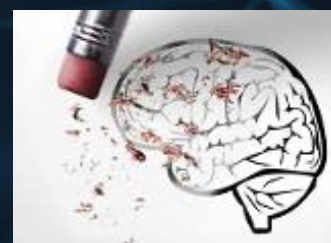




Summer Workshop 25' London

Multimodal Federated Learning for BioMed From Cloud Training to Embedded Inference

Project n°7



Xavier Lessage
Expert researcher @ CETIC



Context

Federated Multimodal Architecture in Healthcare (Alzheimer)

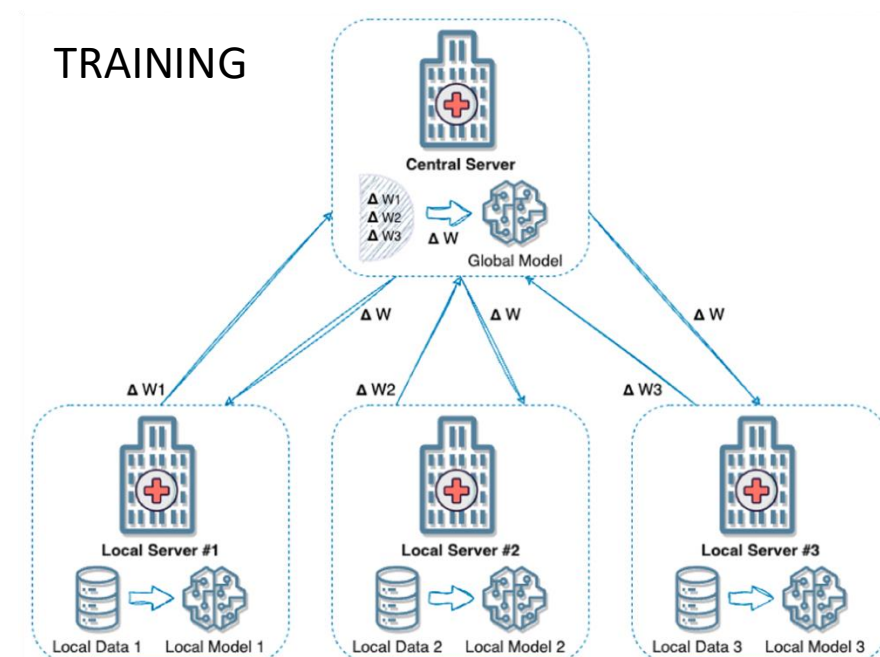
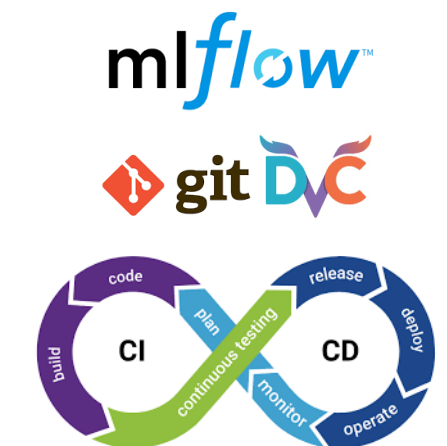
- Use case
 - Public dataset : Adni-data (Alzheimer)
<https://adni.loni.usc.edu/data-samples/adni-data>
 - Several modalities
 - Images : MRI, Tomography
 - Clinical/biological/genetic data
 - Demographic data/Longitudinal follow-up data



Context

Federated Multimodal Architecture in Healthcare (Alzheimer)

- Multimodal Architecture
 - Based on Federated learning (Training in #Silo)
 - Integration of real-world with privacy-preserving data without centralized data sharing
 - Multi centric training
- Embedded Inference (After Training)
 - Model compression (pruning, distillation of knowledge, ...)
 - Integration on embedded system (RPI, FGPA, ...)



INFERENCE



Raspberry Pi®

Work Plan



WP1 : Preparing of each potential model (before the challenge)

WP2 : Creation of the hybrid model based on the best models available

WP3 : Setup of Personalized federated learning architecture

WP4 : Model optimisation for embedded system

Work Plan

WP1 – Preparing of each potential model (before the challenge)

- Task 1.1 : Modality 1 → Dataset preparation and training (01/06 – 25/08) --> Researcher1
- Task 1.2 : Modality 2 → Dataset preparation and training (01/06 – 25/08) --> Researcher2
- Task 1.3 : Modality 3 → Dataset preparation and training (01/06 – 25/08) --> Researcher3

WP2 – Creation of the hybrid model based on the best models available

- Tasks 2.1 : Fusion of models (25/08 – 05/09) --> Team 1 (Min 2 Researchers)
 - Based on State of the art
 - First experimentations
- Tasks 2.2 : Fusion of models (07/09 - 01/06/2026) --> Team 1 (Min 2 Researchers)
 - New iterations
 - Consolidation of results
 - Publications

Work Plan

WP3 – Setup of Personalized Federated learning architecture

- Tasks 3.1 : Setup of Flower (25/08 – 05/09) --> Team 2 (Min 2 Researchers)
 - Week 1 : with a first model
 - Week 2 : with a hybrid model
- Tasks 3.2 : Fusion of models (07/09 - 01/06/2026) --> Team 2 (Min 2 Researchers)
 - New iterations
 - Consolidation of results / Publications

WP4 – Model optimisation for embedded system

- Tasks 4.1 : Model compression (25/08 – 05/09) --> Team 3 (Min 2 Researchers)
 - Week 1 : Pruning, distillation, ...
 - Week 2 : Integration on RPi (ONNX, ...)
- Tasks 4.2 : Model compression (07/09 - 01/06/2026) --> Team 3 (Min 2 Researchers)
 - New iterations
 - Consolidation of results / Publications

Expertise Sought

- Research Axis 1: Healthcare (Alzheimer) / PhD thesis in progress
 - Building of hybrid model
 - Using of hybrid model for Healthcare
- Research Axis 2: Personalized Federated learning / PhD thesis in progress
 - Optimisation by modality, dataset, hardware limitation, ...
 - Integration of hybrid model
- Research Axis 3: Optimisation of models / PhD thesis in progress
 - Optimisation of models (less greedy, faster, efficient and energy-saving) / Fugal AI
 - Integration in embedded system
- Research Axis 4: Multimodal Federated Learning for Edge AI
 - Full pipeline : from constructing the multimodal federating it for training and real-time execution at the edge
 - MLOps integration with best CI/CD integration



Join us @ London !!!

Interested in :

- Healthcare (Alzheimer, ...)
- Federated learning
- Multimodal architecture
- Compression of models
- Integration of AI Edge
- Computer vision / Time series / ...
- MLOps integration and CI/CD
- ...



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TRUSTED AI LABS

Thank you for your attention !



References

Model / Study	Modalities Used	Task	Performance	Link to Paper
MADDi (Multimodal Alzheimer's Disease Diagnosis)	MRI, genetics, clinical features	Classification: AD / MCI / NC	Accuracy: 96.88%	arXiv:2206.08826
Contrastive Attention Network on Imaging + Tabular Data	MRI + tabular data (e.g., MMSE, biomarkers)	AD classification	Accuracy > 83.8% (10% gain over baselines)	arXiv:2308.15469
MRL-AHF (Multimodal Representation Learning with Adversarial Hypergraph Fusion)	MRI, PET, clinical data	Early AD prediction	Outperformed previous models (precise score not provided)	PubMed link
EMBED-AI (Embedding and Ensemble Learning for AD Diagnosis)	MRI, demographics, APOE4, cognitive scores	AD / MCI classification	Accuracy: 91.2%	MDPI Sensors
MoFormer (Transformer for Multimodal Fusion)	MRI, clinical tests, genetic data	AD classification and MCI progression	AUC: 0.94	NeuroImage (2023)
Autoencoder + Graph Neural Network (GNN) Fusion	MRI + cognitive + CSF + demographics	MCI-to-AD progression prediction	AUC: 0.925	IEEE TMI