

Problem Set 4 – Deep Neural Networks

DS598 B1 – DL4DS

Spring, 2024

Problem 4.4¹ Write out the vector and matrix equations for a deep neural network that takes $D_i = 5$ inputs, $D_o = 4$ outputs and has three hidden layers of sizes $D_1 = 20$, $D_2 = 10$, and $D_3 = 7$, respectively in both the forms of equations 4.15 and 4.16. What are the sizes of each weight matrix Ω_\bullet and bias vector β_\bullet ?

Problem 4.5 Consider a deep neural network with $D_i = 5$ inputs, $D_o = 1$ output, and $K = 20$ hidden layers containing $D = 30$ hidden units each. What is the depth of this network? What is the width?

Problem 4.6 Consider a network with $D_i = 1$ input, $D_o = 1$ output, $K = 10$ layers, with $D = 10$ hidden units in each. Would the number of weights increase more if we increased the depth by one or the width by one? Provide your reasoning.

Problem 4.8 – Optional *This is a good exercise to try from the book. the solution is provided in the student solution manual. Don't turn in.*

Problem 4.10 Consider a deep neural network with a single input, a single output, and K hidden layers, each of which contains D hidden units. Show that this network will have a total of $3D + 1 + (K - 1)D(D + 1)$ parameters.

¹Problem numbers correspond to chapter and problem numbers in the book.