CS-E4740 - Federated Learning D, Lectures, 28.2.2024-29.5.2024

Started on	Thursday, 7 March 2024, 11:38 AM
State	Finished
Completed on	Thursday, 7 March 2024, 1:38 PM
Time taken	2 hours
Grade	**8.00** out of 11.00 (**72.73**%)

Question 1

Flag question Mark 2.00 out of 2.00 Correct

What is an empirical graph?

- a. An undirected graph whose nodes carry local datasets and local (personalized) model parameters. ✔
- b. The depiction of data points in a scatter-plot.
- c. A visualization of model parameters in a two-dimensional plane.

Your answer is correct.

See section 3.2 in the Lecture Notes (found here).

The correct answer is:
An undirected graph whose nodes carry local datasets and local (personalized) model parameters.

Question 2

Flag question Mark 2.00 out of 3.00 Partially correct

Consider an empirical graph with 10 nodes which are connected by 9 edges, each having weight 1. Which of the following statements about its Laplacian matrix $\mathbf{L}$ are correct ?

- a. The matrix $\mathbf{L}$ has 10 rows. ✔
- b. The matrix $\mathbf{L}$ might be invertible.
- c. The sum of all entries in the same column of $\mathbf{L}$ is 0. ✔
- d. The matrix $\mathbf{L}$ has 9 rows and 10 columns.
- e. There are two **different** vectors $\mathbf{u}$ and $\mathbf{v}$ such that $\mathbf{u}^{T}\mathbf{L}\mathbf{v} < 0$.

Your answer is partially correct.

You have correctly selected 2.
The Laplacian matrix of an empirical graph is always singular (non-invertible).

The Laplacian matrix $\mathbf{L} \in \mathbb{R}^{n \times n}$, where n is the number of nodes in the empirical graph.
The Laplacian matrix is singular (the sum of all entries in the same column/row of $\mathbf{L}$ is 0) by definition (3.4) in the Lecture Notes.

See the discussion about the Laplacian matrix in the section 3.2 in the Lecture notes (found here).

The correct answers are:
There are two **different** vectors $\mathbf{u}$ and $\mathbf{v}$ such that $\mathbf{u}^{T}\mathbf{L}\mathbf{v} < 0$.

,
The matrix $\mathbf{L}$ has 10 rows.

,
The sum of all entries in the same column of $\mathbf{L}$ is 0.

Question 3

Flag question Mark 0.00 out of 2.00 Incorrect

*This question refers to **the student task #1** in the "FL Design Principle" assignment.*

The assignment requires to you generate the Laplacian matrix, build the matrix Q and the vector q for the quadratic objective function in GTVMin. What is the training error and the total variation for the computed solution for the GTVMin instance?

- a. **The training error** is around 32.77.
- b. **The total variation** is around 203.29.
- c. **The training error** is around 35.23. ✖
- d. **The total variation** is around 198.78.
- e. **The training error** is around 38.55.
- f. **The total variation** is around 207.85. ✖

Your answer is incorrect.

See equations 3.17-3.22 from the Lecture Notes (found here). Please, join Slack channel (link) if you have any questions.

The correct answers are:
The training error is around 32.77.,
The total variation is around 203.29.

Question 4

Flag question Mark 2.00 out of 2.00 Correct

*This question refers to **the student task #2** in the "FL Design Principle" assignment.*

The coding assignment requires you to study the connectivity of the empirical graph whose nodes are FMI weather stations. For which value of the parameter "nrneighbors" is the empirical graph connected?

- a. 1
- b. 2
- c. 3
- d. 4 ✔

Your answer is correct.

Please, join Slack channel (link) if you have any questions regarding the assignment.

The correct answer is:
4

Question 5

Flag question Mark 2.00 out of 2.00 Correct

*This question refers to **the student task #3** in the "FL Design Principle" assignment.*

The coding assignment required you to learn local model parameters by solving an instance of GTV minimization for different values of the regularization parameter α. How does the average local loss (training error) of the learnt model parameter vary with increasing α ?

- a. The training error cannot increase with increasing α.
- b. The training error might increase with increasing α. ✔

Your answer is correct.

Increasing the GTVMin parameter $alpha$ forces the solutions of GTVMin to have a smaller total variation, i.e., to be approximately constant at connected nodes of the empirical graph. This restriction of local model parameters might counter-act the minimization of the local average loss (training error). Note that GTVMin is an instance of regularized empirical risk minimization. For more discussion of the effect of increasing regularization strength see Section 7.1 of this book.

The correct answer is:
The training error might increase with increasing α.

Finish review

Previous activity
⇥ "ML Basics"

Next activity
"Gradient Methods" ⇤