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1 import numpy as np
2 import matplotlib.pyplot as plt
3
4 # Define activation functions and their derivatives
5 def sigmoid(x):
6     return 1 / (1 + np.exp(-x))
7
8 def sigmoid_derivative(x):
9     return sigmoid(x) * (1 - sigmoid(x))
10
11 def tanh(x):
12     return np.tanh(x)
13
14 def tanh_derivative(x):
15     return 1 - np.tanh(x)**2
16
17 def relu(x):
18     return np.maximum(0, x)
19
20 def relu_derivative(x):
21     return np.where(x > 0, 1, 0)
22
23 def leaky_relu(x, alpha=0.01):
24     return np.where(x > 0, x, alpha * x)
25
26 def leaky_relu_derivative(x, alpha=0.01):
27     return np.where(x > 0, 1, alpha)
28
29 def gelu(x):
30     return 0.5 * x * (1 + np.tanh(np.sqrt(2 / np.pi) * (x + 0.044715 * x**3)))
31
32 def gelu_derivative(x):
33     cdf = 0.5 * (1 + np.tanh(np.sqrt(2 / np.pi) * (x + 0.044715 * x**3)))
34     pdf = np.exp(-0.5 * x**2) / np.sqrt(2 * np.pi)
35     return cdf + x * pdf
36
37 def silu(x):
38     return x * sigmoid(x)
39
40 def silu_derivative(x):
41     sig = sigmoid(x)
42     return sig * (1 + x * (1 - sig))
43
44 # Plot settings
45 x = np.linspace(-10, 10, 400)
46
47 # Plot activation functions
48 plt.figure(figsize=(12, 12))
49
50 plt.subplot(3, 2, 1)
51 plt.plot(x, sigmoid(x), label='Sigmoid')
52 plt.plot(x, sigmoid_derivative(x), label='Sigmoid Derivative')
53 plt.title('Sigmoid and its Derivative')
54 plt.legend()
55
56 plt.subplot(3, 2, 2)
57 plt.plot(x, tanh(x), label='Tanh')
58 plt.plot(x, tanh_derivative(x), label='Tanh Derivative')
59 plt.title('Tanh and its Derivative')
60 plt.legend()
61
62 plt.subplot(3, 2, 3)
63 plt.plot(x, relu(x), label='ReLU')
64 plt.plot(x, relu_derivative(x), label='ReLU Derivative')
65 plt.title('ReLU and its Derivative')
66 plt.legend()
67
68 plt.subplot(3, 2, 4)
69 plt.plot(x, leaky_relu(x), label='Leaky ReLU')
70 plt.plot(x, leaky_relu_derivative(x), label='Leaky ReLU Derivative')
71 plt.title('Leaky ReLU and its Derivative')
72 plt.legend()
73
74 plt.subplot(3, 2, 5)
75 plt.plot(x, gelu(x), label='GELU')
76 plt.plot(x, gelu_derivative(x), label='GELU Derivative')
77 plt.title('GELU and its Derivative')
78 plt.legend()
79
80 plt.subplot(3, 2, 6)
81 plt.plot(x, silu(x), label='SiLU')

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82 plt.plot(x, silu_derivative(x), label='SiLU Derivative')
83 plt.title('SiLU and its Derivative')
84 plt.legend()
85
86 plt.tight_layout()
87 plt.show()
88

```

