Universität des Saarlandes
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Lehrstuhl für Signalverarbeitung
NNTI Winter Term 2022/2023

Exercise Sheet 8

NNTI Tutorial

Deadline: 11.01.2023 08:00

Exercise 8.1 - Optimization Algorithms (2 + 2 + 2 + 1 points)

The aim of this exercise is to develop a deeper understanding of a few optimization algorithms [1]. Please limit your answers to 100 words for each question. Feel free to use any additional reading material for the same, but always remember to **cite your sources**.

a) **Convexity of NN**

   a) Are Deep Neural Network convex in nature? Justify your answer.

   b) Based on your answer above, why do we need the Deep Neural Network to be convex / non-convex?

b) **AdaGrad Optimizer**

   a) Describe the basic idea behind AdaGrad algorithm using formulas (if necessary). Clearly state your assumptions, if any.

   b) What is an important property of this algorithm?

   c) What is a major disadvantage of this algorithm?

c) **Adam Optimizer**

   a) Is there any similarity between RMSProp and Momentum? Is it possible to combine them? Explain.

   b) Describe the way in which Adam algorithm performs parameter update. What are the advantage(s) of such an update rule when compared to RMSProp (with momentum)?

d) **AdamW Optimizer**: What is the key difference between Adam and AdamW optimizer?

Exercise 8.2 - Coding Exercise (3 + 1 (Bonus) points)

please see attached *ipynb notebook*

[1] There is a nice overview paper by Sebastian Ruder on different optimizers here: https://arxiv.org/pdf/1609.04747.pdf

Submission instructions

The following instructions are mandatory. If you are not following them, tutors can decide to not correct your exercise.

- Please submit the assignment as a **team of two to three** students.
- Write the Microsoft Teams user name, student id and the name of each member of your team on your submission.
- Hand in zip file containing a `single` PDF with your solutions and the completed ipython notebook. Do not include any data or cache files (e.g. __pycache__).
- Important: please name the submitted zip folder and files inside using the format: **Name1_id1_Name2_id2**.
- Your assignment solution must be uploaded by only **one** of your team members to the 'Assignments' tab of the tutorial team (in **Microsoft Teams**). Please remember to press the **Hand In** button after uploading your work.
- If you have any trouble with the submission, contact your tutor **before** the deadline.