EECE 7398: ST: Advances in Deep Learning

Homework 2

Due: Oct 8th, 5:00pm ET

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1. In previous homework (appended at the bottom) you computed the SoftMax loss L. Now using numerical method compute $\nabla_W L$, the derivative of L with respect to W in matrix form.

2. Next, for a learning rate of 0.2, compute ΔW, Now compute next W.

Consider the following linear classification network with 4 pixels and 4 classes {cat, dog, cow, horse}. The weight matrix W is given by:

W =

-0.57	1.24	-3.37	6.43
-5.53	-1.13	-8.05	3.21
4.23	0.98	-2.53	-7.67
-2.31	-1.84	6.93	-8.66

For the following input/labels compute the SVM and SoftMax loss function L.

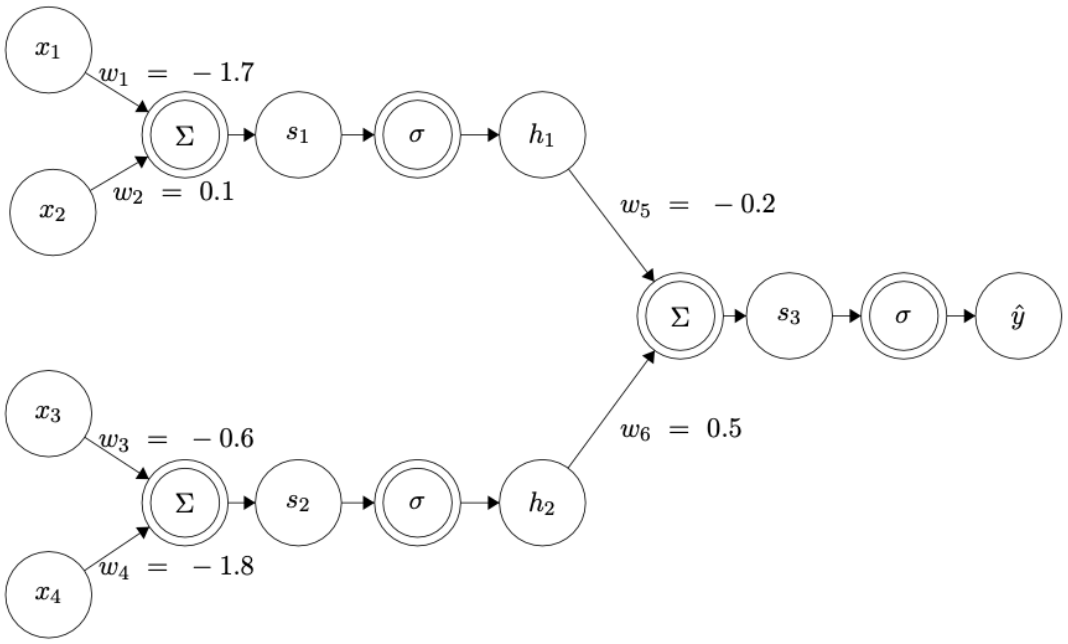
< {1.52, 2.63, 5.37, 4.94} cat >

< {8.87, 1.25, 4.49, 0.12} cat >

< {3.22, 4.63, 3.55, 5.41} dog >

< {1.38, 0.63, 2.90, 8.52} horse >

3.



Consider the following neural network.
Single-circled nodes denote variables (e.g., x1 is an input variable, h1 is an intermediate variable, ŷ is the output variable),
and double-circled nodes denote functions (e.g., Σ takes the sum of its inputs), and σ denotes the logistic function
σ(x) = 1 / (1 + e^(-x)). Suppose we have a loss L(y, ŷ) = ||y - ŷ||^2. We are given a data point (x1, x2, x3, x4) = (-0.3, 4.9, 1.1, -2.7)
with true label 0.7. Use the backpropagation algorithm to compute the partial derivative ∂L/∂W for all wi.