Designing a Federated Learning-Driven Collaborative Diagnostic System for Metastatic Breast Cancer

Reducing Long Diagnosis Delays and Improving Patient Survival Outcomes in Developing Countries

INTRODUCTION

Breast cancer is the leading cause of cancer mortality [1]. Breast cancer patients in developing countries suffer from the highest mortality rates in the world [2].

- These high mortality rates are attributed to long diagnosis delays that could stretch upwards of 15 months [3]. The average number of pathologists per head of population in the Sub-Saharan countries is 50-70 times less than that in the US and UK.

Figure 1. World map of breast cancer mortality rates (all ages), showing high mortality rates in Sub-Saharan Africa, South Asia and South America [2]

EXPERIMENT 1: Federated Learning Integrates Data to Improve Cancer Diagnoses

OBJECTIVE 1

Develop a deep learning (DL)-driven diagnostic system to standardize and automate diagnosis.

OBJECTIVE 2

Develop an efficient and mobile-ready system enabling applications in various environments.

OBJECTIVE 3

Develop a privacy-preserving federated learning (FL) system to leverage global data.

EXPERIMENT 2: Federated Learning Adapts to Lower-Quality Images at Local Sites

Table 1. Diagnostic performance of local models and the federated model (average ROC AUC ± Standard Deviation), tested on respective image data at individual sites (Generated by William Gao)

The FL model showed improved diagnostic performance on lower quality test images at site C3 compared to the local models built at C1, C2, and C3. FL models can improve local diagnostic accuracy on lower quality images by leveraging data from other sites to adapt to variations in local data.

REFERENCES