

# Report: Feasibility of Alzheimer's Disease Prediction

## 1. Introduction

Alzheimer's disease is a progressive neurodegenerative disorder that affects cognitive function. Early detection is crucial for timely intervention, yet many prediction models require medical data that is not easily accessible to the general public. This report evaluates the feasibility of predicting Alzheimer's disease using accessible data such as demographic and cognitive assessment information. The dataset provided includes both accessible and specialized medical data, which helps us explore the viability of developing a model based on easily accessible features.

## 2. Dataset Overview

The dataset used for this analysis includes the following features:

- **Accessible Features:**
  - **Age:** Age of the subject.
  - **Gender (M/F):** Gender of the subject.
  - **Education (EDUC):** Years of education.
  - **Socioeconomic Status (SES):** A measure of the subject's socioeconomic background.
  - **Mini-Mental State Examination (MMSE):** A widely used cognitive assessment.
- **Specialized Medical Features:**
  - **Estimated Total Intracranial Volume (eTIV):** Requires MRI scan.
  - **Normalized Whole-Brain Volume (nWBV):** Requires MRI scan.
  - **Atlas Scaling Factor (ASF):** Requires MRI scan.

Additionally, the dataset includes diagnostic and clinical features:

- **Group:** Alzheimer's diagnosis status (e.g., Nondemented, Demented).
- **Clinical Dementia Rating (CDR):** A measure of dementia severity.
- **Visits and MR Delay:** Information on the frequency and delay of visits.

### 3. Accessible Data and Prediction Feasibility

Given that certain medical features like eTIV, nWBV, and ASF are derived from MRI scans, they are less accessible to the general public. The following factors were considered to assess the feasibility of building a prediction model with only accessible data:

- **Demographic Data (Age, Gender, Education):** These features are readily available and can be collected during routine medical checkups.
- **Cognitive Assessment (MMSE):** The MMSE is a standard screening tool in many clinical settings and can be easily administered by healthcare professionals without advanced equipment.
- **Socioeconomic Status (SES):** Although not a direct medical metric, SES is often collected during patient intake in medical facilities.

Using accessible data such as **age, gender, education, SES, and MMSE scores** is feasible for prediction models. These features are commonly used in initial screenings for Alzheimer's disease and can provide early indications of cognitive decline, though without the precision of neuroimaging data.

### 4. Accuracy Considerations

- **Model Accuracy with Accessible Data:** Using accessible data can still offer valuable predictions, especially when demographic and cognitive assessment data is combined. However, the model's predictive power may be reduced compared to one that includes neuroimaging features (e.g., eTIV, nWBV). Cognitive assessments like the MMSE provide strong predictive signals but may not fully capture early neurodegenerative changes.
- **Model Accuracy with Specialized Medical Data:** Including medical data such as neuroimaging volumes (eTIV, nWBV) will likely improve the accuracy of Alzheimer's disease predictions, as these features directly measure brain structure changes associated with the disease. However, this requires expensive and specialized equipment (e.g., MRI), which is not widely available to all patients.

## 5. Research Insights: Can Alzheimer's Prediction Be Done Using Accessible Data?

Studies have shown that cognitive assessments like the **MMSE** and demographic information can be effective in predicting Alzheimer's disease progression. Models based solely on accessible data may not be as accurate as those incorporating specialized imaging, but they can still provide valuable insights for early detection. Research supports the use of **age, gender, education, and MMSE** as strong predictors, especially when neuroimaging is not feasible.

### Summary of Research Findings:

- Cognitive assessments such as the MMSE can detect early signs of dementia.
- Demographic factors such as age, education, and gender are reliable predictors of Alzheimer's disease.
- Socioeconomic factors (SES) are associated with health outcomes and can enhance prediction models.

## 6. Conclusion

- **Feasibility:** It is feasible to develop an Alzheimer's disease prediction model using only accessible data such as age, gender, education, MMSE scores, and SES. While the model may not reach the accuracy levels achievable with specialized medical data, it can still serve as a valuable tool for early detection in settings where MRI scans and other advanced tests are unavailable.
- **Recommendation:** For scenarios where medical resources are limited, a simplified model based on accessible data is deployed as an early detection tool. In healthcare settings with access to neuroimaging, incorporating these features would improve accuracy and reliability.