## Neural Networks

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## Abstract

This article will organize an extensive list of sorting algorithms, in order to compare their efficiency in different situations. The different sorting algorithms will be compared based on the run time for the algorithm, the number of comparisons required for the algorithm, and the number of array access required for the algorithm. These properties of each algorithm will be determined by averaging runs for a multitude of arrays of the same length, to achieve an average value.

## Introduction 1

Neural networks are really cool. Like totaly awesome.

## $\mathbf{2}$ **BackPropagation**

to determine the error in each of the weights and biases of a neural network. Backpropagation can

Backpropagation is an algorithm that is used be though of as determing the gradiant of the cost function (C).

$$\delta^{L} = \nabla_{a} C \odot \sigma' \left( z^{L} \right) \tag{1}$$

$$\delta^{l} = \left( \left( w^{l+1} \right)^{T} \delta^{l+1} \right) \odot \sigma' \left( z^{l} \right) \tag{2}$$

$$\frac{\partial C}{\partial b_j^l} = \delta_j^l \tag{3}$$

$$\frac{\partial C}{\partial w_{jk}^l} = a_k^{l-1} \delta_j^l \tag{4}$$

These are the four base equation behind the back propagation algorithm. Each one will be explaned in this section.

(1): This is the first equation of the back and the desired output.

propagation algorithm. It is used to find the error in the final set of neurons, by determining the difference between the calculated output,