Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	06 May 2023
Team ID	NM2023TMID17489
Project Name	CancerVision: Advanced Breast Cancer Prediction With Deep Learning

Technical Architecture:

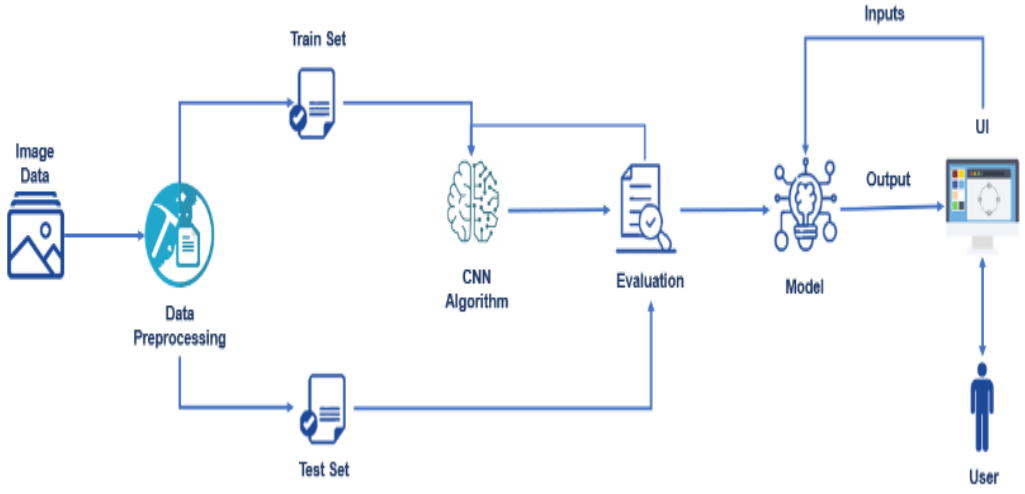

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	Deep Learning Models	Image classification tasks, including breast cancer prediction.And analyze mammogram images and extract meaningful features for accurate predictions.	Convolutional Neural Networks (CNNs): TensorFlow, PyTorch, Keras
2.	Medical Imaging Data	Large datasets of labeled mammograms are required to develop robust prediction models. These datasets can be obtained from hospitals, medical research institutions, or publicly available repositories.	DICOM ,PACS
3.	Preprocessing Techniques:	Image enhancement, noise reduction, and normalization are applied to mammogram images before feeding them into deep learning models. Improve the quality and consistency of the input data, enhancing the model's performance	Image processing libraries: OpenCV, scikit-image, PIL (Python Imaging Library)
4.	Transfer Learning	Pre-trained deep learning models that have been trained on large-scale image datasets.	Pre-trained models: ResNet, VGG, Inception, DenseNet Frameworks: TensorFlow, PyTorch, Keras
5.	Data Augmentation:	Artificially increase the size of the training dataset & helps to introduce more diversity into the training data, reducing the risk of overfitting and improving generalization capabilities.	Image augmentation libraries: imgaug, Albumentations

6.	GPU Acceleration	Capable of parallel processing and provide the necessary computational power to handle large datasets and complex models efficiently.	INVIDIA CUDA toolkit for GPU acceleration
7.	Model Evaluation Metrics	To assess the performance of breast cancer prediction models.Also provide insights into the model's effectiveness and help compare different models.	Python libraries: scikit-learn, TensorFlow, PyTorch
8.	Deployment Frameworks	To integrate the trained model into a larger software system or create user-friendly applications for clinicians and radiologists.	TensorFlow, PyTorch, or Keras.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Accuracy	accurately predicting the presence or absence of breast cancer.	Deep learning models: TensorFlow, PyTorch, Keras Evaluation metrics: scikit-learn, TensorFlow, PyTorch
2.	Speed and Efficiency	The prediction system should be efficient and capable of delivering results in a reasonable time frame.	Technology used

S.No	Characteristics	Description	Technology
3.	Scalability	designed to handle large volumes of data and be scalable to accommodate increasing data sizes and user demand.	Distributed computing frameworks: Apache Spark, TensorFlow distributed training, PyTorch distributed training Cloud computing platforms: Amazon Web Services (AWS), Google Cloud Platform (GCP), Microsoft Azure Integration with Existing Workflows:
4.	Real-time or Near Real-time Performance	The system should provide predictions quickly enough to support timely decision-making and patient care.	High-performance computing (HPC) infrastructure Streaming frameworks: Apache Kafka, Apache Flink
6.	Generalization	Perform well on unseen data from different sources or demographics.Techniques like data augmentation, transfer learning, and cross-validation can help improve generalization.	Data augmentation libraries:Albumentations Transfer learning: TensorFlow, PyTorch, Keras
7.	Interpretability and Explainability	Making it difficult to understand how they arrive at their predictions.	Attention mechanisms: TensorFlow, PyTorch Saliency maps: TensorFlow, PyTorch Explainable AI libraries: SHAP (SHapley Additive exPlanations), LIME (Local Interpretable Model-agnostic Explanations)
8.	Integration with Existing Workflows	Involve interoperability with existing software systems and compliance with relevant standards,	Interoperability standards: DICOM (Digital Imaging and Communications

S.No	Characteristics	Description	Technology
		ensuring a smooth integration into the clinical environment.	in Medicine), HL7 (Health Level Seven International) Integration frameworks: Flask, Django, FastAPI for web service development EHR integration: FHIR (Fast Healthcare Interoperability Resources) standards