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Code

Notebook Python 3 (ipykernel)

```
[6]: import numpy as np
import matplotlib.pyplot as plt
x = np.linspace(-10, 10, 400)
def sigmoid(x):
    return 1 / (1 + np.exp(-x))
def sigmoid_derivative(x):
    s = sigmoid(x)
    return s * (1 - s)
def tanh(x):
    return np.tanh(x)
def tanh_derivative(x):
    return 1 - np.tanh(x)**2
def relu(x):
    return np.maximum(0, x)
def relu_derivative(x):
    return np.where(x > 0, 1, 0)
def leaky_relu(x):
    return np.where(x > 0, x, 0.01 * x)
def leaky_relu_derivative(x):
    return np.where(x > 0, 1, 0.01)
def softmax(x):
    e_x = np.exp(x - np.max(x))
    return e_x / e_x.sum()
activations = {
    'Sigmoid': (sigmoid, sigmoid_derivative),
    'Tanh': (tanh, tanh_derivative),
    'ReLU': (relu, relu_derivative),
    'Leaky ReLU': (leaky_relu, leaky_relu_derivative)
```

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```
'Leaky ReLU': (leaky_relu, leaky_relu_derivative)
}
colors = ['blue', 'orange', 'green', 'red']
plt.figure(figsize=(14, 10))
for i, (name, (act_func, der_func)) in enumerate(activations.items(), 1):
    color = colors[i - 1]
    plt.subplot(4, 2, 2*i - 1)
    plt.plot(x, act_func(x), color=color, label=f'{name}')
    plt.title(f'{name} Activation')
    plt.legend()
    plt.grid(True)
    plt.subplot(4, 2, 2*i)
    plt.plot(x, der_func(x), color=color, label=f'{name} Derivative')
    plt.title(f'{name} Derivative (Gradient)')
    plt.legend()
    plt.grid(True)

plt.tight_layout()
plt.show()
plt.figure(figsize=(12, 5))
plt.subplot(1, 2, 1)
for name, (act_func, _) in activations.items():
    plt.plot(x, act_func(x), label=name)
plt.title('Activation Functions')
plt.legend()
plt.grid(True)
plt.subplot(1, 2, 2)
for name, (_, der_func) in activations.items():
    plt.plot(x, der_func(x), label=name)
```

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Code

```
plt.plot(x, act_func(x), label=name)
plt.title('Activation Functions')
plt.legend()
plt.grid(True)
plt.subplot(1, 2, 2)
for name, (_, der_func) in activations.items():
    plt.plot(x, der_func(x), label=name)
plt.title('Derivatives of Activation Functions')
plt.legend()
plt.grid(True)

plt.tight_layout()
plt.show()
x_softmax = np.linspace(-2, 2, 10)
y_softmax = softmax(x_softmax)
plt.figure(figsize=(6, 4))
plt.plot(x_softmax, y_softmax, marker='o', color='purple', label='Softmax')
plt.title('Softmax Output (Vector)')
plt.grid(True)
plt.legend()
plt.show()
```

Python 3 (ipykernel)

Sigmoid Activation Sigmoid Derivative (Gradient)

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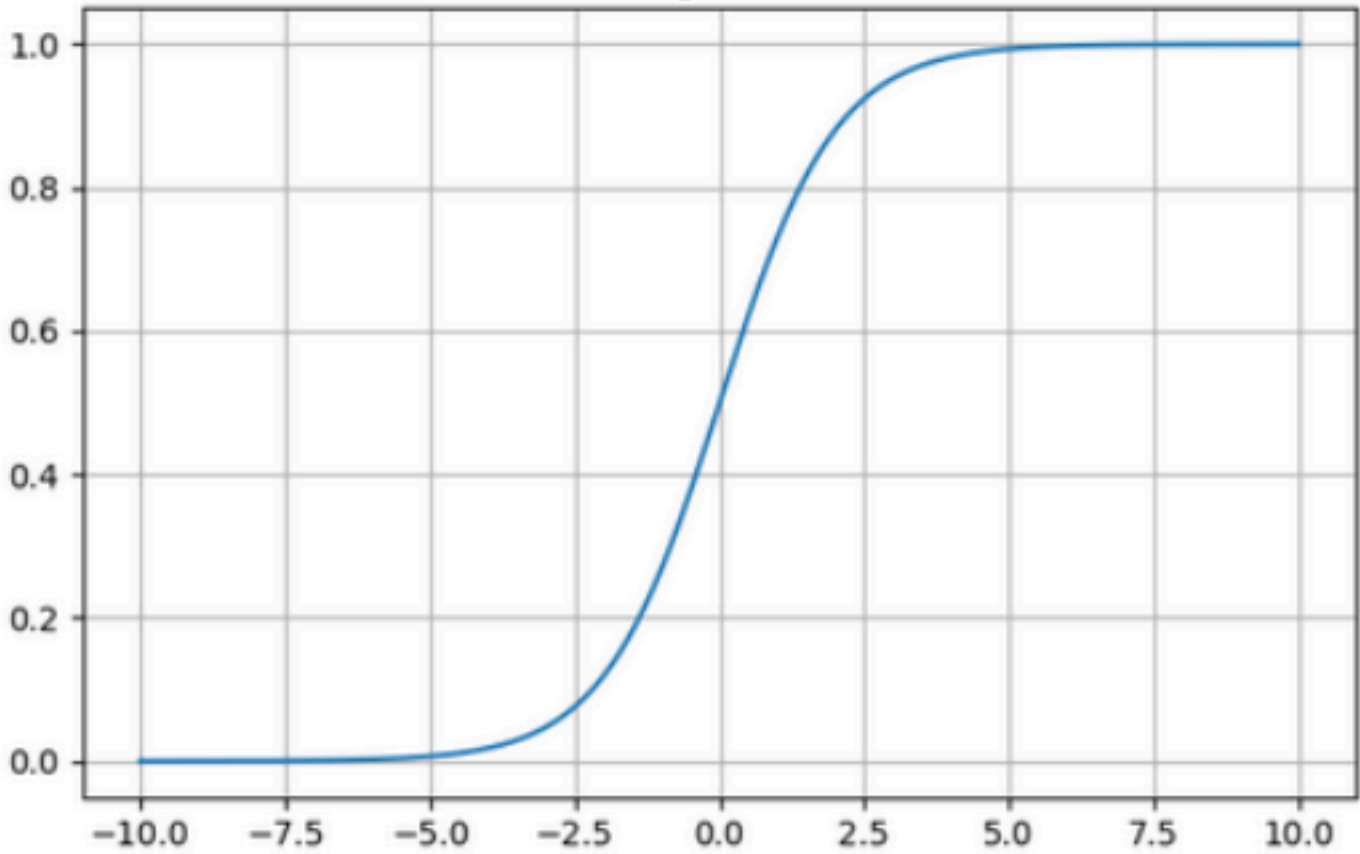
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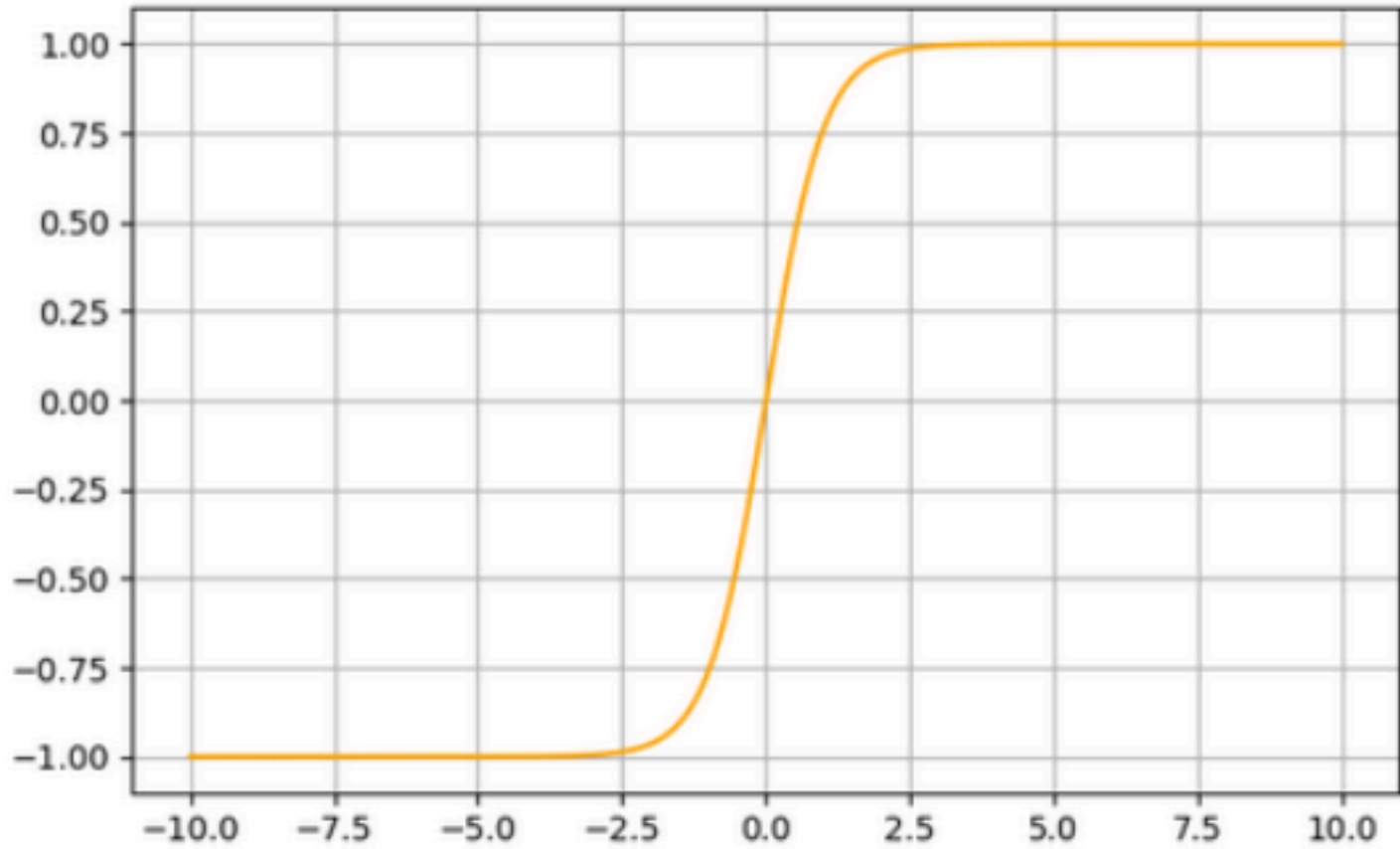
Sigmoid



A plot of the Sigmoid function, which is an S-shaped curve. The x-axis ranges from -10.0 to 10.0 with major ticks every 2.5 units. The y-axis ranges from 0.0 to 1.0 with major ticks every 0.2 units. The curve starts near 0 for negative x, passes through (0, 0.5), and approaches 1 for positive x.

x	y
-10.0	0.00
-7.5	0.00
-5.0	0.01
-2.5	0.08
0.0	0.50
2.5	0.92
5.0	0.99
7.5	1.00
10.0	1.00

Tanh



A plot of the Tanh function, which is an S-shaped curve centered at the origin. The x-axis ranges from -10.0 to 10.0 with major ticks every 2.5 units. The y-axis ranges from -1.00 to 1.00 with major ticks every 0.25 units. The curve passes through (0, 0), approaches -1 for negative x, and approaches 1 for positive x.

x	y
-10.0	-1.00
-7.5	-1.00
-5.0	-1.00
-2.5	-0.98
0.0	0.00
2.5	0.98
5.0	1.00
7.5	1.00
10.0	1.00



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