

# FEDERATED LEARNING PROJECT REPORT TEMPLATE

*First Last, email@address.com*

**Instructions (Remove before submission).** Font-size 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.

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