Artificial Neural Networks

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Problem Set 1: Introduction

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1. **Function**

   In the following you find two relations, $y = f(x)$ and $y = g(x)$, that map x onto y. Determine which one is a function and why.

   (a) $f(x) = x^2$

   (b) $g(x)^2 = x$

   Also, plot the y vs. x for both relationships in Python and try to visually determine which one is a function. Note that the range of x in your plot is limited and therefore you may not see the full characteristics of the functions, so choose the range carefully!

2. **Types of functions**

   Plot the following functions for $x \in [-10, 10]$. Be sure to plot them in a way that you can change the parameters easily:

   (a) $f(x) = 2x + 2$

   (b) $f(x) = 5x^2 + x$

   (c) $f(x) = 11x^3 + 2x^2 + 2x + 3$

   (d) $f(x) = e^x$

   Try the following adjustments:

   - Take the linear function from above in its generalized form $f(x) = ax + b$. It has 2 parameters. Adjust each of them and plot the result. Observe how do they change the behavior of the function.
   - Take the quadratic function from above in its generalized form $f(x) = ax^2 + bx + c$. Can you tune the parameters in such a way that the minimum of the function lies at -2? What happens if you multiply the quadratic term with a large constant? Extra: can you explain why the linear factor does not contribute to the result?