Medical Image Segmentation utilizing Federated Learning

Presented by
Tanni Das
Graduate Research Assistant
Video Processing Lab
Gachon University, Korea

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Motivation

- Medical image segmentation requires a lot of diverse dataset
- In federated learning paradigm, data privacy is a target issue
- So, the direct inter-client data share is discouraged
- As a result, due to lack of data model generalization becomes tough
- Some researches show various way to share data in inter-institutional mode by having privacy
- Having this kind of work, maximum researches focus on only data sharing protocol not in model development which can tackle generalization problem
- In my research, I will try to fill this gap

Previous Works

- Sheller et. al. [1] suggested a very basic way to use segmentation model in a federated learning way. But in their model no scheme for protected data sharing is proposed
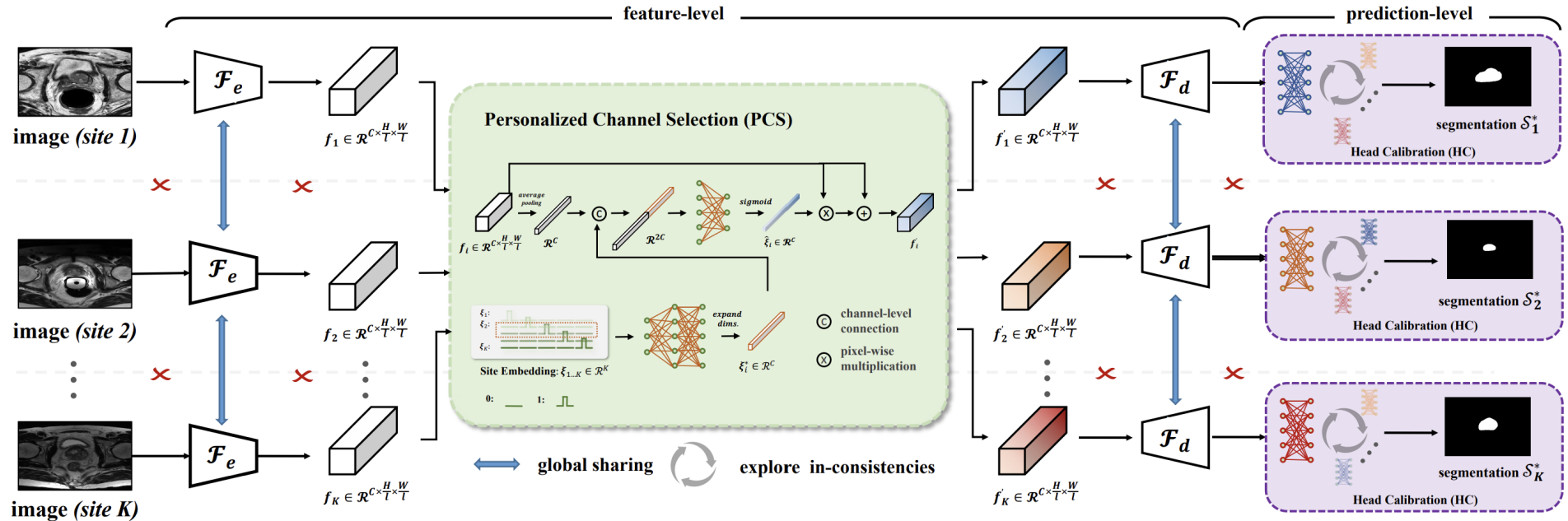

Federated Learning Architecture
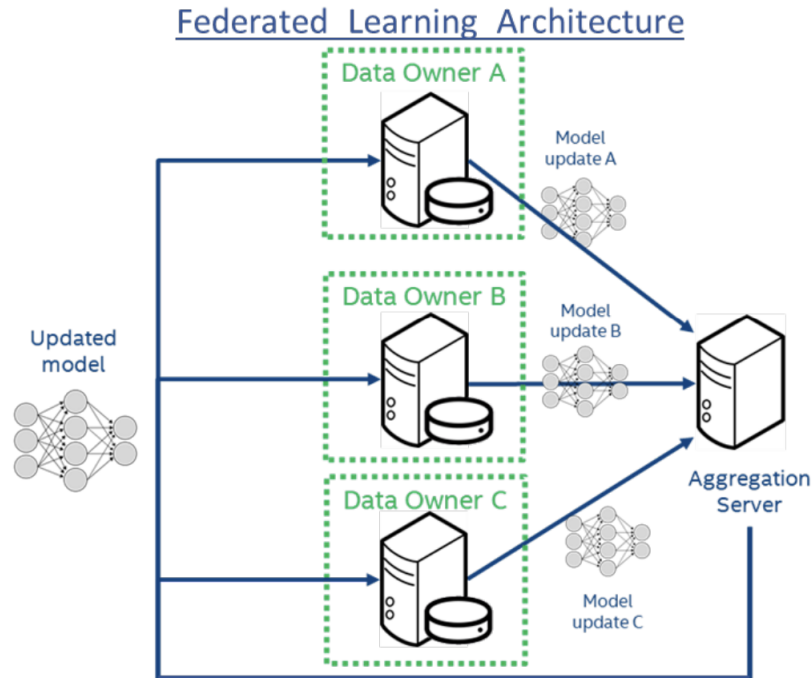
Previous Works

- Liu et. al. [2] proposed a frequency domain based data sharing scheme and implemented in medical image segmentation
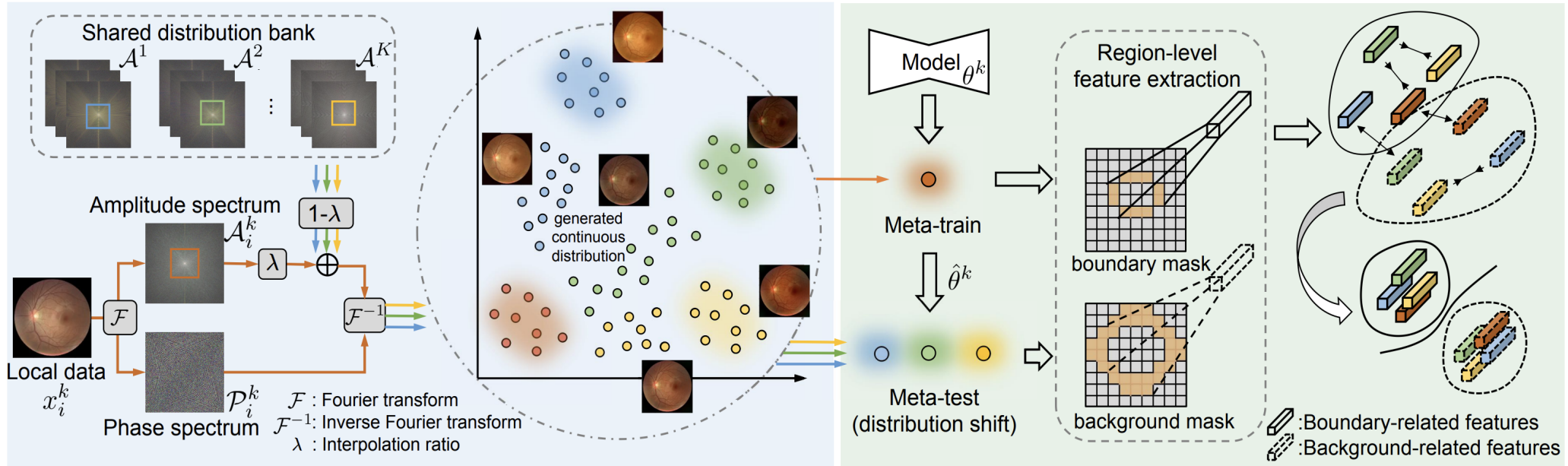
Previous Works

- Wang et. al. [3] proposed a method where federated learning works in two steps: feature level and prediction level

My proposal

- In order to make a generalized medical image segmentation model, previous efforts are made into data sharing

- But deep learning model design also contributes to be a generalized model

- So, my target will be to develop an efficient CNN model from the previous ideas of U-net, U-net++, and attention U-net etc.

References

[1] M. J. Sheller, G. A. Reina, B. Edwards, J. Martin, and S. Bakas, "Multi-Institutional Deep Learning Modeling Without Sharing Patient Data: A Feasibility Study on Brain Tumor Segmentation." arXiv, Oct. 22, 2018. doi: 10.48550/arXiv.1810.04304.

[2] Q. Liu, C. Chen, J. Qin, Q. Dou, and P.-A. Heng, "FedDG: Federated Domain Generalization on Medical Image Segmentation via Episodic Learning in Continuous Frequency Space." arXiv, Mar. 10, 2021. doi: 10.48550/arXiv.2103.06030.

[3] J. Wang, Y. Jin, and L. Wang, "Personalizing Federated Medical Image Segmentation via Local Calibration." arXiv, Jul. 11, 2022. doi: 10.48550/arXiv.2207.04655.

Thank You