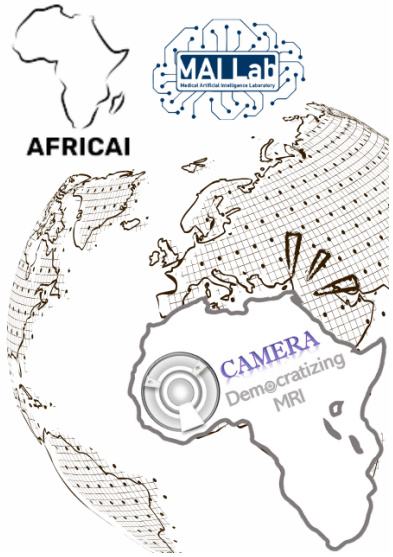
The Sprint AI Training for AfRican Medical Imaging Knowledge Translation

SPARK ACADEMY

In Deep Learning and Medical Imaging

22nd February - 9th August 2025

Train for Change, from Science to Practice



2025 PROGRAM GUIDE

Program Platform: https://event.fourwaves.com/spark

Program Overview: The ***Sp***rint ***A***I Training for Af***r***ican Medical Imaging ***K***nowledge Translation (SPARK) program is designed to train a new generation of African artificial intelligence (AI) experts in medical imaging who can train others. The program is in partnership with the African Imaging Network for Artificial Intelligence in Biomedical Imaging (AFRICAI), a Special Interest Group of the Medical Image Computing and Computational Intervention (MICCAI) Society, and hosted locally, by the Medical Artificial Intelligence (MAI) Lab, Lagos, Nigeria. We use a case-based learning approach and collective intelligence from various related fields (radiology, medical physics, computer science, neurology/neurosurgery, and oncology) to rapidly turn AI knowledge into action.

SPARK Academy February 15th, 2025

The **SPARK Academy** has trained and empowered 300 African researchers to address health inequities by providing training in cutting-edge AI innovations for medical imaging. This **free**, case-based, hands-on training brings together experts in medical imaging and AI to guide passionate learners in creating home-grown solutions for medical imaging diagnostics. Participants engage in seminars on imaging, image processing, and deep learning, culminating in the development of AI models for a specific need. For the past two years, SPARK has participated in the **MICCAI Brain Tumor Segmentation (BraTS)** Challenge, with learners developing top-performing models for automated tumour segmentation. This Year's program welcomes a new generation of researchers from Africa, Southeast Asia, and other underserved regions around the world to build their technical capacity, foster innovation, and strengthen collaborative networks that will create a sustainable impact in African healthcare through AI.

For more details on the program's **vision, mission, and approach, see the program platform**.

Objectives

The main objectives of SPARK Academy are:

1. Instill knowledge of machine learning (ML) and deep learning (DL) applications in medical imaging.
2. Teach skills in designing, implementing, and evaluating ML and DL architectures for medical segmentation.
3. Provide proficiency in transferable research skills, including study design, execution, and dissemination, with a focus on academic writing, publications, and science communication.
4. Create a collaborative ecosystem for effective interdisciplinary research in the development of innovative medical solutions.
5. Engage with the global AI imaging community to contribute to open-science initiatives.

Program Format:

- All training activities will be delivered through the **SPARK Academy Fourwaves program platform.**
    - Review the platform overview and how to use the platform and the Live APP, **Here**.
- Program guides and tutorial materials are provided on Github and Fourwaves.
- The official programming platform is Kaggle.
- **Fourwaves, Kaggle and GitHub require personal logins and single access and cannot be shared.**

Program Structure:

- Training is completed in 3 blocks (see below)
- Training is completed as a team, not as an individual.
    - Each candidate is enrolled as part of a team (see team composition in the program guide folder)
    - The foundation block is self-paced and is intended to be completed individually with mandatory mid-week team meetings.
    - All tutorial assignments, including during the foundation block, are completed as a team.
    - Each candidate participates in the hackathon and MICCAI BraTS Challenge as a team.
    - Teams comprise of 1 site director, 2-3 team coordinators, 1 team lead, and 10-12 team members.
    - To foster cross-regional and cross-discipline collaborations, some teams may include members from outside the country and at least 2 clinicians.
    - Team roles and assignments are in the **Team Composition** documentation in the program guide folder.

Program Expectations and Code of Conduct:

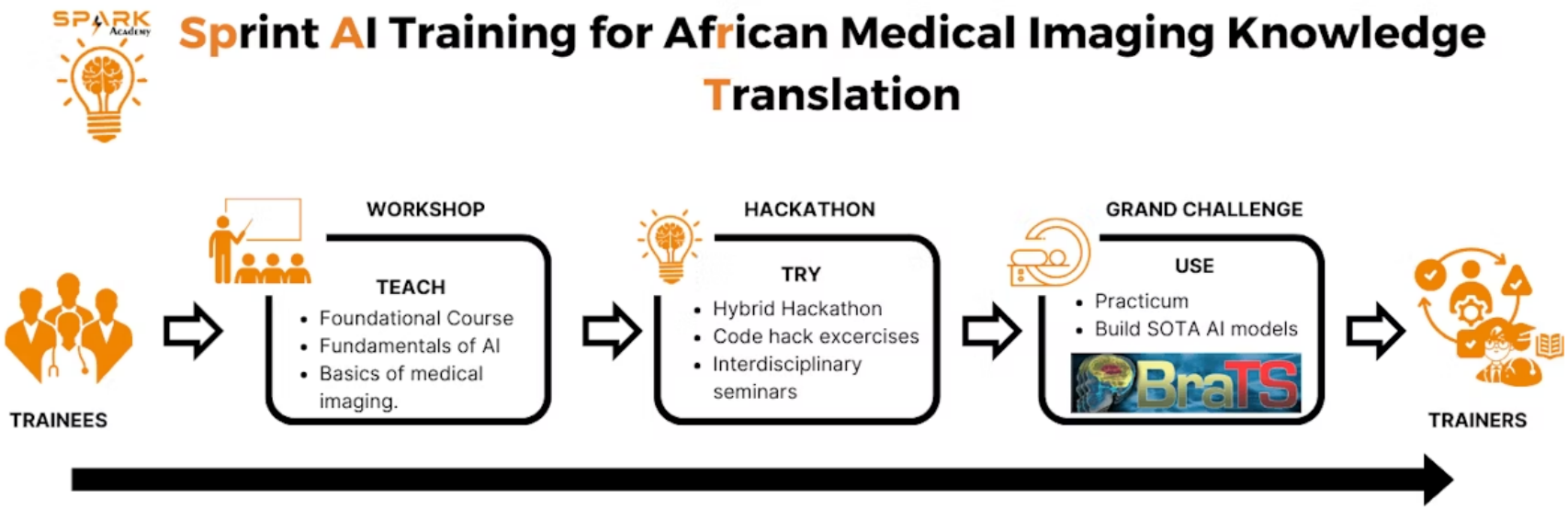
1. All participants are expected to be active team players.
2. All participants are expected to participate in all program activities including live lectures and tutorials.
3. All participants are expected to participate in completing all reading and lecture materials, assignments, milestones and deliverables.
4. All participants are expected to attend and participate in the hackathon, daily.

5. All participants of the SPARK Academy are expected to behave professionally and responsibly towards everyone both in-person and online during all formal and informal activities, regardless of location.
6. All participants are expected to review and understand the SPARK Academy code of conduct appended below, as well as on the **SPARK program platform**.

Program Contact information:

- General program information is in the **FAQ section** of the program platform.
- General program inquiry: SPARK Academy Team at **spark@mailab.io**
- For project-specific inquiries, including questions related to team assignments, hackathon projects, or team BraTS projects, contact your team supervisor.
- Follow SPARK Academy social channels for program updates; Twitter (**CAMERA** and **MAI Lab**) and **LinkedIn**.

Program Blocks (TTU):



1. **Teach: Ten-weeks Virtual Foundation Course. (February 22nd to May 3rd, 2025)**

   Learn the basics. Engage our self-paced online learning platform with ***mandatory midweek meetings and live weekend tutorials on Saturdays*** and discover fundamentals in imaging and computational science relevant to building advanced AI applications for medical imaging in ten weeks.

2. **Try: One Week Hybrid Africa-BraTS BrainHack 2025 (May 12th to May 16th, 2025)**

   Charge your creative adrenaline. Join six regional participants for a **one-week (M-F) hybrid hackathon** where we deconstruct and reconstruct top AI glioma diagnostic methods as well as engage in daily seminars, networking opportunities, and team-building capstone projects.

3. **Use: Six-week BraTS Practicum (May 24th to August 9th, 2025)**

GO for the win. Apply skills gained and create winning AI models for the MICCAI BraTS challenge. There are opportunities to win a monetary prize as the top African winning model and as the top-ranked method from around the world.

Tutorials and Assignment Submissions

- Each team submits one assignment/tutorial exercise/Capstone project or BraTS practicum exercises through the Team's leader.
- Submissions are pushed to Github ***(New in 2025)***.
- No late submission will be considered or reviewed *(**submission deadline: Every Friday at 11:59 pm East Africa Time**).*

Attendance

Attendance will be strictly monitored for both weekend tutorials and midweek meetings. If you need to be absent, please send a leave request via email, copying both the Team Captain and the Coordinator.

Participation and engagement will be tracked for all sessions, with contributions noted during discussions, labs, and group activities. This includes asking questions, contributing to discussions, collaborating with peers, and completing assigned tasks.

Requirements for graduation and receiving a certificate, or inclusion in any SPARK-related awards.

1. Minimum attendance of 70% in the foundational course, hackathon, and practicum.
2. Submission of your team's BraTS Africa Lighthouse Challenge Model and solutions.
3. Submission of your team's BraTS Africa short paper.
4. Submission of your team's GitHub code to the SPARK2025 CAMERA page.
5. Submission of your team's camera-ready paper for **arXiv**.

6. Creation of a **Hugging Face Space** for your method, including BraTS evaluation results and your clinical team member's evaluation.

Program Schedule

- Each block is outlined below.
- All tutorials and live events including hackathons are in ***East Africa Time***
- To complete each course or attend live training events, log into your Fourwaves account to access the program

SPARK 2025 FOUNDATIONAL COURSE CURRICULUM

February 22nd to May 3rd, 2025

Weekend Tutorial	Clinical & Imaging Primers & Concepts	Computing Basics	Weekend Tutorial
Week 1 February 22	**Imaging Physics Mid-Week Presentation** ● Introduction to medical imaging I. Overview of X-Ray, CT and US a. Anatomy of the X-ray tube b. Properties of X-rays c. Introduction to CT d. Principles of Ultrasound imaging e. Advantages of US imaging	**Introduction to Python** ● Setup and Installation ▪ Install Python, Google Collab or Kaggle setup and overview ▪ vs code ● Python Variables and Data Types ▪ Strings, Integers, Floats, Booleans, Lists, Tuples, Dictionaries ● Basic Data Structures ▪ Lists, Dictionaries, Tuples ● List comprehension ▪ Syntax and use-cases of list comprehension ● **Code versioning with GitHub**	***Lab/hands-on/assignment content:*** i. *Installing Python and setting up the environment (on VS code),* *ii. Getting started with GitHub and how to push their code* iii. *Creating and manipulating variables* *iv. Working with Lists and Dictionaries* *v. List comprehension exercises*
Week 2 March 1	Imaging Physics **Mid-Week Presentation** 1. Introduction to medical imaging II: Overview of MRI, and PET a. Production of MR Signal	**Python Basics and Introduction to NumPy** ● Control Structures ▪ If-Else statements, If-Elif-Else statements ▪ Loops (for, while)	***Lab/hands-on/assignment content:*** *i. Write conditions* *ii. Basic loop exercises* *iii. Basic NumPy operations (min, max, ..etc)*

	b. Relaxation times c. MR pulses d. Spin Echo (SE) techniques e. Special MR techniques f. MR artefacts	● Introduction to NumPy ▪ NumPy Arrays, Array Operations (addition, subtraction, multiplication, etc.) **Introduction to Object-Oriented Programming (OOP-1)** ● What is OOP? ▪ Principles of OOP: Encapsulation, Inheritance, Polymorphism, Abstraction ● Functions in Python ▪ Function Definition, Function Calling, Functions with Arguments, Return Statements ▪ Array slicing, reshaping, and indexing etc.	*iv. Array slicing and indexing* *v. 2d NumPy indexing* *vi. Creating and calling functions* *vii. Create more functions and combine them e.g SNR and CNR* *viii. Redo previous assignments with functions*
Week 3 March 8	Imaging Physics **Mid-Week Presentation** ● Introduction to medical imaging ii: How are images produced in MRI, US, X-ray, CT, and PET ● X-ray production ● Principles of CT image production ● X-ray tube and collimator	**Introduction to Object-Oriented Programming (OOP-2)** ● Python Classes and Object ▪ Creating Classes and Objects, Instance vs Class Variables, Object Manipulation ● Inheritance basics ▪ Inheriting from parent classes, Method Overriding	***Lab/hands-on/assignment content:*** *i. Create a Python class for medical patients (name, age, diagnosis) and a method to display patient details* *ii. Create a class for medical appointments and include a method to schedule an appointment* *iii. Implementing inheritance*

	● production of PET images **Maruf**		
Week 4 March 15	Imaging Physics **Mid-Week Presentation** ● Introduction to data visualization in healthcare and medical imaging ▪ Significance of Data Visualization in HC (epidemiology) and MI **Ken**	**[20%] Introduction to Data Visualization** ● Introduction to Matplotlib. ▪ Plotting techniques: Bar charts, Histograms, Scatter Plots, Line Plots ● Customizing plots ▪ Adding titles, labels, legends, axis formatting ● Creating clear visual reports ▪ Best practices for creating insightful visualizations **[60%] Week 1-4 review and mini-capstone** **[20%] Overview of Machine Learning: types and applications in healthcare.** ● Machine Learning Task: Classification, regression, synthesis, cluster, etc. ● Machine learning types: Supervised, unsupervised, and reinforcement learning ● Machine learning vs deep learning	***Lab/hands-on/assignment content:*** *i. Basic visualisation with Matplotlib* *ii. Customising plots for clarity* *iii. Implement a full Python program (medical chatbot) they should utilize functions and classes and what they have learned so far.*
Week 5 March22		**Introduction to Machine Learning Concepts**	***Lab/hands-on/assignment content:***

		● Introduction of Supervised Learning: Linear and Logistic Regression: Theory of Linear Regression ● Unsupervised Learning: Overview of K-means and hierarchical clustering ● Implementation of Machine Learning Methods ▪ Preparing numerical data for ML: data splitting, normalization, and feature selection. ▪ Linear regression implementation ▪ Clustering implementation ▪ Model Evaluation Metrics: Cross-validation, Confusion Matrix, Precision, Recall, F1 Score ● **After-school:** ▪ Classification Models: Overview of KNN, Decision Trees, Random Forests, Naive Bayes, SVM ▪ Ensemble methods: gradient Boosting and XGBoost.	*i. Load a .npy file and display basic information like mean, median, and missing values* *ii. Calculate and visualize the distribution of a dataset of patient ages* *iii. Split a dataset into training and testing sets* *iv. In a single script using the same dataset, Implement and evaluate the performance of Linear Regression using accuracy, precision, recall, and F1-score.* v. *Write a report summarizing the entire process from data cleaning to model evaluation, including which models worked best for the task and why.*
Week 6 March 29	Imaging Physics **Mid-Week Presentation** Basic Neuroanatomy and Imaging Planes ● Brain Anatomy Relevant to Glioma Imaging	**Medical data manipulation and preprocessing** ● Introduction to Image Processing: Image IO and Transformation ▪ Loading and saving medical data: DICOMS and NIFTI (Pydicom,	***Lab/hands-on/assignment content:*** *i. Load medical images and visualize them* *ii. Preprocess medical images and visualize the transformations*

	▪ MRI Brain anatomy, including cortical and subcortical structures, ventricles, brainstem, and cerebellum. ● MR Imaging Planes (Axial, Coronal, Sagittal) ▪ Introduction to MR imaging planes: axial, coronal, and sagittal slices.	SimpleITK/ITK, Nibabel, Neurodebain) ▪ Medical image (pre-)processing - Normalization - Rescaling - Reshaping - Registration - Skull striping ▪ Data augmentation in medical imaging: its meaning, when, and how to apply them ▪ Feature extraction and representation ▪ Data-loader in PyTorch	*iii. Augment medical images to increase dataset size* *iv. Write a data loader with PyTorch*
Week 7 April 5		**Convolutional Neural networks** ● Overview of biological vs artificial Neural networks ● Basics of Neural Network ● Neural Network Layers ▪ Activation Functions: ReLU, Sigmoid, and Softmax ▪ Loss functions: MSE e.t.c ▪ Optimizers ▪ Gradient Descent ▪ Pooling layers ▪ HRegularization: Dropout, Batch Normalization, L2	***Lab/hands-on/assignment content:*** *i. Implementing a convolutional layer* *ii. Implementing pooling layers in a CNN.* *iii. Build a complete CNN with convolutional, pooling, and fully connected layers.* *iv. Build a simple CNN model to classify medical images (e.g., X-rays, MRIs)*

		● Convolutional Neural Networks ▪ Basic Concepts: Convolution, feature maps, Activation function II, Pooling II (Max Pooling, Average Pooling, and Global Pooling), Fully Connected Layers, filters. ● Forward and backward propagation ● Parameters vs Hyperparameters (batch size, learning rate, optimizers, etc) ● Introduction to PyTorch ▪ Pytorch tensors and Autograd **After-school:** ● Other deep learning frameworks: TensorFlow, Caffe, and Keras	
Week 8 April 12	Imaging Physics **Mid-Week Presentation** MR Imaging Sequences and Protocols for Glioma ● Conventional Sequences ▪ Overview of T1-weighted, T2-weighted, pd, FLAIR, and Diffusion-Weighted Imaging (DWI). ● Contrast Enhancement in Glioma Evaluation	**U-Net for segmentation** ● Introduction to U-Net architecture ▪ Basic Medical Image Segmentation with U-Net ● Steps to train a U-Net ▪ Data preprocessing, Data Augmentation, Data loader, model initialization (Convolutional layers, filters, activations, loss function)	***Lab/hands-on/assignment content:*** i. *Train a simple Unet to segment MRI scans (code guided for full implementation)* *ii.* *Evaluate the model and visualize the results* *iii.* *Saving the trained models*

	▪ The role of gadolinium contrast in glioma imaging, including tumour characterization, blood-brain barrier disruption, and grading.	● Training Best Practices: Cross-validation, Leave-one-out Training Loops, Epochs, and Learning Rate Schedulers ● Saving and Loading Models: Model checkpoints, saving and restoring models **After-school:** ● Exploring architectures like U-Net for medical imaging segmentation	
Week 9 April 19	Neurosurgery **Mid-Week Presentation** Preoperative Planning and Diagnosis and Staging ● Imaging for Surgical Planning ▪ Imaging to assess tumour margins, proximity to eloquent brain areas (motor, speech), and surgical resection feasibility. ● Staging with Advanced Imaging ▪ Whole-brain imaging and functional mapping using techniques like fMRI and DTI to assess tumour spread and functional preservation.	● Examples of Using Pre-trained Models ▪ Fine-tuning pre-trained models (e.g., ResNet, VGG) for medical imaging ● Generative model ▪ Overview and applications of Autoencoders (VAEs)and Generative Adversarial Networks (GANs) ● Vision Transformers ▪ Introduction to Vision Transformers ▪ Introduction about SwinUNetr	***Lab/hands-on/assignment content:*** i. *Employ GAN to train an Unet and segment MRI scans (code guided for full implementation)* *ii. Employ SwinUNetr to segment MRI scans (code guided for full implementation)*

Week 10 April 20		Advanced Deep Learning Techniques ● Overview ▪ Fine-tuning, PEFT, Meta-Learning, knowledge distillation and Transfer Learning and their application in medical imaging ● Emerging Trends in Medical AI (Advanced Architectures) ▪ Introduction, review and evaluation of SOTAs: nnUNet, Transformers, SWIN UNetR, and Diffusion models for medical image segmentation	***Lab/hands-on/assignment content:*** *i. Reading assignment* *ii. Implement either Meta-learning or knowledge distillation to any clinical application (optional)*

Every Week starts with a virtual 2-3 hours tutorial on Saturday (1 hr 30 minutes lecture and 15 minute Q&A)
After school (Optional but Important)*: Participants are encouraged to explore the additional materials at their leisure to deepen their understanding.*

SPARK 2025 HACKATHON COURSE CURRICULUM

May 12th to May 16th, 2024, East African Time (EAT)

	Monday	Tuesday	Wednesday	Thursday	Friday
7:30 am Morning Coffee					
8:00 – 9:00 am AM Seminar	Intro to BraTS Intro to Africa-BraTS Challenge	Neuropathology of Gliomas	Imaging Physics – MRI of Gliomas	State of AI in Brain Tumor	Bioinformatics & Radiomics of early detection
9:00 – 11:00 am DeCode	Evolution of Medical Imaging - (MRI, PET, DTI, Imaging guiding surgery in gliomas) Intro to BraTs SSA 2025 Dataset	Code Hack	Neurosurgery of Gliomas Code Hack	Code Hack	Code Hack
11:00-12:00 pm Lunch Break					
12:00 – 2:00 pm Ubuntu	Live Coding with BraTS 2024 Authors	Team Exercise, Recode	Team Exercise, Recode	Team Exercise, Recode	Team Exercise, Recode

2:00 - 2:30 pm Afternoon Tea	**Team Photos**				
2:30 – 3:30 pm PM Seminar	Image processing and analysis of Brain Tumors	Neuroradiology of Gliomas	Team Exercise, Recode	Big Data, FAIR & Open Science	Capstone Project Presentations
3:30 – 4:30 pm Umoja	Team Exercise, Recode	Imaging Brain Tumors in Africa	Low-cost Clinical Deployment	How to Write MICCAI Papers	
4:30 pm Plenary					Closing Plenary
5:30 pm					**Team Photos** Group Dinner

All live events are in East Africa Time

The 3rd SPARK BraTS-Africa BrainHack

Code Hack & Team Exercise Tasks

Instructions:

1. Use the **Code Hack Session** to run your chosen model's code on Compute Canada and produce results that are similar to the reported model's performance.

2. Use the **Team Exercise Session** to work on the Capstone Project presentation or to continue to hack your code (i.e., the Code Hack Session).

3. **Capstone Project** Presentation: 5-minute presentation of the team's model implementation, performance and lesson learned.

Daily Activities:

Day	**Code Hack Task and Team Exercise**
Monday	**Project planning and data acquisition** ● Review Model's method paper: *Each team will be provided with papers and GitHub repositories (**for Unet, UNnetr, nnUnet, SwinUnetr, and GAN**) to review each paper and code and choose a model to use.* ● Review the model's code in Kaggle **Deliverables:** *1-page Report* ● Submit a summary of the model paper outlining: ○ Motivation for your model selection ○ **Model Details:** Name, Architecture (figure or table) ○ Identify model deficiencies & outline strategies to address them. ○ Start Preparing your 5-Minute Capstone Presentation (***See details on day 5***) ● **Submit Mid-program evaluation**

Tuesday	**Data Exploration and Preprocessing** ● Download Data set from Cancer archive and TCIA (2021) ● Perform exploratory data analysis ● Preprocess data for and design data loader for model training ● Transfer code from Github repo tho kaggle ● Start training model **Deliverables:** *1-page Report* ● Outline any challenges faced in implementing the model ● Continue working on your 5-Minute Capstone Presentation (***See details on day 5***)
Wednesday	**Model Selection and Training** ● Continue training your chosen model on 2024 BraTS data ● Implement ways to improve the model **Deliverables:** *1-page Report* ● Report preliminary results from model training ● Report model performance with the implementation of new strategies ● Outline any challenges faced in implementing the model ● Continue working on your 5-Minute Capstone Presentation (***See details on day 5***)
Thursday	**Model Training, Validation and Evaluation** ● Continue training your chosen model on 2024 BraTS data ● Compare your results with the model's reported (published) results **Deliverables:** *1-page Report* ● Update results from model training ● Update Identified model deficiencies & outline strategies to address them. ● Continue working on your 5-Minute Capstone Presentation (***See details on day 5***)
Friday	**Model Evaluation and Optimization**

	● Finalize any remaining model training evaluation ● Add updated results to the 5-Minute Capstone Presentation **Deliverables:** **Capstone Presentation** ● *5-Minutes no more than 8 slides* ● *Present a summary of:* ○ *The motivation for choosing the model includes the advantages of the method* ○ *The model architecture* ○ *Outline any observed or suspected model deficiencies* ○ *Results: performance of the model and if performance was replicated* ○ *Challenges faced in implementing the model* ○ *Introduce the proposed BraTS 2025 Challenge model*

SPARK 2025 PRACTICUM COURSE CURRICULUM

May 24th to August 9th, 2024

Weekend Tutorial	Medical Imaging Project Design??	Design Labs / Deliverables
Week 1 May 24	**Data Preparation** ● *Perform exploratory data analysis.* ● *Preprocess data for deep learning (DL) model training.* ▪ *Modify Pytorch data loader* ▪ *Data augmentation** **Model Selection and Training I** ● *Overview of Different Model Types: U-Net, V-Net, nnUnet, SwinUNetr, and other segmentation models.* ● *Criteria for Model Selection: Accuracy, interpretability, computational efficiency, and medical relevance.* ● *Comparing Models: Pros and cons of different segmentation models.* ● *Select a model for BraTS 2025* **Charles Delahunt (GH Labs)** *Optional	***Possible Lab/hands-on/assignment content:*** *i. Review the BraTS 2025 dataset and its features (multimodal MRI scans with tumour segmentation masks)* *ii. Preprocess the data to ensure that the model receives the correct input format (e.g., resizing images, normalizing pixel values).* *iii. Review three (3) example data loaders using different approaches* *iv. Provide tips on designing data loaders* *v. Split the data into training, validation, and test sets.* *vi. Show sample data automation pipelines.* *vii. Access code snippets of each model (U-Net, Attention U-Net, V-Net, nnUnet, SwinUNetr.. . as many as possible) using PyTorch* *viii. Compare training times, memory consumption, and inference speeds on the 2025 BraTs dataset.* **Deliverables:** *A report summarizing the criteria used (including literature review) for model selection and results from model comparison.*
Week 2 May 31	**Model Selection and Training II** ● *Setting Up the Training Environment*	***Possible Lab/hands-on/assignment content:*** *I. Initialize and configure the chosen model for training.*

	● *Train selected BraTS 2025 model*	II. *Set up data loading for the BraTS dataset.* III. *Use evaluation metrics (Dice, IoU) to assess model performance on the test set.* IV. *Train the model for a predefined number of epochs and observe training/validation performance.* V. *Monitor the training process using validation loss* VI. *Save model checkpoints after each epoch* **Deliverables:** *Visualize model predictions (overlaid on MRI scans) and compare them with ground truth masks.*
Week 3 June 7	**AI Project Design** ● *Defining the Project Scope* ▪ *Identifying the Problem, Defining the Objective, Understanding the Data* ▪ *Project design using SMART Goals* ● *Data Acquisition and Preprocessing* ▪ ----- ● *Choosing the Right Algorithms* ▪ *Selecting ML/DL Algorithms for the Problem (e.g., CNN, Transfer Learning, etc.)* ● *Model Evaluation and Iteration* ▪ *Hyperparameter Tuning, Model Performance Metrics (Accuracy, Recall, F1-Score)* **Model Training Continues**	***Deliverables:*** I. *Write a concise abstract summarizing your research on the application of your chosen model for brain tumour segmentation in SSA. It should include the following an introduction, the problem statement, methods, results, and conclusions.* ***Note: Must be between 250 and 300 words. The best team abstract wins a gift card.*** II. *Write the introduction section of your research paper, including context, literature review, research gap, problem statement, aim, and objective.* ***Note: A minimum of 1 page is required.*** III. *Using* ***Canva*** *or* ***PPTX*** *design a graphical representation of your model architecture.*
Week 4 June 14	**Scientific Writing** ● *Introduction to Scientific Writing*	***Deliverables:*** i. *Read and summarize a scientific paper related to AI in healthcare (e.g., deep learning for medical imaging)*

	▪ *Structure of Scientific Papers (Abstract, Introduction, Methods, Results, Discussion)* ● *Writing the Introduction* ▪ *Importance of Context, Literature Review, and Problem Statement* ● *Writing the Methodology Section* ▪ *Experiment Design, Data Collection and Preprocessing, Model Development* ● *Writing the Results and Discussion* ▪ *Presenting Results with Visualizations and Interpretation and Discussing Challenges* ● *Conclusion and Future Work* ▪ *Summarising Findings, and Future Directions* **Model Training Continues**	*ii. Write the Methodology section of your project report detailing the experiment design, data collection, preprocessing, and model development. Note: A minimum of 1/2 page is required.* *iii. Write the Results and Discussion section based on your model's performance, challenges, and insights. Create visualizations to present your results. Note: A minimum of 1/2 page is required.* *iv. Write the Conclusion and Future Work section of your project, highlighting findings and future research directions*
Week 5 June 28	Training Cont.: Hyperparameter Tuning and Validation ● *Continue training model and modifying hyperparameters* ● *Fine-tune DL model to optimize performance* ● *Revise Manuscript Draft* **Model Training Continues**	***Possible lab/hands-on/assignment content:*** *I. Implement hyperparameter tuning.* *II. Consider fine-tuning your model or implementing a pre-trained model for brain tumour segmentation* *III. Apply regularization techniques to improve model generalization.* **Deliverables:** ● *Report the impact of fine-tuning on model performance.* ● *Revise the manuscript and update the methodology, results, and discussion sections*
Week 6 July 05	**Week 5 Training Continues**	**Deliverables:** ● *Revise the manuscript and update the methodology, results, and discussion sections*

	Model Training Continues	
Week 7 July 12	**Training Cont.: Model Evaluation and Optimization** ● *Identify model deficiencies & outline strategies to address them.* ● *Optimize the model and the training process based on the strategies outlined above.* ● *Submit Draft of MICCAI paper*[1] ***Model Training Continues***	***Deliverables:*** ● *Error Analysis: Identifying common misclassifications and areas where the model underperforms.* ● *Visual Inspection: Examining segmentation results to spot patterns in errors.* ● *Develop a plan to address identified deficiencies, including data augmentation, model architecture adjustments, and regularization techniques.* ● *Implementing Identified Strategies: Applying the outlined strategies to improve model performance.* ● *Use plots and images to illustrate model performance.* ● *Finalize the manuscript, ensuring it meets MICCAI submission guidelines.* ● *Prepare and submit the draft for review*
Week 8 July 19	**Training Cont.: Model Evaluation and Optimization** ● *Optimize the model and the training process.* ● *Revise Manuscript Draft* ***Model Training Continues***	***Deliverables:*** ● *Revise the draft manuscript and update the methodology, results, and discussion sections based on feedback from reviewers*
Week 9 July 26	**Model Publication and Reporting** ● *Revise Manuscript Draft*	**Deliverables:** ● *Revise the draft manuscript and update the methodology, results, and discussion sections based on feedback from reviewers*

[1] ***Reporting method & results on training and validation data. The only difference with the final paper submission should be the inclusion of the testing results in the camera-ready submission***

	Short paper submission deadline: July 31st ***Model Training Ends***	● *Submit the MICCAI Short paper to the MICCAI Submission site.* ● *Group Presentation of MICCAI paper*
Week 10 August 2	**Model Containerization and Test Evaluation** ● *ML-Cube Containerization: BraTS* ● *BraTS Hugging Face Space—Mandatory* ***Containerized algorithm submission deadline: August 15th***	***Possible Lab/hands-on/assignment content:*** *I. Install MLCube and its dependencies (Docker, Singularity).* *II. Define the MLCube configuration for the brain tumour segmentation model.* *III. Run the MLCube container on a local machine and a cloud environment.* *IV. Deploy the trained brain tumour segmentation model on Hugging Face Spaces.* *V. Share the model with the community and gather feedback.*
Week 11 August 9	**After SPARK, What's Next? Career Paths in Medical Imaging and AI** ● *Importance of AI in Healthcare* ● *Clinical Roles* ▪ *Radiologist* ▪ *Radiologic Technologist* ● *Technical Roles* ▪ *Medical Imaging Scientist* ▪ *AI Research Scientist* ● *Data Science and Engineering Roles* ▪ *Data Scientist* ▪ *Machine Learning Engineer* ● *Healthcare IT and Informatics Roles* ▪ *Health Informatics Specialist* ▪ *Clinical Data Analyst*	***Possible Lab/hands-on/assignment content:*** *I. Report the final performance metrics of the model, including Dice Similarity Coefficient and Intersection over Union.* *II. Create visualizations to illustrate the segmentation performance on test data.* *III. Interpret the results and discuss their significance.* *IV. Revise the short paper submission manuscript and update the methodology, results, and discussion sections and include test results and conclusions* *V. Complete end of Program Evaluation* *VI. Summit camera-ready 10-page manuscript **on or before September 17th, 2025***

	• *Emerging Roles*
	  ▪ *AI Ethicist*
	  ▪ *AI Product Manager*
	
	Introduce COMPASS, OYFM, AFRICAI, and the MICCAI Rise	

Each week starts with a 2-3 hr virtual weekend tutorial on Saturday (1 hr 30 min overview & 45 min Q&A / review of exercises).

Code of Conduct

SPARK Academy is dedicated to providing a harassment-free experience and safe environment for all, regardless of race, cultural affiliations, gender, nationality, beliefs, age, or disability. Indecent imagery is not appropriate at any of the Academy's events including virtual and in-person events.

All attendees, speakers, and volunteers are expected to comply with this code of conduct and violations of its standards may result in sanctions or expulsion from participating in events, at the discretion of the Academy Team. Upholding the standards of behaviour is mandatory to maintain SPARK's integrity and create a positive environment.

Expected behavior

All attendees, speakers, and volunteers at SPARK events must:

1. Behave professionally and responsibly towards each other, both in-person and online, during all formal and informal social activities, regardless of location.
2. Respect each other and avoid making judgments based on race, gender, nationality, beliefs, age, or disability.
3. Refrain from any forms of harassment, bullying, or discrimination towards fellow participants.
4. Adhere to the guidelines and instructions given by SPARK organizers and staff during events.
5. Maintain confidentiality of any sensitive information shared during events.
6. Avoid engaging in any illegal or unethical behaviour.

Unexpected behaviour

1. Behaving in a manner that is disruptive or disrespectful towards other participants, staff, or the event itself.
2. Using language that is inappropriate, disrespectful, or offensive towards other participants, staff, or the event itself. 3. Engaging in any illegal or unethical behaviour, such as theft, plagiarism, vandalism, or fraud.
4. Disobeying or ignoring the guidelines and instructions given by SPARK organizers and staff during the event.

5. Engaging in any behaviour that may pose a threat to the safety or security of other participants, staff, or the event itself. 6. intentionally causing damage to the event venue, equipment, or other property.
7. Engaging in any form of inappropriate or unwanted physical contact towards other participants or staff.
8. Violating the confidentiality of any sensitive information shared during the event.
9. Using SPARK events or platforms for personal or commercial gain without prior authorization from the organizers.

Recording Policy: Online events may be recorded or live streamed, but only with the express written permission from SPARK Academy and the authors/owners of the content. Any unauthorized recordings will violate ethical and legal standards.

Reporting Process: To report any concerns regarding the violation of the aforementioned guidelines, please email the SPARK Academy organizers at spark@mailab.io.