UNIVERSITÉ
CÔTE D'AZUR

WEEKLY TER REPORT
03/12/2021

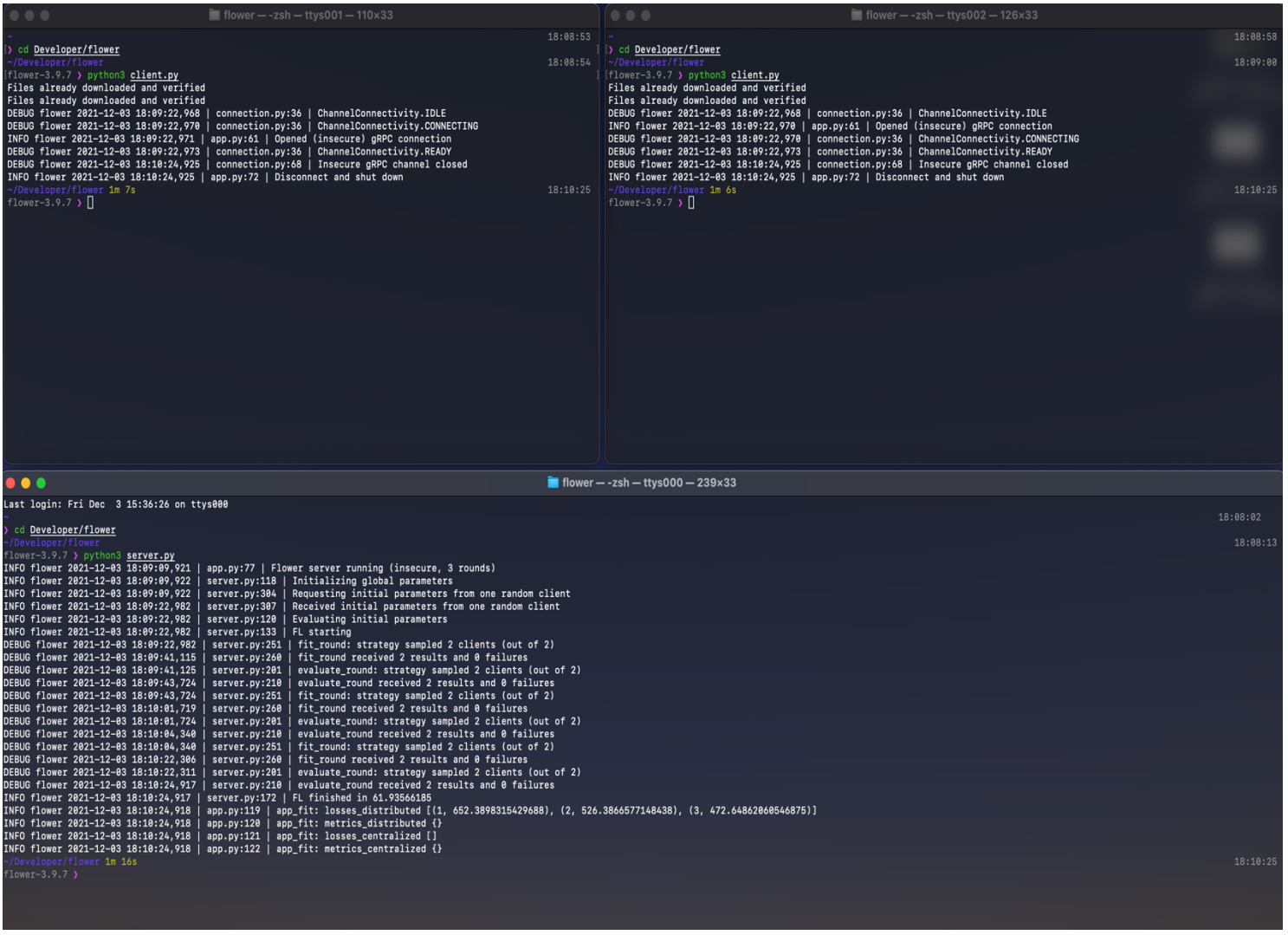
Federated Learning for autonomous cars

- BONATO-PAPE Hadrien (SI5-WIA)
- LAUBRY Vincent (M2-IoTCPS)
- TOPRAK Erdal (M2-SD)
- FIROOZ Hossein (M2-EIT Digital)

Table of contents

1. Client perspective progress

We explored a first implementation of federated learning with the Flower framework. In the following screenshot we have the server (bottom) and two clients (top). The pre-trained model is the CIFAR-10. We use the default train/test and default Flower FederatedAveraging strategy[1].



This is only our first solution for implementing a viable federated learning, we are also looking for a TensorFlow Lite on devices and custom solution on the server side according to research papers.

Our first idea is to implement a simple model that allows the car to avoid obstacles.
Then, we can work on this situation to improve communication and federated learning.

We will continue to study Flower, especially the output of this framework.
We will also try to compare this framework to the FADNet framework and TensorFlow Federated Learning.

2. Questions for the professors

We have some questions about how to tackle federated learning, here is the list in no particular order:

- Do we have to do inter-car communications ? (This is in addition to federated learning, something like mqtt for immediate action for the nearby cars)
    - This question is based on the fact that we can't do real-time federated learning but we still need to tell cars in a certain radius to do a quick action while the in-board model computes.

- At what frequency/evenement does federated learning should happen?

- Should we aim, at first, our focus to do federated learning for one specific case, which is, for example, obstacle avoidance ?
    - This question is there to prepare for the final demonstration in case the other sub-project cannot integrate all the models.

    - We want to aim our work to do federated learning, at least, on a straight line with two cars and one obstacle. Our goal would be to demonstrate the validity of our federated learning implementation and the outputs for the cars and server.

3. References

1. Li, Qinbin, Zeyi Wen, Zhaomin Wu, Sixu Hu, Naibo Wang, Yuan Li, Xu Liu, and Bingsheng He. "A Survey on Federated Learning Systems: Vision, Hype and Reality for Data Privacy and Protection." *ArXiv:1907.09693 [Cs, Stat]*, July 1, 2021. http://arxiv.org/abs/1907.09693.

2. Li, T., Hu, S., Beirami, A., & Smith, V. (2020). Federated multi-task learning for competing constraints. arXiv preprint arXiv:2012.04221. https://research.fb.com/wp-content/uploads/2021/05/Federated-Multi-Task-Learning-for-Competing-Constraints.pdf

3. Smith, V., Chiang, C. K., Sanjabi, M., & Talwalkar, A. (2017, December). Federated multi-task learning. In Proceedings of the 31st International Conference on Neural Information Processing Systems (pp. 4427-4437). http://papers.neurips.cc/paper/7029-federated-multi-task-learning.pdf

4. Zhu, H., Zhang, H. & Jin, Y. From federated learning to federated neural architecture search: a survey. Complex Intell. Syst. 7, 639–657 (2021). https://doi.org/10.1007/s40747-020-00247-z

5. FADNet Framework. https://github.com/HKBU-HPML/FADNet

6. TensorFlow Federated Learning. https://www.tensorflow.org/federated?hl=fr