Architecture Document

Data Collection:

Public Datasets:

Alzheimer's Disease Neuroimaging Initiative : A large-scale study providing MRI, PET, and clinical data for Alzheimer's research.

Kaggle: Public datasets, including some related to Alzheimer's disease, might be available.

Microservices :

- **Breaking Down the System:** Divide the system into smaller, independent services that can be developed, deployed, and scaled independently.
- **Example Services:**
    - **Image Preprocessing Service:** Handles image normalization, augmentation, and noise reduction.
    - **Feature Extraction Service:** Extracts features using traditional or deep learning methods.
    - **Model Training Service:** Trains and evaluates machine learning models.
    - **Prediction Service:** Provides real-time predictions based on new input data.

Data set : https://drive.google.com/file/d/1pQAUGlE_3zoub6HKPo8yALqL7TiEJmDq/view?usp=sharing

Data Processing:

Preprocessing:

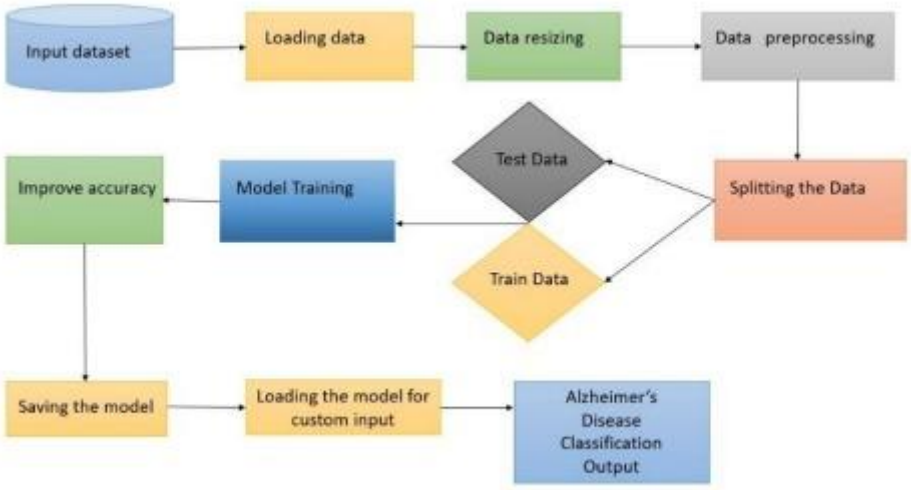
Normalization: Adjust image intensity values to a common range to prevent bias.

Augmentation: Create variations of existing images (e.g., rotations, flips, zooming) to increase dataset size and improve model generalization.

Registration: Align images from different patients or time points to ensure anatomical consistency.

Serverless Functions

- **On-Demand Execution:** Utilize serverless functions (e.g., AWS Lambda, Google Cloud Functions) to execute code without managing servers.
- **Cost-Efficiency:** Pay only for the resources consumed during function execution.
- **Example Functions:**
    - Preprocessing functions
    - Feature extraction functions
    - Model training functions



Architecture diagram

Feature Extraction:

Traditional Methods:

- **Statistical Features:** Calculate measures like mean, standard deviation, skewness, and kurtosis to capture image characteristics.
- **Texture Features:** Extract information about image patterns using techniques like gray-level co-occurrence matrices (local binary patterns).
- **Shape Features:** Describe the geometric properties of brain structures using methods like principal component analysis or Fourier descriptors.

Deep Learning Approaches:

- **Convolutional Neural Networks (CNNs):**
    - **Pre-trained Models:** Utilize pre-trained CNNs (e.g., VGG, ResNet) on large-scale image datasets (e.g., ImageNet) to extract high-level features.
    - **Fine-tuning:** Adapt pre-trained models to the specific task of Alzheimer's detection by retraining the final layers on the medical image dataset.

Data Exchanges :

The frequency of data exchanges for an Alzheimer's detection and monitoring project will depend on several factors, including:

- **Data Source:** If data is collected from real-time sources (e.g., wearable devices, continuous monitoring systems), the frequency of data exchange will be higher.
- **Monitoring Frequency:** The desired frequency of patient monitoring will determine how often data needs to be exchanged. For example, daily monitoring might require daily data exchanges, while weekly monitoring could involve less frequent exchanges.

- **Model Update Frequency:** If the machine learning model is updated regularly (e.g., based on new data or improved algorithms), data exchanges will be necessary to incorporate the new model and provide updated predictions.
- **System Architecture:** The chosen system architecture (e.g., microservices, event-driven) will influence the frequency of data exchanges between components.

Here are some potential scenarios for data exchange frequency:

- **Real-time Monitoring:** Data exchanges could occur every few minutes or seconds to provide immediate feedback and detect changes in patient status.
- **Daily Monitoring:** Data exchanges might happen once a day to collect and process data from wearable devices or other sources.
- **Weekly or Monthly Monitoring:** Less frequent exchanges could be sufficient for less time-sensitive monitoring scenarios.

It's important to carefully consider the specific requirements of the project and the desired level of monitoring to determine the appropriate frequency of data exchanges.