# Milestone 1 - Progress Evaluation

1) Project Title: Tomographic Medical Image Reconstruction using Federated Learning
   Members: Joshua Sheldon (jsheldon2022@my.fit.edu), Yash Jani (vjani2023@my.fit.edu), Tanuj Kancharla tkancharla2022@my.fit.edu), and Izzy MacDonald (imacdonald2022@my.fit.edu)
2) Faculty Advisor: Dr. Debasis Mitra (dmitra@fit.edu)
3) Client: Same as advisor.
4) Progress matrix for current milestone:

| Task | Competition | Joshua | Izzy | Tanuj | Yash | To Do |
|---|---|---|---|---|---|---|
| Compare and Select Technical Tools | 100% | Federated Learning & Networking | User Interface | Authentication | Orchestration Logic | None |
| Provide Demos | 100% | Federated Learning & Networking | User Interface | Authentication | Orchestration Logic | None |
| Familiarize with Existing Pipeline | 100% | 25% | 25% | 25% | 25% | None |
| Research Federated Learning | 100% | 70% | 10% | 10% | 10% | None |
| Select Collaboration Tools | 100% | 25% | 25% | 25% | 25% | None |
| Create Requirement Document | 100% | 10% | 10% | 40% | 40% | None |
| Create Design Document | 100% | 70% | 10% | 10% | 10% | None |

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|---|---|---|---|---|---|---|
| Create Test Plan | 100% | 10% | 40% | 10% | 40% | None |

5) Task Discussions
    a) All members needed to find the best tools for the different components of our project.
    b) Once we had found the tools that we wanted to use, we needed to make sure that they would work efficiently. Therefore, we created little demos of our tools to ensure we knew how to use them and could work with the project.
    c) Even though Josh and Izzy had prior knowledge of the pipeline, we all needed to familiarize ourselves with the specific stages of the pipeline we are in charge of. Izzy is in charge of the XCAT/XCAT+ section, Yash is in charge of OpenGate, Tanuj is in charge of the model, and Josh is in charge of the federated learning aspect.
    d) Josh is in charge of federated learning in the project, so he has done research into what federal learning framework we should implement and how it would be done. However, every member did basic research to have an understanding since it is a large portion of our project.
    e) The team needed a way to communicate and track progress. So we decided to mainly talk through Discord, and have our code uploaded to a Github repository. Along with tracking our progress on Github. We are currently working on looking for a way to communicate data between the machines.
    f) We split up the three documents as fairly as possible between the members. We all talked and contributed to each document, however it was mainly written by 1-2 people as stated in the chart.
6) Member Contributions

Izzy:

- Researched different ways to incorporate a user interface
- Created the user interface demo presented to the class
- Met with Ty from first year group to understand the XCAT and XCAT+ portion of the pipeline
- Researched what new parameter changes should be added to the Organ_Param file to create more diverse XCATs.
- Worked on Test Document

Yash:

- Took responsibility for the OpenGATE part of the pipeline
- Orchestrator/Contributor architecture and solutions
- Worked on Requirements Document

- Worked on Test Document

Joshua:

- Setup the collaboration tools, including Discord for communication, GitHub for code, GitHub Projects for project management, and G Suite for document creation and storage.
- Assigned certain members of the group to have ownership over certain aspects of the project in collaboration with Dr. Mitra.
- Setup GitHub Projects for project management by creating issues, assigning people to issues, defining start and end dates for issues, and creating milestones.
- Researched federated learning, including different paradigms, different aggregation strategies, etc.
- Organized multiple meetings between members of the first and second year groups to 'onboard' the second year group to the project.
- Redeveloped the data augmentation stage to further understand it and to integrate the ability to save intermediary steps of augmentation.
- Investigated various open issues in the project, such as how to generate more diverse XCATs, whether certain augmentation steps should be changed or removed, etc.
- Created 17 animations to visualize the effect of different steps of the augmentation stage and proposed changes to the augmentation stage.
- Wrote an 11 page dataset augmentation plan outlining how data is generated for the project, what open questions we need answered about the process, what changes we want to make to the process, and when we want to make those changes, including supporting figures and animations.
- Reached out to the creator of the XCAT phantom program to get the necessary files to create more diverse XCATs.
- Got real data to compare with synthetic data, and provided the real data to the current machine learning expert to test the model with.
- Explored different federated learning frameworks, including following tutorials and surveying documentation.
- Developed a demo of federated learning using OpenFL, and developed a script that visualizes the performance of the model trained during the demo.
- Wrote the design document.

Tanuj:

- Wrote the requirements document.
- Researched authentication solutions and machine learning.
- Developed a demo of authentication solutions.

7) Next Milestone Plan

| Task | Joshua | Izzy | Tanuj | Yash |
|---|---|---|---|---|
| Orchestrator application user interface | 10% | 40% | 10% | 40% |
| Orchestrator application initial model selection | 40% | 10% | 10% | 40% |
| Contributor application can accept training data | 25% | 25% | 25% | 25% |
| Correct and accurate synthetic data can be generated | 25% | 25% | 25% | 25% |

8) Task Discussions
    a) We need a way for the learning managers to be able to interact with the model and that starts with a user interface they can use. We hope to make a user friendly interface that the learning managers can train the model with.
    b) Since there may not be training done on the model originally, the model needs to be able to randomly initialize one.
    c) The main objective of this project is for real data from real medical professionals to be able to train this model. We are not focusing on the model being trained from this data at this milestone, more so that the training data can even be uploaded.
    d) Our team now understands the pipeline and our individual stages of it. Now we want to ensure that the pipeline is generating correct and accurate synthetic data that we can use for our model.
9) Meeting Dates with Client: See Meeting Dates with Advisor.
10) Client Feedback: See Faculty Advisor Feedback below.
11) Meeting Dates with Advisor: 1/31 9am-10 am, 2/14 9am-10am, 2/21 9am-10am
12) Faculty Advisor Feedback:
    Everything seems on track.

Faculty Advisor Signature: _____ Date: _____

Evaluation by Faculty Advisor

Faculty Advisor: detach and return this page to Dr. Chan (HC 209) or email the scores to pkc@cs.fit.edu

- Score (0-10) for each member: circle a score (or circle two adjacent scores for .25 or write down a real number between 0 and 10)

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Joshua Sheldon | 0 | 1 | 2 | 3 | 4 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |
| Izzy MacDonald | 0 | 1 | 2 | 3 | 4 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |
| Tanuj Kancharla | 0 | 1 | 2 | 3 | 4 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |
| Yash Jani | 0 | 1 | 2 | 3 | 4 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |

Faculty Advisor Signature: _____ Date: _____