Project Design Phase-I

Solution Architecture

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Team ID	NM2023TMID00113
Project Name	Cognitive Care: Early Intervention for Alzheimer's Disease

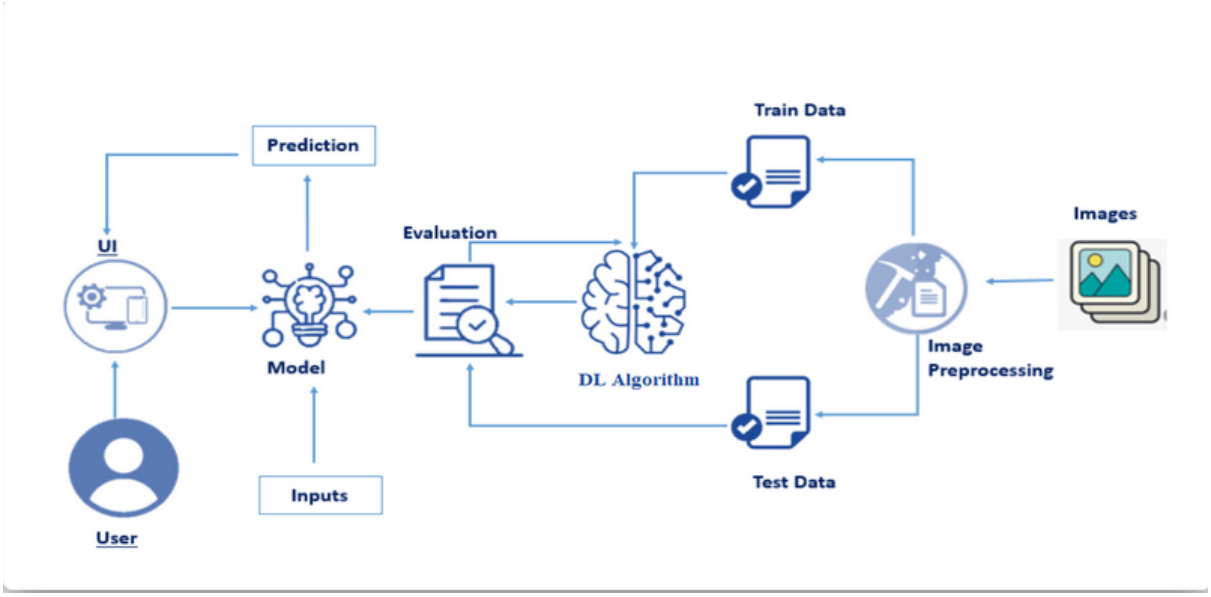
General Solution Architecture

The solution architecture for an AI-based MRI classification model typically includes the following components:

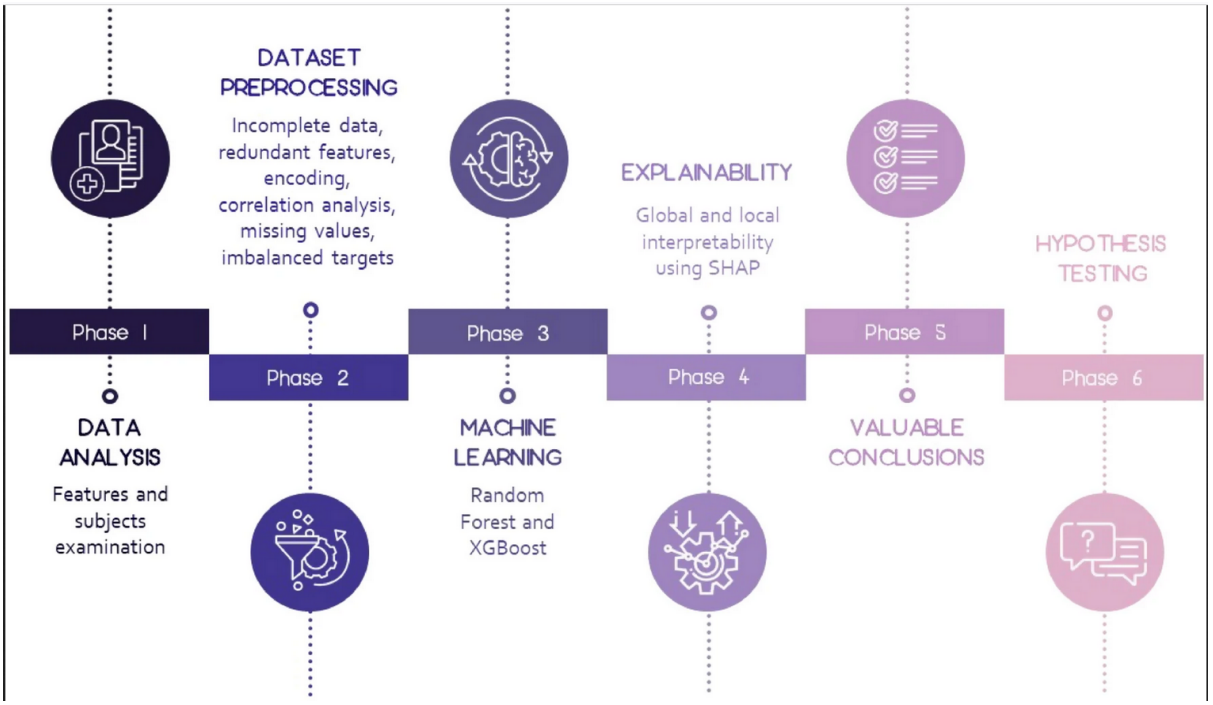
1. Data collection and preprocessing
2. Feature extraction
3. Model development
4. Model evaluation
5. Model deployment
6. Continuous learning

A Block Diagram Visualization Of Our Solution Architecture is presented below

Simplified Model:



ML Workflow:



Software Architecture:

The software architecture will consist of a client-server model, with the client application running on a healthcare professional's device and the server application running on a cloud-based platform. The client application will provide an intuitive interface for the user to upload patient MRI scans and view the AI-generated diagnosis results. The server application will house the AI models for MRI classification and provide the necessary compute power to process the large amounts of data generated by the client application.

The solution will be developed in multiple phases, starting with the design and development of the AI models for MRI classification. The models will be trained on large datasets of MRI scans to ensure high accuracy in diagnosis. The client-server application will then be developed, integrating the AI models into the server application and designing the user interface for the client application. In the final phase, rigorous testing and quality assurance measures will be implemented to ensure the software's reliability and accuracy.

Project Stages :

1. **Data collection and Pre-processing:** In this step, MRI scans of patients are collected and pre-processed to remove any unwanted artifacts and noise. This is an important step as it ensures that the quality of data used for model training and development is of high quality. Pre-processing techniques may involve filtering, noise reduction, and image enhancement techniques to improve the accuracy of the MRI scans.

2. **Feature extraction:** Once the MRI scans are pre-processed, AI algorithms are used to extract features from them. These features can include shape, size, texture, and intensity of different regions of the brain. Feature extraction is a crucial step in the development of the AI model, as it determines the predictive power of the model. Different algorithms and techniques can be used for feature extraction, such as Principal Component Analysis (PCA), Independent Component Analysis (ICA), and Wavelet Transform.
3. **Model development:** In this step, the extracted features are used to train and develop an AI model using machine learning algorithms such as deep learning. The choice of algorithm and architecture depends on the nature of the problem and the type of data. Deep learning algorithms, such as Convolutional Neural Networks (CNNs), are commonly used for MRI classification problems due to their ability to extract hierarchical features from data.
4. **Model evaluation:** The developed model is evaluated to ensure that it meets the desired performance criteria. Evaluation metrics such as accuracy, sensitivity, specificity, and area under the curve (AUC) are used to assess the performance of the model. The model may need to be fine-tuned and optimized based on the evaluation results.
5. **Model deployment:** The developed model is then deployed in a healthcare institution's IT infrastructure to process new MRI scans and make diagnostic predictions. The model may be integrated with existing electronic health record systems for seamless data exchange and processing.
6. **Continuous learning:** As new data becomes available, the model can be re-trained and updated to improve its accuracy and reliability. This process of continuous learning is essential to ensure that the model remains up-to-date with the latest data and trends.