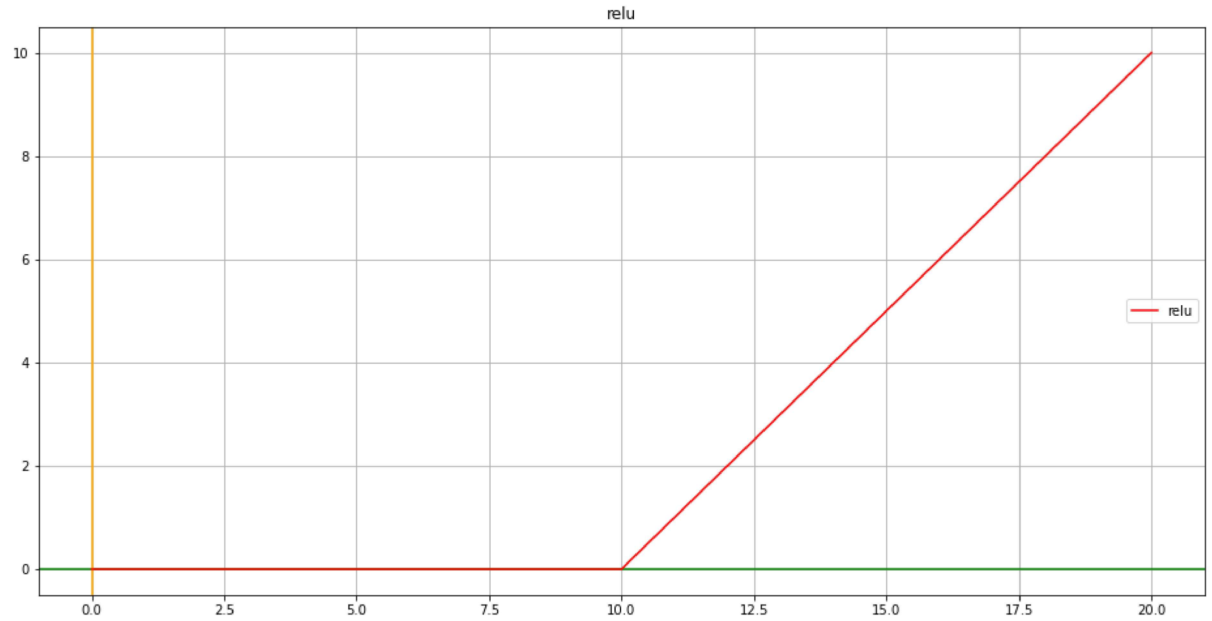
Initializing relu activation function

In [11]:

```
def relu(value):
    if value<0:
        return 0
    else:
        return value
```

In [12]:

```
plotting(relu,"relu")
```



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In [1]:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:

```
def processImage(image):
    image = cv2.imread(image)
    image = cv2.cvtColor(src=image, code=cv2.COLOR_BGR2GRAY)
    return image
```

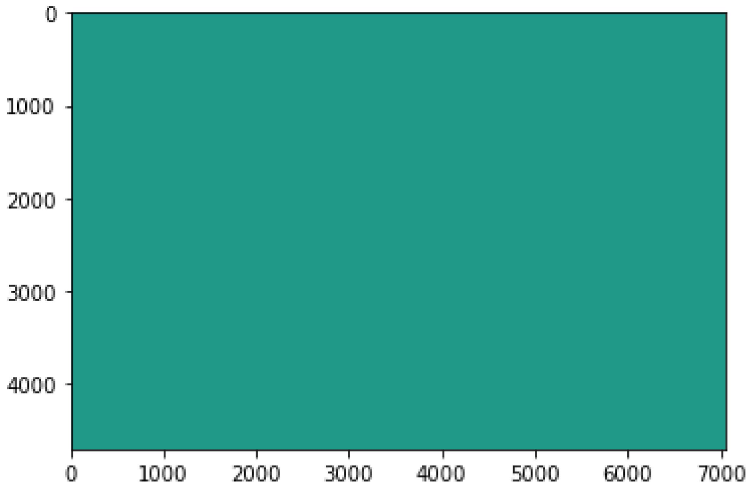
In [3]:

```python
def convolve2D(image, kernel, padding=0, strides=1):
    # Cross Correlation
    kernel = np.flipud(np.fliplr(kernel))

    # Gather Shapes of Kernel + Image + Padding
    xKernShape = kernel.shape[0]
    yKernShape = kernel.shape[1]
    xImgShape = image.shape[0]
    yImgShape = image.shape[1]

    # Shape of Output Convolution
    xOutput = int(((xImgShape - xKernShape + 2 * padding) / strides) + 1)
    yOutput = int(((yImgShape - yKernShape + 2 * padding) / strides) + 1)
    output = np.zeros((xOutput, yOutput))

    # Apply Equal Padding to All Sides
    if padding != 0:
        imagePadded = np.zeros((image.shape[0] + padding*2, image.shape[1] + padding*2))
        imagePadded[int(padding):int(-1 * padding), int(padding):int(-1 * padding)] = image
        print(imagePadded)
    else:
        imagePadded = image

    # Iterate through image
    for y in range(image.shape[1]):
        # Exit Convolution
        if y > image.shape[1] - yKernShape:
            break
        # Only Convolve if y has gone down by the specified Strides
        if y % strides == 0:
            for x in range(image.shape[0]):
                # Go to next row once kernel is out of bounds
                if x > image.shape[0] - xKernShape:
                    break
                try:
                    # Only Convolve if x has moved by the specified Strides
                    if x % strides == 0:
                        output[x, y] = (kernel * imagePadded[x: x + xKernShape, y: y + yKernSha
                except:
                    break

    return output
```

In [4]:

```python
if __name__ == '__main__':
    # Grayscale Image
    image = processImage('113629_original_7042x4699.jpg')

    # Edge Detection Kernel
    kernel = np.array([[-1, -1, -1], [-1, 8, -1], [-1, -1, -1]])

    output = convolve2D(image, kernel, padding=2)
    plt.imshow(output)
    plt.show()
```

```
[[0. 0. 0. ... 0. 0. 0.]
 [0. 0. 0. ... 0. 0. 0.]
 [0. 0. 2. ... 2. 0. 0.]
 ...
 [0. 0. 2. ... 2. 0. 0.]
 [0. 0. 0. ... 0. 0. 0.]
 [0. 0. 0. ... 0. 0. 0.]]
```



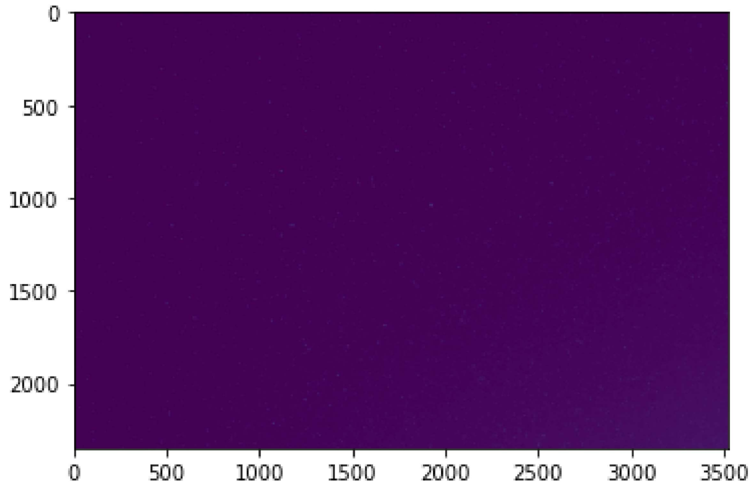
Taking stride as 2 and kernel size as 5*5

In [5]:

```python
stride=2
filter_size=5
```

In [6]:

```
kernel = np.array([[1, 1, 1,1,1], [1, 1, 1,1,1], [1, 1, 1,1,1],[1, 1, 1,1,1], [1, 1, 1,1,1]])
# Convolve and Save Output
output2 = convolve2D(image, kernel,strides=2)
plt.imshow(output2)
plt.show()
```



In [7]:

```
output2
```

Out[7]:

```
array([[  50.,    0.,   50., ...,   93.,    0.,   98.],
       [   0.,    0.,    0., ...,    0.,    0.,    0.],
       [  50.,    0.,   51., ...,   87.,    0.,   92.],
       ...,
       [   0.,    0.,    0., ...,    0.,    0.,    0.],
       [  50.,    0.,   50., ..., 1059.,    0., 1115.],
       [   0.,    0.,    0., ...,    0.,    0.,    0.]])
```

Taking stride as 1 but making an image padded with 0 padding

In [8]:

```
import numpy as np
import pandas as pd
from keras.models import Sequential
from keras.layers.convolutional import Conv2D
import cv2
from matplotlib import pyplot as plt
```

In [9]:

```
def processImage(image):

    image = cv2.imread(image)
    image = cv2.cvtColor(src=image, code=cv2.COLOR_BGR2GRAY)
    return image
```

In [10]:

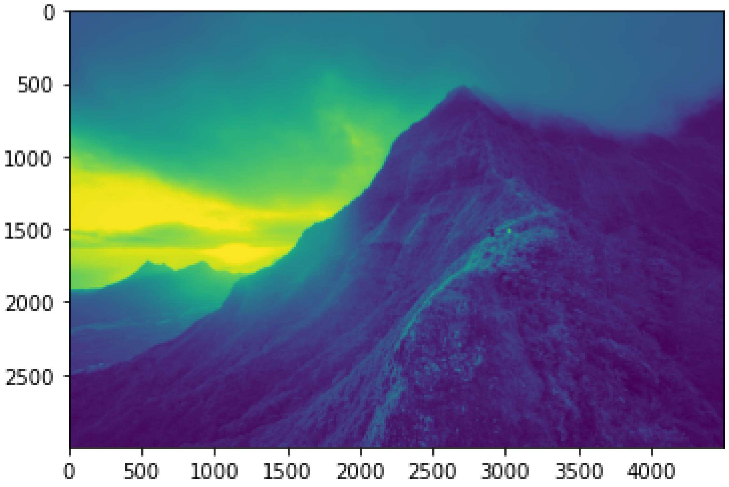
```
def convolve2D(image, kernel, padding=0, strides=1):
    # Cross Correlation
    kernel = np.flipud(np.fliplr(kernel))

    # Gather Shapes of Kernel + Image + Padding
    xKernShape = kernel.shape[0]
    yKernShape = kernel.shape[1]
    xImgShape = image.shape[0]
    yImgShape = image.shape[1]

    # Shape of Output Convolution
    xOutput = int(((xImgShape - xKernShape + 2 * padding) / strides) + 1)
    yOutput = int(((yImgShape - yKernShape + 2 * padding) / strides) + 1)
    output = np.zeros((xOutput, yOutput))

    # Apply Equal Padding to All Sides
    if padding != 0:
        imagePadded = np.zeros((image.shape[0] + padding*2, image.shape[1] + padding*2))
        imagePadded[int(padding):int(-1 * padding), int(padding):int(-1 * padding)] = image
        print(imagePadded)
    else:
        imagePadded = image

    # Iterate through image
    for y in range(image.shape[1]):
        # Exit Convolution
        if y > image.shape[1] - yKernShape:
            break
        # Only Convolve if y has gone down by the specified Strides
        if y % strides == 0:
            for x in range(image.shape[0]):
                # Go to next row once kernel is out of bounds
                if x > image.shape[0] - xKernShape:
                    break
                try:
                    # Only Convolve if x has moved by the specified Strides
                    if x % strides == 0:
                        output[x, y] = (kernel * imagePadded[x: x + xKernShape, y: y + yKernSha
                except:
                    break

    return output
```

In [11]:

```
image = processImage('peter-vanosdall-ktpyjH2h9xs-unsplash.jpg')
kernel = np.array([[1, 1, 1], [1, 1, 1], [1, 1, 1]])
output3 = convolve2D(image, kernel, padding=0)
plt.imshow(output3)
```

Out[11]:

```
<matplotlib.image.AxesImage at 0x12eab20aa00>
```



In [12]:

```
output3
```

Out[12]:

```
array([[630., 630., 630., ..., 684., 684., 684.],
       [630., 630., 630., ..., 682., 684., 684.],
       [633., 633., 633., ..., 682., 684., 684.],
       ...,
       [150., 140., 130., ...,  80.,  83.,  85.],
       [143., 135., 127., ...,  72.,  76.,  82.],
       [134., 130., 126., ...,  59.,  64.,  71.]])
```

Calculating metrics i.e. entropy between original image and filtered image

In [13]:

```
import skimage.measure
entropy_original_image = skimage.measure.shannon_entropy(image)
```

In [14]:

```
print(entropy_original_image)
```

```
7.470314626942694
```

In [15]:

```
import skimage.measure
entropy_for_1_stride = skimage.measure.shannon_entropy(output)
```

In [16]:

```
print(entropy_for_1_stride)
```

```
5.679802588028154
```

In [17]:

```
import skimage.measure
entropy_for_2_stride = skimage.measure.shannon_entropy(output2)
```

In [18]:

```
print(entropy_for_2_stride)
```

```
2.819561491155553
```

In [19]:

```
import skimage.measure
entropy_for_0_padding = skimage.measure.shannon_entropy(output3)
```

In [20]:

```
print(entropy_for_0_padding)
```

```
10.51879444649381
```