Activation functions

- Activation functions are a **key part of neural network design.**
- The modern default activation function for hidden layers is the **ReLU function**.
- The activation function for **output layers depends on the type of prediction problem**

Activation functions are a critical part of the design of a neural network.

- The choice of activation function in the **hidden layer will control how well the network model learns the training dataset.**
- The choice of activation function in the **output layer will define the type of predictions** the model can make.
- Careful choice of activation function must be made for each deep learning neural network project.

Types of Activation Functions

Depending on the activation function you pick, you will find that some objective functions are more appropriate for different kinds of data.

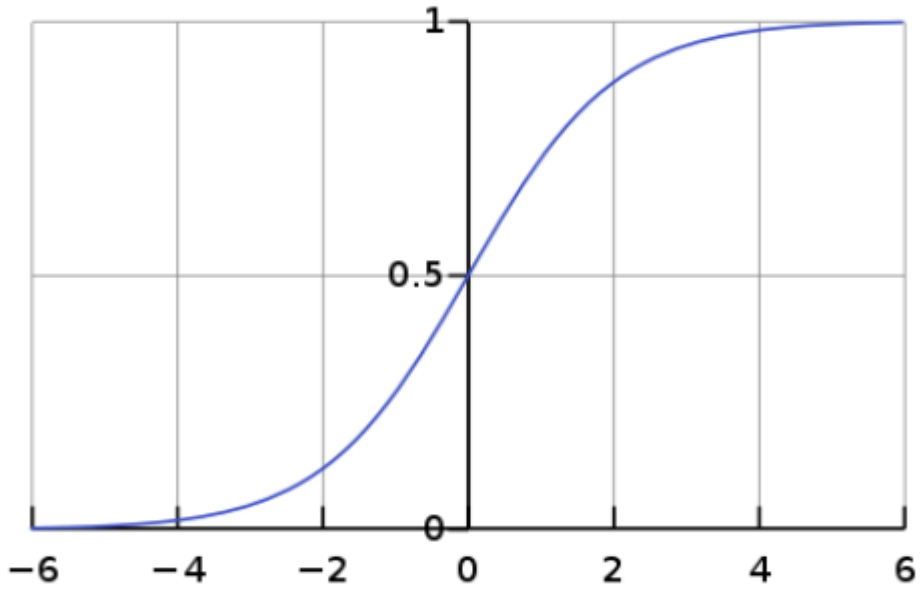
Different Types of Activation Functions:-

- Sigmoid
- Tanh
- Hard Tanh
- ReLu (Rectified Linear Unit)

SIGMOID

A **sigmoid function** is a mathematical function having a characteristic "S"-shaped curve or **sigmoid curve**. A common example of a sigmoid function is the logistic function .Logistic Regression.

$$S(x) = \frac{1}{1 + e^{-x}}$$



SIGMOID

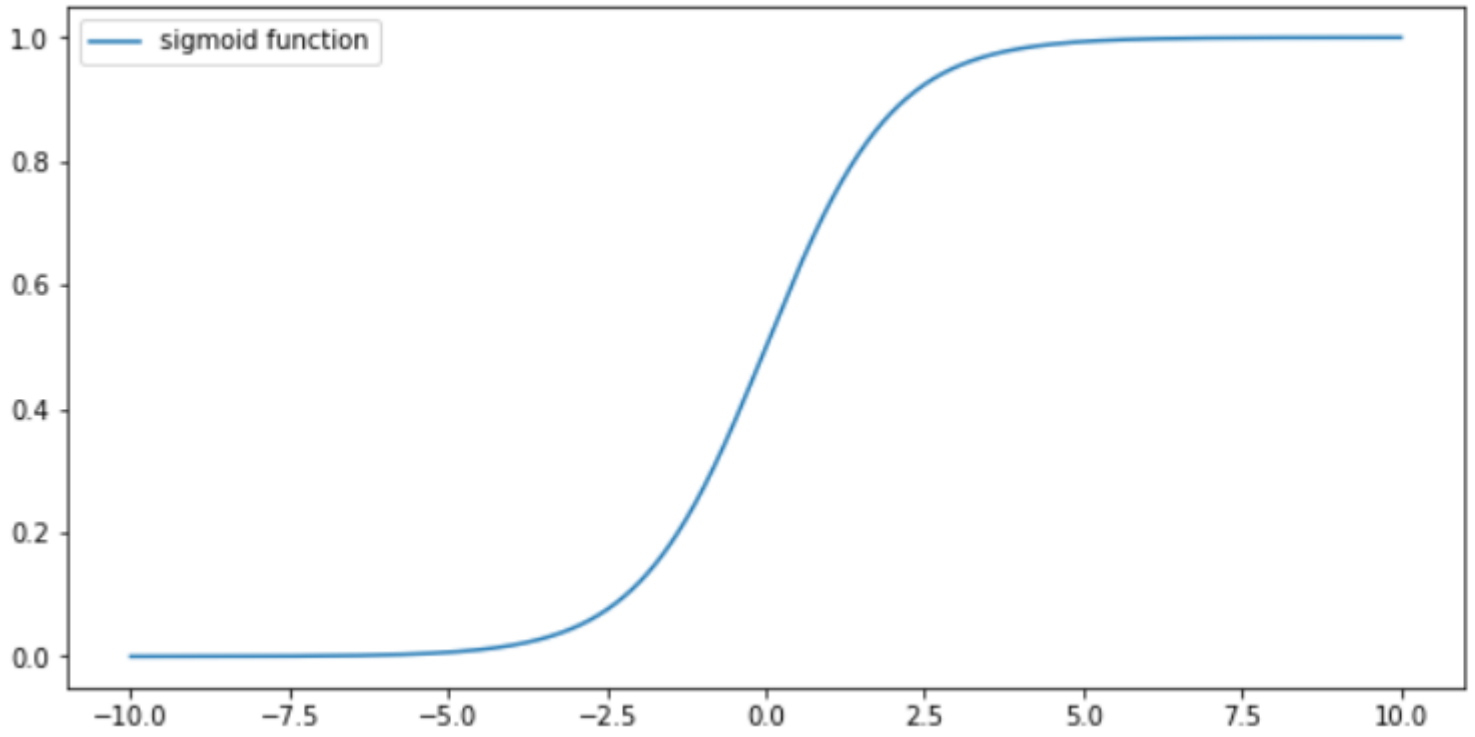
- We use the activation function (sigmoid) to convert the outcome into categorical value.
- There are many examples where we can use logistic regression.
- Example:
  - ✓ fraud detection,
  - ✓ spam detection,
  - ✓ cancer detection, etc.

Write a python program to plot Sigmoid Function

```
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
x = np.linspace(-10, 10, 1000)
y = 1 / (1 + np.exp(-x) )

plt.figure(figsize=(10, 5))
plt.plot(x, y)
plt.legend(['sigmoid function'])
plt.show()
```

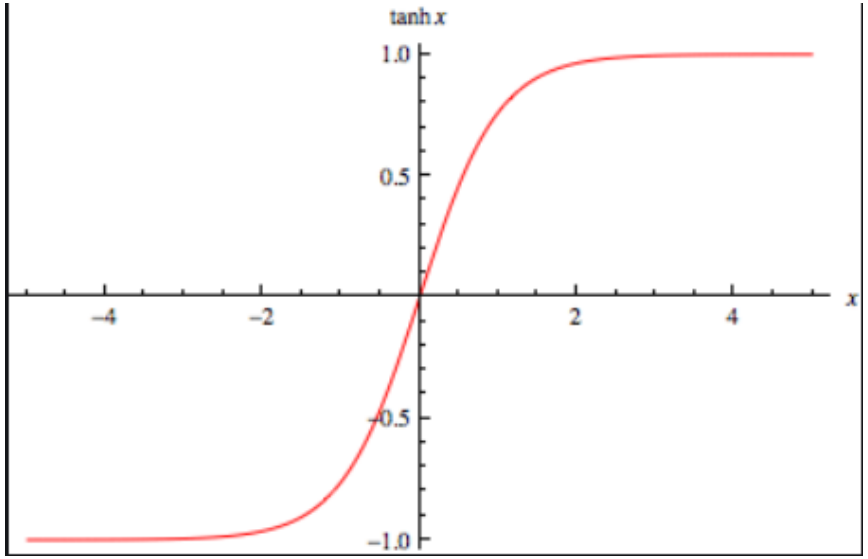
Result



Tanh

Hyperbolic tangent functions are analogues of the ordinary trigonometric functions, but defined using the hyperbola.

$$g(x) = \frac{e^x}{1 + e^x}$$



Tanh…

- Hyperbolic tangent **function**, is a rescaling of the logistic sigmoid, such that its outputs range from -1 to 1.

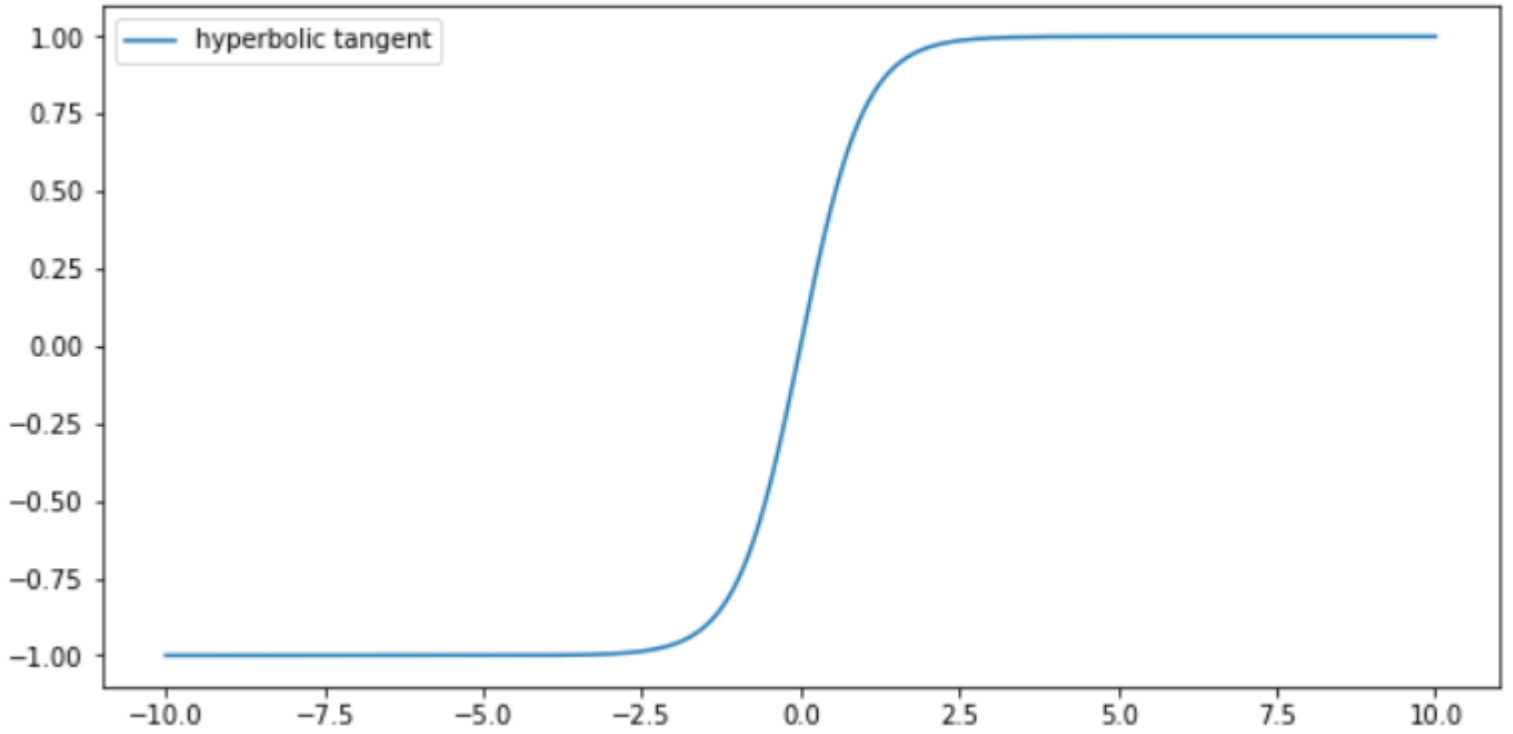
Hard Tanh

- Anything more than +1 is made to +1 and Anything less than -1 is made to -1.

Write a python program to plot tanh Function

```
import numpy as np
import matplotlib.pyplot as plt
x = np.linspace(-10, 10, 1000)
y = ( 2 / (1 + np.exp(-2*x) ) ) -1
plt.figure(figsize=(10, 5))
plt.plot(x, y)
plt.legend(['hyperbolic tangent'])
plt.show()
```

Result

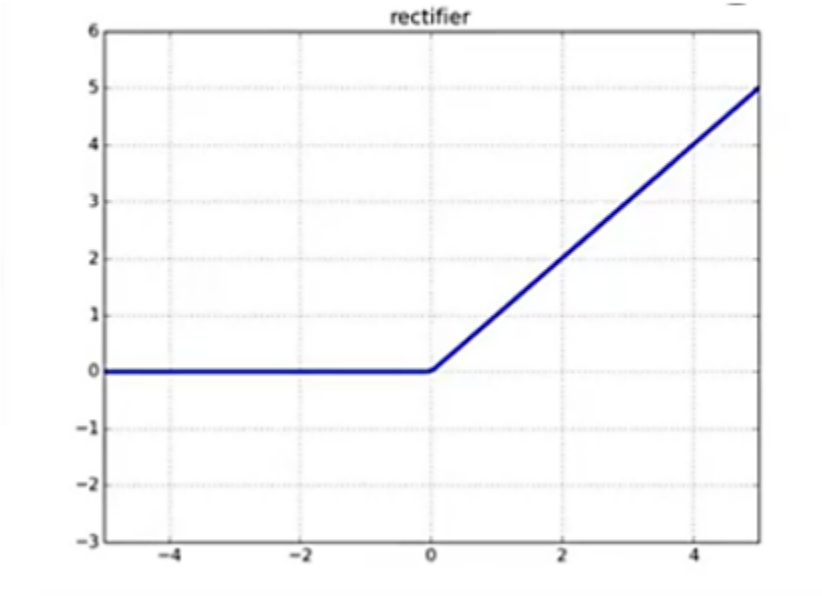

hyperbolic tangent
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
−10.0
−7.5
−5.0
−2.5
0.0
2.5
5.0
7.5
10.0

ReLU(Rectified Linear unit)

The **ReLU** is an activation function defined as the positive part of its argument:

$$f(x) = \begin{cases} 0 & \text{for } x < 0 \\ x & \text{for } x \Rightarrow 0 \end{cases}$$

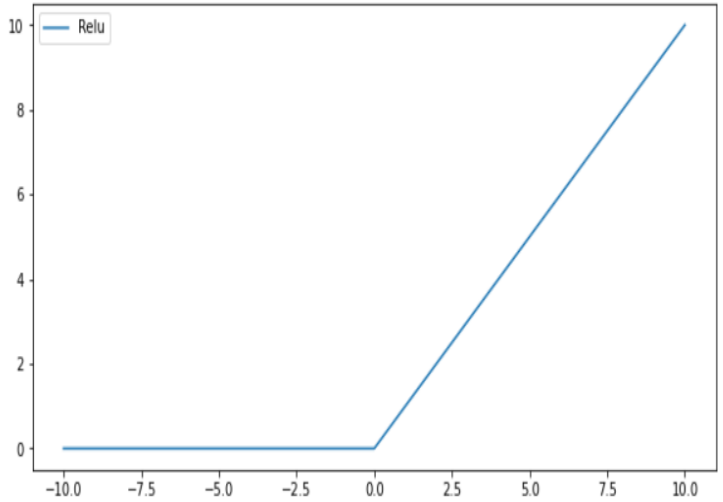
$$f(x) = max\,(0, x)$$



Write a python program to plot tanh Function

```
x = np.linspace(-10, 10, 1000)
y = np.maximum(0, x) #Returns the maximum value
plt.figure(figsize=(10, 5))
plt.plot(x, y)
plt.legend(['Relu'])
plt.show()
```

Result



Applications of Relu

- Normally used for more than two classes
- Classification of different types of Animals,Flowers etc