# MemoTag AI/ML Task Report

## Objective

To develop a basic AI/ML pipeline that analyzes raw voice recordings and extracts features to identify potential indicators of early cognitive decline, using unsupervised learning techniques.

## Key Features Extracted

The pipeline extracted the following audio-based features:

- ZCR (Zero Crossing Rate): Indicates speech clarity.
- RMSE (Root Mean Square Energy): Loudness/energy of speech.
- Spectral Centroid: Reflects articulation and control.
- Spectral Bandwidth: Captures vocal variation.
- Rolloff: Related to voicing and speech sharpness.
- MFCC Mean: Abstract vocal characteristics.

Most insightful features: MFCC Mean, Spectral Centroid, and ZCR.

## ML Method Used

Method: Unsupervised Clustering (KMeans)

- Features were normalized using StandardScaler.
- PCA used for dimensionality reduction and visualization (optional).
- KMeans helped detect outlier voice samples without needing labeled data.

## Potential Next Steps

- Add text-based features like pauses, hesitation markers.
- Use real clinical data with expert annotations.
- Incorporate speech-based cognitive tests.
- Combine voice with facial or gesture data.
- Explore deep learning methods if labeled data is available.

- Package into an API that returns a risk score from voice input.

## Summary

This proof-of-concept demonstrates a simple yet effective voice processing pipeline. With clinical data and text-based features, this system can evolve into an early cognitive screening tool.