Alzheimer's Disease Prediction in the Elderly: Requirement Analysis Document

1. Introduction

1.1 Purpose

This document aims to establish the requirements for an advanced predictive model for Alzheimer's disease in the elderly, leveraging both existing dataset parameters and additional data collection methodologies to improve prediction accuracy and facilitate early intervention.

1.2 Scope

This project encompasses the augmentation of baseline demographic, clinical assessment, and neuroimaging data with novel data types, including physiological, behavioural, and environmental metrics, to create a multifaceted predictive model.

2. Project Overview

2.1 Objectives

- To create a predictive model that can be seamlessly adopted by healthcare practitioners for the early identification and management of Alzheimer's disease in elderly patients.
- To prioritize ethical data collection, ensuring privacy compliance and informed participant consent.

2.2 Target Audience

- Healthcare providers specializing in geriatric care and neurology.
- Researchers focusing on Alzheimer's disease.
- Elderly individuals and their caregivers.

3. Data Requirements

Current Dataset Overview:

- **Demographic Information**: Age, gender (M/F), and education (EDUC).
- **Clinical Assessments:** MMSE- Mini Mental State Examination (cognitive function), CDR- Clinical Dementia Rating.
- **Neuroimaging Metrics**: eTIV - estimated total intracranial volume, nWBV - Normalize whole brain volume, ASF – Atlas Scaling Factor (brain structure and volume).

Additional Data Collection Requirements:

- **Behavioural and Environmental Data:** Usage patterns from GPS trackers and home monitoring systems (motion sensors and video surveillance) to assess daily routines and spatial orientation.
- **Advanced Neuroimaging:** Additional MRI scans for detailed brain analysis.
- **Genetic Markers**: Collection of genetic data focusing on alleles associated with Alzheimer's disease.

4. Methodology

4.1 Data Collection and Management Strategy

- **Data Review and Cleanup:** Begin with a comprehensive review of the existing dataset to identify and rectify any inconsistencies, missing data, or outliers. This step ensures the data's quality and reliability for predictive modelling.
- **Data Enrichment Plan:** Develop a strategy to enrich the current dataset with additional parameters identified as valuable for Alzheimer's disease prediction. This includes integrating new data types in a manner that aligns with the existing data structure.

Data Management and Security

- **Secure Infrastructure:** Upgrade and maintain a secure data storage and processing infrastructure that complies with privacy regulations and ethical guidelines. This includes implementing robust encryption and access controls to protect participant information.
- **Real-Time Integration and Analysis Platform:** Enhance a platform capable of integrating diverse data types in real-time, from structured medical records to continuous data streams from wearable devices.

4.2 Data Analysis Plan

- Employ machine learning algorithms to analyse the enriched dataset, identifying key predictors of Alzheimer's disease.
- Iterate on the predictive model based on ongoing data collection and feedback from initial healthcare provider deployments.

4.3 Implementation and Evaluation

- Conduct pilot tests of the predictive model within select healthcare settings.
- Refine the model based on real-world performance metrics.

5. Conclusion

This document outlines a comprehensive approach to enhancing Alzheimer's disease prediction in the elderly. By integrating a wide array of data sources with existing demographic, clinical, and neuroimaging data, the project aims to develop a predictive model that improves early diagnosis and intervention strategies, thereby enhancing the care and management of elderly individuals at risk for Alzheimer's disease.