Source: https://www.rmit.edu.au/study-with-us/biomedical-sciences

ISMB 2022 - Tutorial Session

Federated Learning in Biomedicine

Applying federated learning on geographically distributed datasets

1. Application of Centralized Machine Learning
2. Application of Federated Machine Learning
3. Federated Workflows with FeatureCloud
4. Hands on Exercise
   - Assemble a federated workflow
   - Run a federated workflow with other participants

Centralized Machine Learning

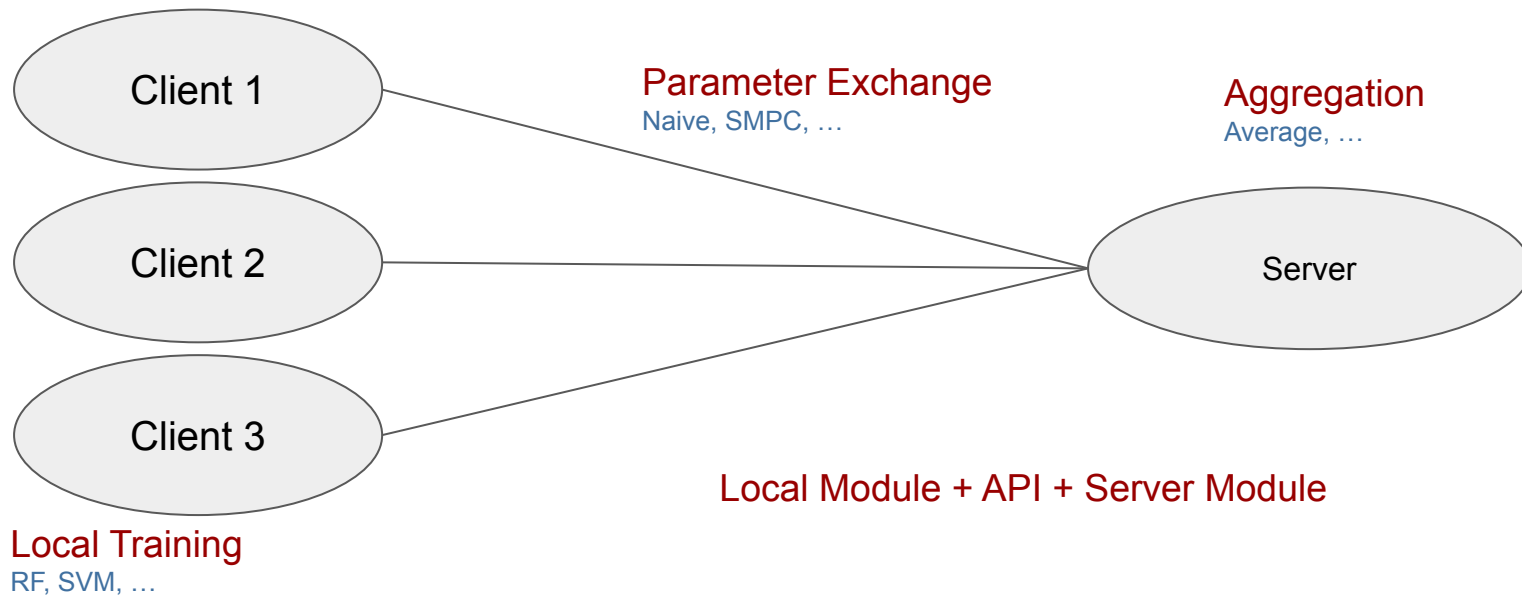Computer/Cloud/…

Cross Validation ▷ Normalization ▷ Model Training ▷ Evaluation

```python
X, y = load_data()
pipe = Pipeline([('scaler', StandardScaler()), ('clf', SVC())])

cross_validate(X, y, cv=5, scoring='roc_auc')
```
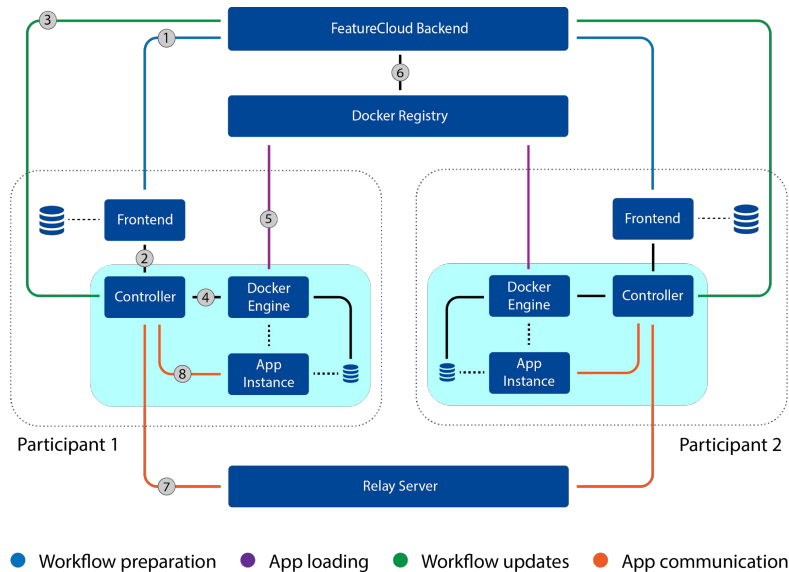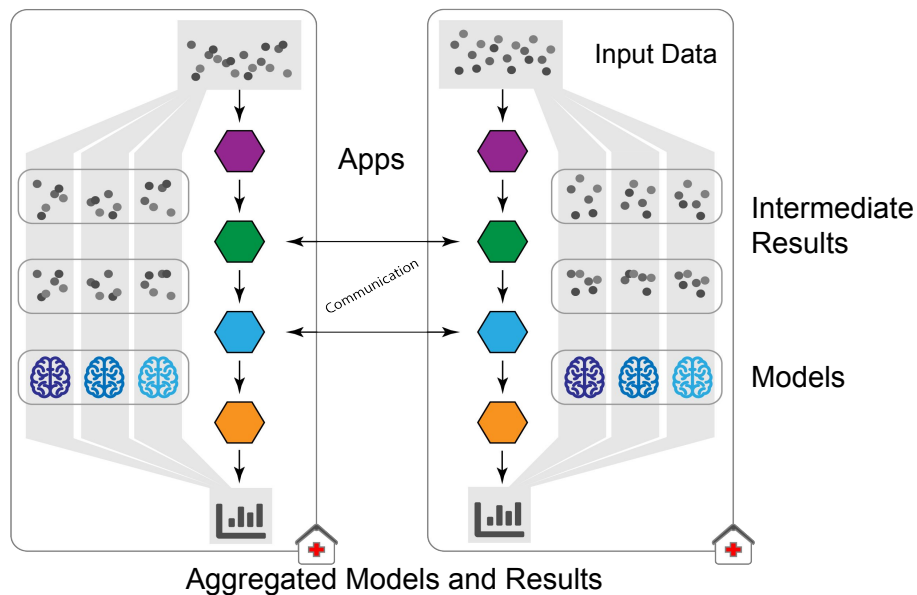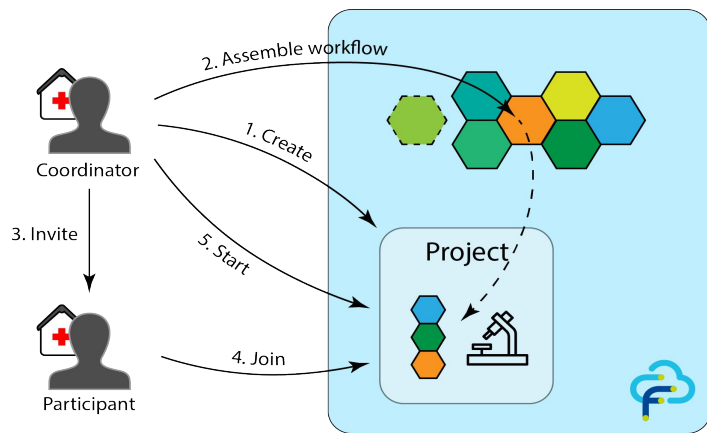
Federated Machine Learning

Client 1

Client 2

Client 3

Parameter Exchange
Naive, SMPC, …

Aggregation
Average, …

Server

Local Module + API + Server Module

Local Training
RF, SVM, …

Complex Architectures

- Communication
- Different Operating Systems
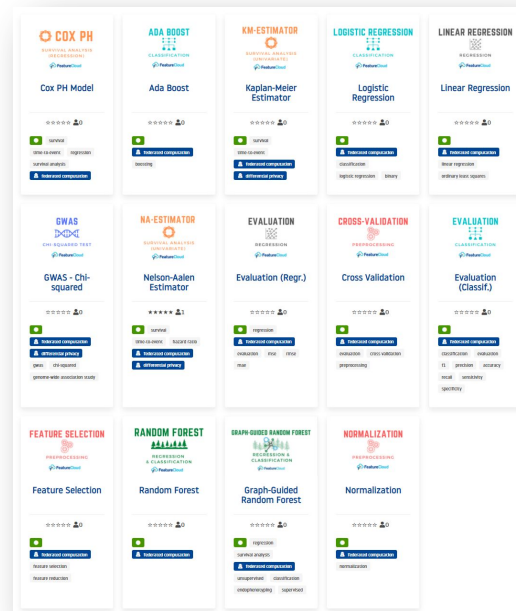- Aggregation server

Example: FeatureCloud

FeatureCloud for running federated workflows

FeatureCloud for running federated workflows

Ready-to-use apps by the FC community

- Cross-Validation
- Preprocessing
- Models
  - Classification
  - Regression
  - Survival
- Evaluation
  - Classification
  - Regression
  - Survival

FeatureCloud for running federated workflows

Local adjustment of certain app parameters

- Filenames
- Format
- Model parameters
- Column names
- Privacy adjustments
- …

Config files
(yaml)

Hands-on Task

Diagnose classification of breast cancer (malignant vs. benign)

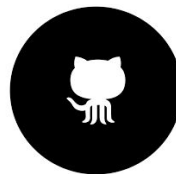| Cross Validation	Normalization	Logistic Regression	Evaluation (Classif.)
- Perform a 5-fold cross validation	- Apply a variance normalization on the data	Train a logistic regression model	Evaluate the logistic regression model

Hands-on Task (~25 minutes)

1. Find your breakout room
2. Create a FeatureCloud Account + Site
3. Choose a person as the coordinator
4. Run Docker and the FeatureCloud controller
5. Coordinator:
   a. Create a project
   b. Assemble workflow
   c. Invite participants
6. Coordinator + participants
   a. Take a look at the data
   b. Create config files
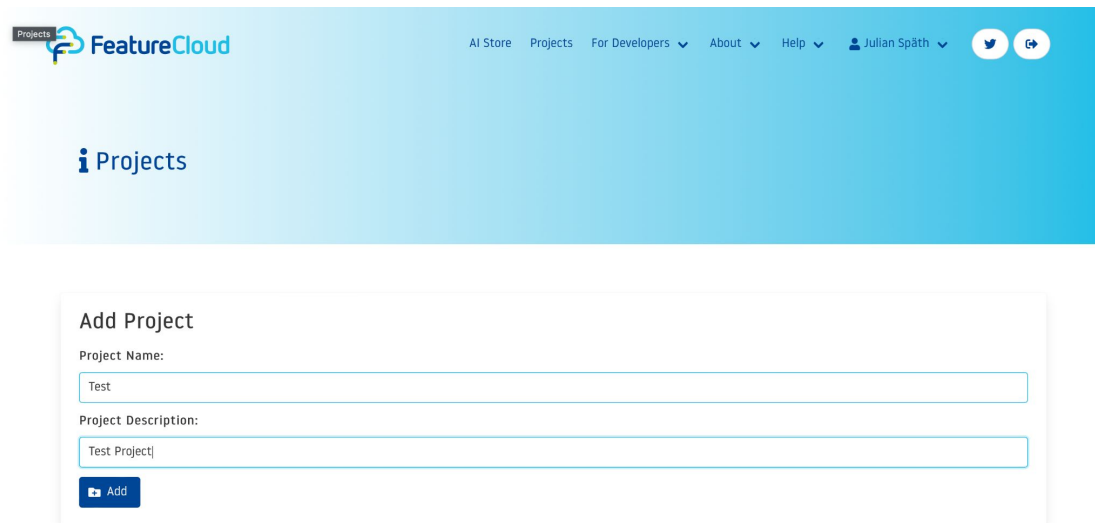   c. Choose input files
7. Coordinator:
   a. Start workflow

https://github.com/FeatureCloud/ismb-tutorial-2022

featurecloud.ai

Hands-on Task Guide

1. Create a project

Hands-on Task Guide

2. Assemble Workflow

Hands-on Task Guide

3. Invite Participants

Hands-on Task Guide

4. Start Workflow, Choose Data

Hands-on Task Guide

5. Enjoy the workflow :)

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Thank you!

Please, fill out the Feedback form.