

Assignment 3.: Backpropagation

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1 Description

The aim of this assignment is to understand the operation of backpropagation through step-by-step calculation. Backpropagation is a widely used algorithm for training neural networks. It was first proposed in the 1970s, but its practical application was limited due to the lack of computing power. The algorithm was then independently rediscovered and improved by several researchers in the 1980s, including David Rumelhart, Geoffrey Hinton, and Ronald Williams. This led to a surge of interest in neural networks and their potential applications. Today, backpropagation is an essential tool for training deep neural networks, and also understanding their behaviors.

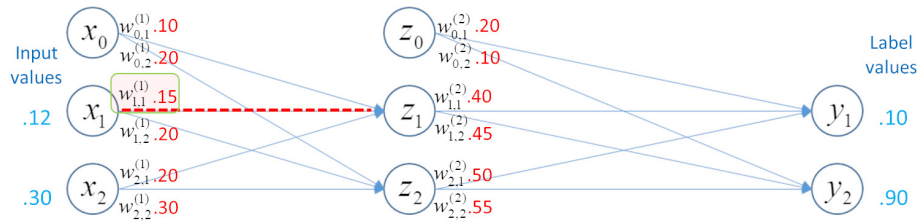


Figure 1: The number with red color shows the weight of the corresponding link.

In this assignment, you are expected to update the weight of the link $w_{1,1}^{(1)}$, 0.15 in Fig.1 in a way that the error, which is caused by the first forwarding of the input values 0.12 and 0.3, is reduced. Please, elaborate all procedures to calculate the new weight.

- Activation function: ReLu in the hidden layer and Hyperbolic Tangent in the output layer
- Error function: Mean Squared Error
- Learning rate: 0.5

2 Required Task(s)

1. You need to submit

- (a) A report which includes the solution as well as the procedure you obtain it.

While doing this assignment, you are most likely to write down many equations including mathematical symbols, which slows down the completion of this assignment. Thus, you may write down them on the paper first, and then scan or take a photo of it, and finally put it into your report with some explanation. Please, make sure that your hand writing is clean enough to understand in this case.

3 Administrative

- Due: 24:00, July 19, 2023
- Submission to (suyong@ist.osaka-u.ac.jp)
 - Please, zip the report. Then, name with your student number and assignment number, e.g., 32A18041_3.pdf
- Late submission will be penalized at the rate of 10% reduction per day