FEDERATED LEARNING PROJECT REPORT TEMPLATE

Olli Glorioso, `olli.glorioso8@gmail.com`

Instructions (Remove before submission). Fontsize must not be smaller than 9 points. The report cannot be longer than 5 pages, including everything: abstract, all 6 sections of the report, and figures. The 5th page should contain only the references section.

ABSTRACT

Instructions (Remove before submission). This abstract provides a concise summary of the project, including the FL application, empirical graph modeling, variation minimization approach, and the FL algorithms used.

Keywords: Federated learning, networks, personalized machine learning, trustworthy artificial intelligence

1. INTRODUCTION

Instructions (Remove before submission). Introduce the background and motivation for your FL project:

- A real-life scenario motivating your FL application.

- Summary of state-of-the-art methods relevant to your project.

- Brief outline of the structure of your report.

2. PROBLEM FORMULATION

Instructions (Remove before submission). Model your FL application as an FL network (see [1, Ch. 3]). In particular, clearly define and explain:

- Nodes: What real-world devices do they represent?

- Local Models: Describe the ML models used at each node.

- Loss Functions: Specify local loss functions used at each node.

- Edges: How are edges and their weights chosen? See [1, Ch. 7] for data-driven methods to choose the edges of an FL network.

3. METHODS

Instructions (Remove before submission). The project requires you to apply GTVMin-based methods to the FL application modelled in Section 2. In this section you need to clearly state and explain:

- Your choice of variation measure, e.g., $\phi(\mathbf{w}^{(i)} - \mathbf{w}^{(i')})$ for parametric models.

- Your choice of FL algorithm (i.e., optimization method for solving GTVMin) and its message passing implementation.

4. NUMERICAL EXPERIMENTS

Instructions (Remove before submission). Discuss the following.

- Data sources used. One example of such a source is the Finnish meteorological institute `https://en.ilmatieteenlaitos.fi/open-data`.

- Model validation, selection, and diagnosis methods (see [2, Sec. 6.6]).

- Training, validation, and test losses for each node of the FL network.

Important: Your submission must include a zip archive containing a single Python script along with any necessary data files. Minimize the use of non-standard Python packages to ensure ease of execution and reproducibility.

5. CONCLUSION

Instructions (Remove before submission).

- Discuss whether the obtained results solve the problem satisfactorily.

- Identify limitations and suggest potential improvements.

6. REFERENCES

[1] A. Jung, *Federated Learning: From Theory to Practice*, Aalto, 2025. Available: `https://github.com/alexjungaalto/FederatedLearning/blob/main/material/FLBook.pdf`.

[2] A. Jung, *Machine Learning: The Basics*, Springer, 2022.

Instructions (Remove before submission). Please try to follow the IEEE reference guide `http://journals.ieeeauthorcenter.ieee.org/wp-content/uploads/sites/7/IEEE_Reference_Guide.pdf`.