# DEEP LEARNING: EXERCISE SHEET 9 (SOSE2018)

### 20TH OF JUNE (DUE 27TH OF JUNE AT 14:00)

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# **QUESTION 16**: RNN RECAP (10 POINTS)

Answer the following questions with a maximum of two phrases:

- a) Consider the standard RNN with some activation function f(x), and matrices W and U and an input  $X = (x_1, x_2, x_3, x_4, x_5)$ . Write down the unrolled formula for the final output of the RNN given X.
- b) Comparing LSTMs with GRUs, if we consider that LSTM and GRUs have the same learning power, what is the advantage of GRU over LSTM?
- c) What is Gradient Clipping? Why is it important?
- d) What is a vanishing gradient?
- e) What are the main contributions of LSTMs and GRUs to RNNs.

# **QUESTION 17**: LSTM FEED-FOWARD (10 POINTS)

Consider the following sequence:

Time(t)	x
1	0.7
2	0.5
3	0.7

And the following configuration of an LSTM:

$$U^g = 0.3 \quad W^g = -0.3 \qquad b^g = 0.1$$

 $U^f = 0.25$   $W^f = 0.3$   $b^f = 0$ 

 $U^q = 0.4$   $W^q = 0.3$   $b^q = 0.2$ 

U = 0.01 W = 0.1 b = 1

 $h^{(0)} = 0$   $s^{(0)} = 0$ 

where:  $h^{(t)} = ReLU(s^{(t)}) * q^{(t)}$ 

and

 $output_t = \sigma(h^{(t)} * V + c)$  $V = 5 \qquad c = -1$ 

Perform the foward pass on the whole sequence with an LSTM. Plot your results for each step. Is the output from t = 1 the same as t = 3? Why?

#### 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.unihildesheim.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.