

ASSIGNMENT – XOR GATE

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Section:- AI&ML SEC-02

Output:-

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[5]: import numpy as np
    from matplotlib import pyplot as plt

[6]: def sigmoid(z):
    return 1 / (1 + np.exp(-z))

[7]: def initialize_parameters(n_x, n_h, n_y):
    W1 = np.random.randn(n_h, n_x)
    b1 = np.zeros((n_h, 1))
    W2 = np.random.randn(n_y, n_h)
    b2 = np.zeros((n_y, 1))

    parameters = {"W1": W1, "b1": b1,
                  "W2": W2, "b2": b2}
    return parameters

[8]: def forward_propagation(X, Y, parameters):
    m = X.shape[1]
    W1 = parameters["W1"]
    W2 = parameters["W2"]
    b1 = parameters["b1"]
    b2 = parameters["b2"]
    Z1 = np.dot(W1, X) + b1
    A1 = sigmoid(Z1)
    Z2 = np.dot(W2, A1) + b2
    A2 = sigmoid(Z2)
    cache = (Z1, A1, W1, b1, Z2, A2, W2, b2)
    logprobs = np.multiply(np.log(A2), Y) + np.multiply(np.log(1 - A2), (1 - Y))
    cost = -np.sum(logprobs) / m
    return cost, cache, A2

[9]: def backward_propagation(X, Y, cache):
    m = X.shape[1]
    (Z1, A1, W1, b1, Z2, A2, W2, b2) = cache

    dZ2 = A2 - Y
    dW2 = np.dot(dZ2, A1.T) / m
    db2 = np.sum(dZ2, axis = 1, keepdims=True)

    dA1 = np.dot(W2.T, dZ2)
    dZ1 = np.multiply(dA1, A1 * (1 - A1))
    dW1 = np.dot(dZ1, X.T) / m
    db1 = np.sum(dZ1, axis=1, keepdims=True) / m

    gradients = {"dZ2": dZ2, "dW2": dW2, "db2": db2,
                 "dZ1": dZ1, "dW1": dW1, "db1": db1}
    return gradients

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return gradients

[13]: # update the weights
    def update_parameters(parameters, grads, learning_rate):
        parameters["W1"] = parameters["W1"] - learning_rate * grads["dW1"]
        parameters["W2"] = parameters["W2"] - learning_rate * grads["dW2"]
        parameters["b1"] = parameters["b1"] - learning_rate * grads["db1"]
        parameters["b2"] = parameters["b2"] - learning_rate * grads["db2"]
        return parameters

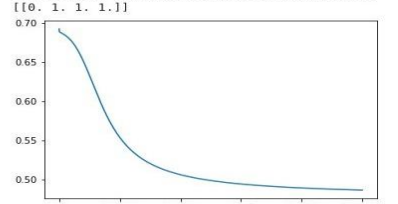
[11]: X = np.array([[0, 0, 1, 1], [0, 1, 0, 1]])
    Y = np.array([[0, 1, 1, 0]]) # XOR
    n_h = 2
    n_x = X.shape[0]
    n_y = Y.shape[0]
    parameters = initialize_parameters(n_x, n_h, n_y)
    num_iterations = 100000
    learning_rate = 0.01
    losses = np.zeros((num_iterations, 1))

    for i in range(num_iterations):
        losses[i, 0], cache, A2 = forward_propagation(X, Y, parameters)
        grads = backward_propagation(X, Y, cache)
        parameters = update_parameters(parameters, grads, learning_rate)

[12]: cost, _, A2 = forward_propagation(X, Y, parameters)
    pred = (A2 > 0.5) * 1.0
    print(A2)
    print(pred)
    plt.figure()
    plt.plot(losses)
    plt.show()

[[0.01116107 0.66032398 0.66035854 0.66816089]]
[[0. 1. 1. 1.]]

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