CS-4243, S 2023-1, Coursework 3

Coursework Description

- This coursework consists of two parts, comprising four questions, and contributes to a total of 9 CA marks out of the final 100-mark evaluation.
  - Part 1: Two multiple-choice questions (MCQs), each worth 2 marks (4 marks in total). Each MCQ has a **single** correct answer. There is no penalty for incorrect answers. Please select the **best and most accurate** option.
  - Part 2: Two Long answer questions, worth 2.5 CA marks each (5 marks in total).
- The coursework will be submitted through a Canvas Quiz. The CW3 quiz will be available soon. Different parts and questions in the quiz have been appropriately categorized. For instance, Part 1 consists of MCQs, and Part 2 comprises essay questions where you can include images or attach files to your responses.
- The CW3 quiz will be accessible in the Canvas "Quizzes" folder, allowing you to submit your coursework.
- The coursework is due on **Sunday, 26/11/2023, 11:59 pm**.
- Good luck, my friends

Part 1. MCQs (2 Marks each)

1. Consider a clustering task where data items have 5 features each, and we are going to cluster them into 2 clusters. Assume that the dataset has got 4 items. The dataset, x, and weight matrix, w, are:

	Feature1	Feature2	Feature3	Feature4	Feature5
Ds1	-3	-2	1	-1	1
Ds2	-1	-4	0	-1.2	0.9
Ds3	-2	-2	1	-0.8	1.1
Ds4	3	1	3	-2	-2

x

Weights represent cluster 1	Weights represent cluster 2
-0.465	0.911
-0.146	0.392
0.806	0.522
-0.245	-0.792
0.757	-0.246

w

After computing the inner product, a softmax function will be applied to assign clusters to data samples. What will be the clustering results without any weight modification or training?

a. {Ds1,Ds2,Ds3} ϵ Cluster1 , {Ds4} ϵ Cluster2
b. {Ds2,Ds3} ϵ Cluster1 , {Ds1,Ds4} ϵ Cluster2
c. {Ds1,Ds2} ϵ Cluster1 , {Ds3,Ds4} ϵ Cluster2
d. {Ds1} ϵ Cluster1 , {Ds2,Ds3,Ds4} ϵ Cluster2

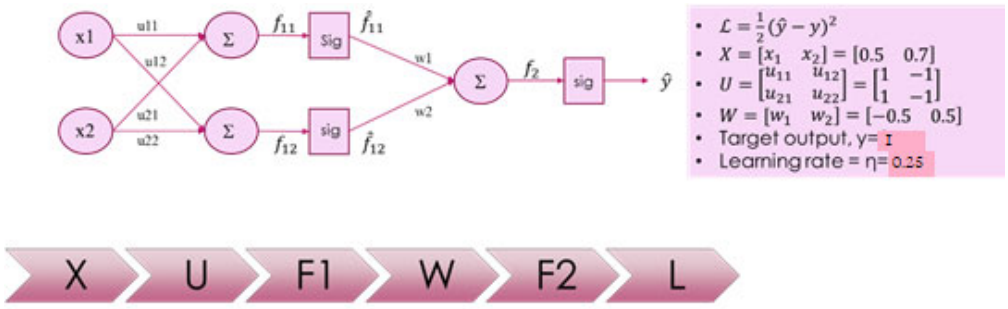
2. For the ANN below, what are the $\mathcal{L}$ in the forward pass and the new W, W^{+1}, in the backward pass? The **Sigmoid** is used as your activation function everywhere, and the **loss** function is $\mathcal{L} = \frac{1}{2}(\hat{y} - y)^2$. Other parameters can be seen in the picture below. Target output, y=1, and the learning rate, η=0.25 .

a. $\mathcal{L}$=0.232 , $U^{+1}=\begin{bmatrix}1.004 & -1.004\\ 1.004 & -1.004\end{bmatrix}$

b. $\mathcal{L}$=0.232 , $U^{+1}=\begin{bmatrix}0.998 & -0.998\\ 0.998 & -0.998\end{bmatrix}$

c. $\mathcal{L}$=0.16 , $U^{+1}=\begin{bmatrix}0.998 & -0.998\\ 0.998 & -0.998\end{bmatrix}$

d. $\mathcal{L}$=0.16 , $U^{+1}=\begin{bmatrix}1.004 & -1.004\\ 1.004 & -1.004\end{bmatrix}$



Part 2. Long answer Questions (2.5 mark each)

3. How a multi-layered Perceptron can be a non-linear model? Specifically,
   a. Why do we need a hidden layer or layers with more than one neuron to materialize non-linearity in MLPs?
   b. How do non-linear activation functions in hidden layer neurons help the MLP to be non-linear? (word limit= 300 words)

4. Review and write an abstract for 'How to train your deep multi-object tracker' paper below, which was published in CVPR 2020 Conference. As the title suggests, this article is about object tracking using deep learning. You can find the PDF in Canvas/ Files/ extra/ DeepTrack1.pdf. Points to consider:
   c. Word limit = 500 words
   d. Mention: What the paper is all about?
   e. Mention: The proposed algorithm
   f. Mention: What did you get from that paper?

How To Train Your Deep Multi-Object Tracker

Yihong Xu[1] Aljoša Ošep[2] Yutong Ban[1,3] Radu Horaud[1]
Laura Leal-Taixé[2] Xavier Alameda-Pineda[1]
[1]Inria, LJK, Univ. Grenoble Alpes, France [2]Technical University of Munich, Germany
[3]Distributed Robotics Lab, CSAIL, MIT, USA
[1]{firstname.lastname}@inria.fr [2]{aljosa.osep, leal.taixe}@tum.de [3]yban@csail.mit.edu

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