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How do various activation functions affect the output of a neural network?

A. As society begins to implement machine learning algorithms into all modern devices, it's important to grasp an idea of the basic technicalities of how these models learn in order to obtain a surface level understanding of the technologies we'll be using in the future.

   Additionally, when developing such technologies, it's important that you know how to optimize it. Doing so will save you computational time and resources.

   In the case of my experiment, I will program a basic neural network called a "perceptron". And neural networks require what's called an "activation function." All an activation function does is decide whether or not to "fire" a node (Also called a neuron). This terminology comes from the same terminology used to describe parts of the brain, this is because neural networks are inspired by the brain! So, when a neuron in a neural network fires, that means that it's output value can move onto the next neuron, and the next neuron, and the next neuron until it reaches the end of the network and spits out an output value. Each time a neuron takes an input it takes the dot product of that input (And it's corresponding weight value) and inputs that into the given activation function. (The dot product is an operation that adds each element in a list and multiplies the sums).

   My neural network will be a "classification neural network" and it will be used to identify lines that it hasn't seen before. For example, vertical lines, diagonal lines, ext.

B. **Research Question:** How do various activation functions affect the accuracy of a classification neural network? **Hypothesis:** I hypothesise that the *GElu* activation function will be the most accurate because it has seen the most success in the past due to its ability to not suppress large input values. **Engineering Goal:** My main goal with this is to develop a graphical interface that renders a detailed graph of what's happening under the hood so that it's easy to identify the benefits and drawbacks of each activation function in more detail. Additionally, I will program both the neural network and the interface in the Python programming language for it's ability to abstract vector arithmetic. **Expected Outcomes:** I expect to generate a visual of how effective each activation function is.

C. I will conduct an experiment that measures percent% error of the neural networks's output compared to the preferred output according to the activation function in use. My goal with this is to figure out which activation function works best for the task i'm trying to complete.
   Procedures: I will be implementing the standard scientific method in my project.
   Risk: No Risk
   Data Analysis: The efficiency of each activation function will be rendered on a graph.

D. In this experiment I will be referring to a neural network series from Grant Sanderson that explains the learning process of neural networks at a theoretical level.