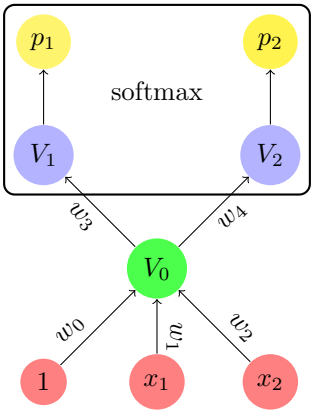
Homework-3

Question 1



The above neural network has two inputs. It computes a selection between the two alternatives A, B in terms of two probability outputs. p_1 is the probability that A occurs, and p_2 is the probability that B occurs. The node V_0 is implemented with ReLU. The nodes V_1, V_2 are linear (ADALINE), and they are not connected to a bias. The probabilities p_1, p_2 are computed from the values of V_1, V_2 using softmax.

A.1: Compute the values of all nodes in forward propagation when the network is given the input $\boxed{x_1 = 2,\ x_2 = 7}$, the current weight values are: $\boxed{w_0 = 0,\ w_1 = 0.2,\ w_2 = 0.1,\ w_3 = 0.1,\ w_4 = 1}$, with $\boxed{\text{the desired selection being } \mathbf{A}}$. Use training rate $\boxed{\epsilon = 0.1}$. Your answer should be explicit numeric values for each node.

Question 2

Consider a deep neural net applied to decide between the following four categories:

cat, tiger, human face, lion

The neural net uses a softmax unit at the output layer. Consider the case where the values fed into the output layer are:

cat	0.5
tiger	0.8
human face	-3
lion	0.6

The softmax converts these values into a probability vector.

1. Compute the probabiity vector.

Answer:

2. Which outcome is the most likely?

Answer:

3. Which outcome is the least likely?

Answer:

4. What is the result of cross-entropy cost function if the target output is lion?

Answer:

Question 3

In the table below cases 3,4 are distributions, and cases 1, 2 can be converted into distributions.

case	A	B	C	D
1	1	-2	3	-4
2	1	2	-3	0
3	1	0	0	0
4	1/4	1/4	1/4	1/4

1. Use cross entropy to determine which distribution among 1,2,3 is most similar to 4. **Show your computations.**

Answer: 1 / 2 / 3

2. Use cross entropy to determine which distribution among 1,2,4 is most similar to 3. **Show your computations.**

Answer: 1 / 2 / 4

Question 4

In this question, if you need to compute logarithms use natural basis logarithm (ln).

Consider a deep neural net applied to decide between the following three categories: A, B, C.

1.

1.1 What is the one-hot encoding of the category A?

Answer:

1.2 What is the one-hot encoding of the category B?

Answer:

1.3 What is the one-hot encoding of the category C?

Answer:

2.

Consider the deep learning network output specified by the vector $z = (1.0, 2.0, 3.0)$. Using softmax and the cross entropy criterion is z closer to A, to B, or to C (in their one-hot encoding)?

Answer:

A / B / C

3.

Find a bias value x (it can be either positive or negative) such that the vector $z_x = (1.0 + x, 2.0 + x, 3.0 + x)$ would be considered by the network as closer to A than to B or to C.

Answer.

$x =$

4.

Find a bias value x (it can be either positive or negative) such that the vector $z_x = (1.0 + x, 2.0 + x, 3.0 + x)$ would be considered by the network as closer to B than to A or to C.

Answer.

$x =$

5.

Find a bias value x (it can be either positive or negative) such that the vector $z_x = (1.0 + x, 2.0 + x, 3.0 + x)$ would be considered by the network as closer to C than to A or to B.

Answer.

$x =$