DEEP LEARNING: EXERCISE SHEET 5 (SOSE2018)

18TH OF MAY (DUE 30TH OF MAY AT 14:00)

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QUESTION 8: DROPOUT-REGULARIZATION IN NEURAL NETWORKS (10 POINTS)

- a) In your own words, briefly explain the dropout regularization scheme for neural networks!
- b) Assume we have a neural network with ReLU activation function and want to perform a regression task, the weights (and therefore the structure) is given through:

$$W^{1^{T}} = \begin{pmatrix} 1 & 2 \\ -1 & 1 \\ 2 & -1 \end{pmatrix} \qquad W^{2^{T}} = \begin{pmatrix} 1 & 2 & -2 \\ 2 & -1 & 1 \end{pmatrix}$$
$$W^{3^{T}} = \begin{pmatrix} 2 & 1 \\ -1 & -1 \end{pmatrix} \qquad v^{T} = (1-1)$$

and

$$b^{1} = \begin{pmatrix} -1\\1\\2 \end{pmatrix} \quad b^{2} = \begin{pmatrix} 2\\-1 \end{pmatrix} \quad b^{3} = \begin{pmatrix} 1\\1 \end{pmatrix} \quad b^{4} = 1$$

Predict for the instance $x^T = \begin{pmatrix} 1 & 1 \end{pmatrix}$ twice, using the following dropout masks:

$$\mu^0 = \begin{pmatrix} 1\\1 \end{pmatrix} \qquad \mu^1 = \begin{pmatrix} 1\\0\\1 \end{pmatrix} \qquad \mu^2 = \begin{pmatrix} 1\\0 \end{pmatrix}$$

and

$$\mu^{0} = \begin{pmatrix} 0\\1 \end{pmatrix} \qquad \mu^{1} = \begin{pmatrix} 0\\1\\1 \end{pmatrix} \qquad \mu^{2} = \begin{pmatrix} 1\\1 \end{pmatrix}$$

c) Explain, why dropout is not used for bias nodes!

QUESTION 9: SOLVING THE XOR PROBLEM (10 POINTS)

Implement the backpropagation learning algorithm using L2 regularization for a network with one hidden layer and two hidden neurons. The size of the input layer is also set to two. Do not forget biases. Initialize the weights by drawing from a Gaussian distribution centered around zero, and learn the weights for the XOR data:

x_1	x_2	y
1	1	1
-1	1	0
1	-1	0
-1	-1	1

Please print your source code and the convergence of your algorithm and put it to the pdf submission.

How to submit?

DO NOT FORGET TO WRITE YOUR NAME ON YOUR SHEET! Nameless files will NOT be graded!

The new submission method is via LearnWeb. https://www.uni-hildesheim.de/ learnweb2018/course/search.php? search=3108

WARNING!

If we detect **Plagiarism** on your solution, you will receive no points for it. If a second plagiarism attempt is detected, you might fail the class or be expelled from your program. You are allowed to discuss solutions, but if you work on a group, you must indicate on your sheet with whom are you working with. Group submissions earn 0 points, but counts as participation.

PENTECOST WEEK

We won't have tutorials next week. Thus, this sheet is due only on the following after (30th of may).