

Exercise

09

TUM Department of Informatics

Supervised by	Prof. Dr. Stephan Günnemann Informatics 3 - Professorship of Data Mining and Analytics
Submitted by	Marcel Bruckner (03674122) Julian Hohenadel (03673879) Kevin Bein (03707775)
Submission date	Munich, December 12, 2019

Deep Learning

Problem 1:

$$\begin{aligned}y &= \log \sum_{i=1}^N e^{x_i} \stackrel{!}{=} a + \log \sum_{i=1}^N e^{x_i - a} \\e^y &= \sum_{i=1}^N e^{x_i} \\e^y e^{-a} &= e^{-a} \sum_{i=1}^N e^{x_i} \\e^{y-a} &= \sum_{i=1}^N e^{x_i} e^{-a} \\\log e^{y-a} &= \log \sum_{i=1}^N e^{x_i} e^{-a} \\y - a &= \log \sum_{i=1}^N e^{x_i} \\y &= a + \log \sum_{i=1}^N e^{x_i - a}\end{aligned}$$

Problem 2:

$$\frac{e^{x_i - a}}{\sum_{i=1}^N e^{x_i - a}} = \frac{\frac{e^{x_i}}{\sum_{i=1}^N e^{x_i}} \stackrel{!}{=} \frac{e^{x_i - a}}{\sum_{i=1}^N e^{x_i - a}}}{\frac{e^{-a} e^{x_i}}{\sum_{i=1}^N e^{x_i} e^{-a}}} = \frac{e^{-a} e^{x_i}}{e^{-a} \sum_{i=1}^N e^{x_i}} = \frac{e^{x_i}}{\sum_{i=1}^N e^{x_i}}$$

Problem 3:

Appendix

We confirm that the submitted solution is original work and was written by us without further assistance.
Appropriate credit has been given where reference has been made to the work of others.

Munich, December 12, 2019, Signature Marcel Bruckner (03674122)

Munich, December 12, 2019, Signature Julian Hohenadel (03673879)

Munich, December 12, 2019, Signature Kevin Bein (03707775)