

Early Diagnosis of Neurological Disorders by Detecting Irregularities in Speech

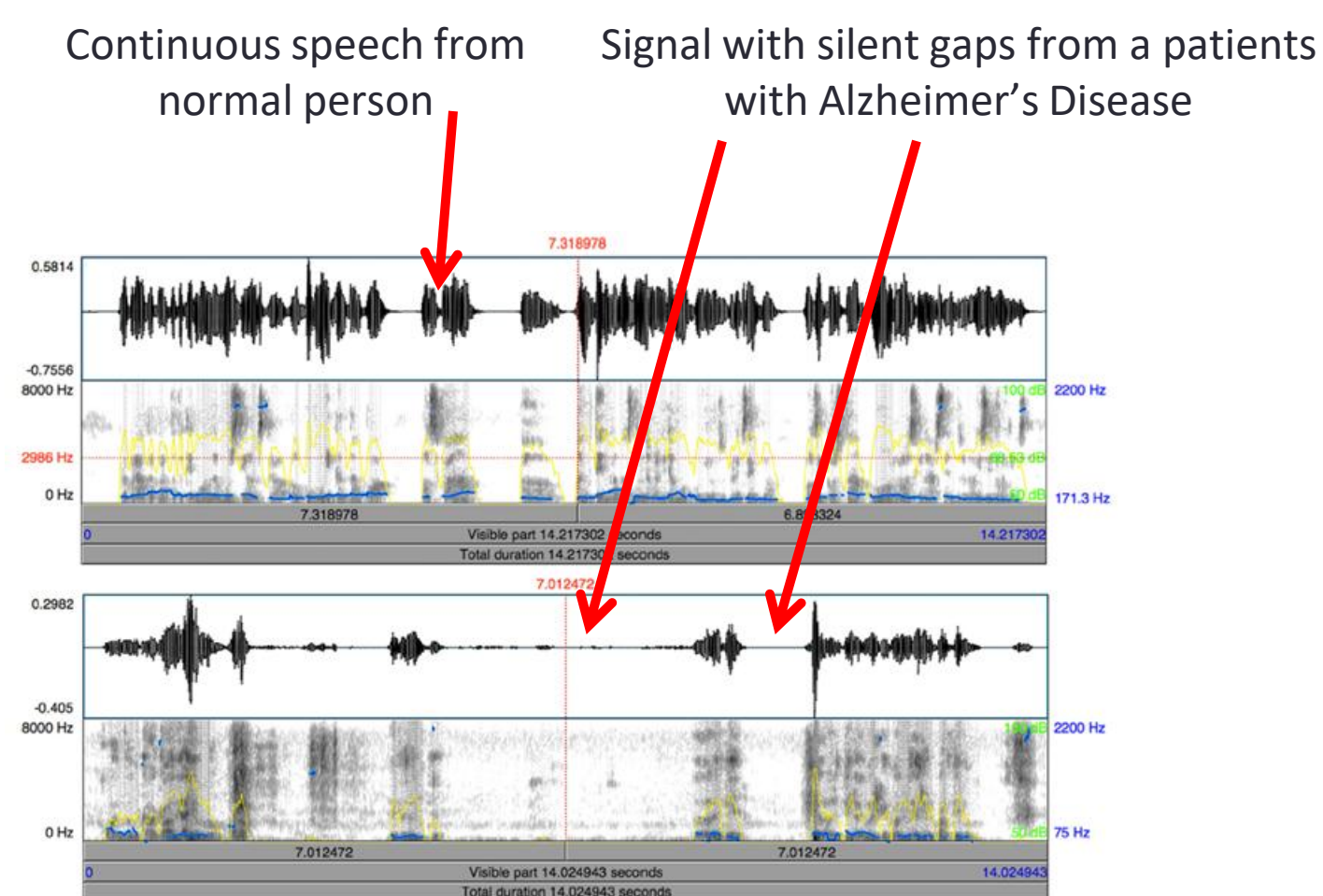
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MOTIVATION

- Early diagnosis of neurological diseases such as Parkinson's, Alzheimer's, Dementia etc.
- Almost all patients show signs of some sort of impairment in speech.
- Early diagnosis of neurological diseases may mitigate the effects.
- With the bandwidth increase in mobile devices, it is possible to obtain speech recording from the patients.

Speech signal examples



Speech signal and spectrogram for a normal person and a patient with Alzheimer's disease

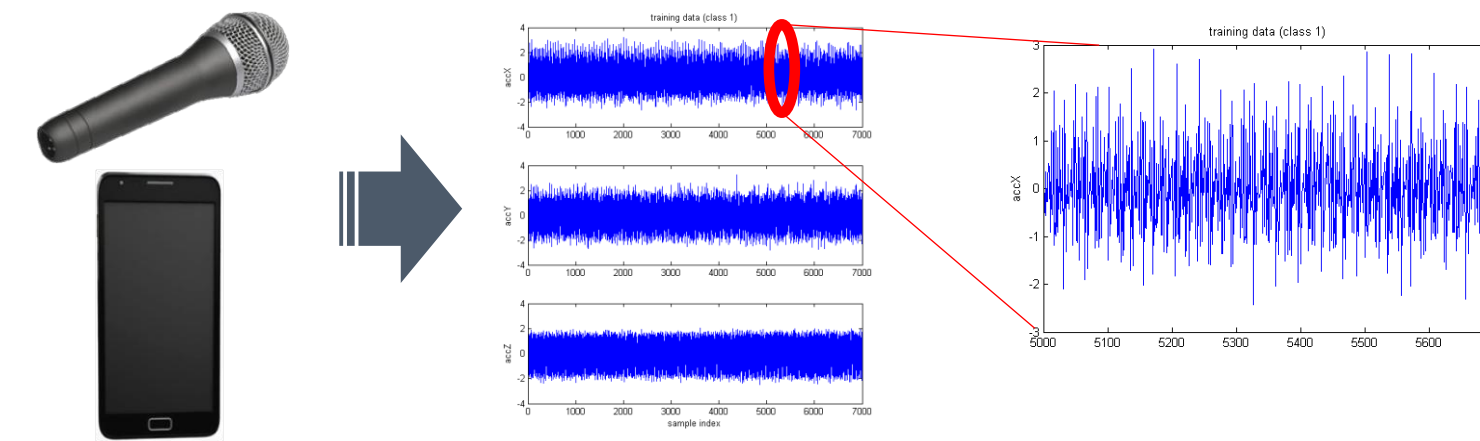
PROBLEM

- Relevant feature extraction is required.
- Develop appropriate machine learning methods.
- Differentiate neurological symptoms from symptoms generated from other diseases.
- Early detection of these diseases to mitigate the effects and increasing the gestation period.

METHOD

Data Acquisition and Sensors

- Speech signal: Speech signals from microphones.

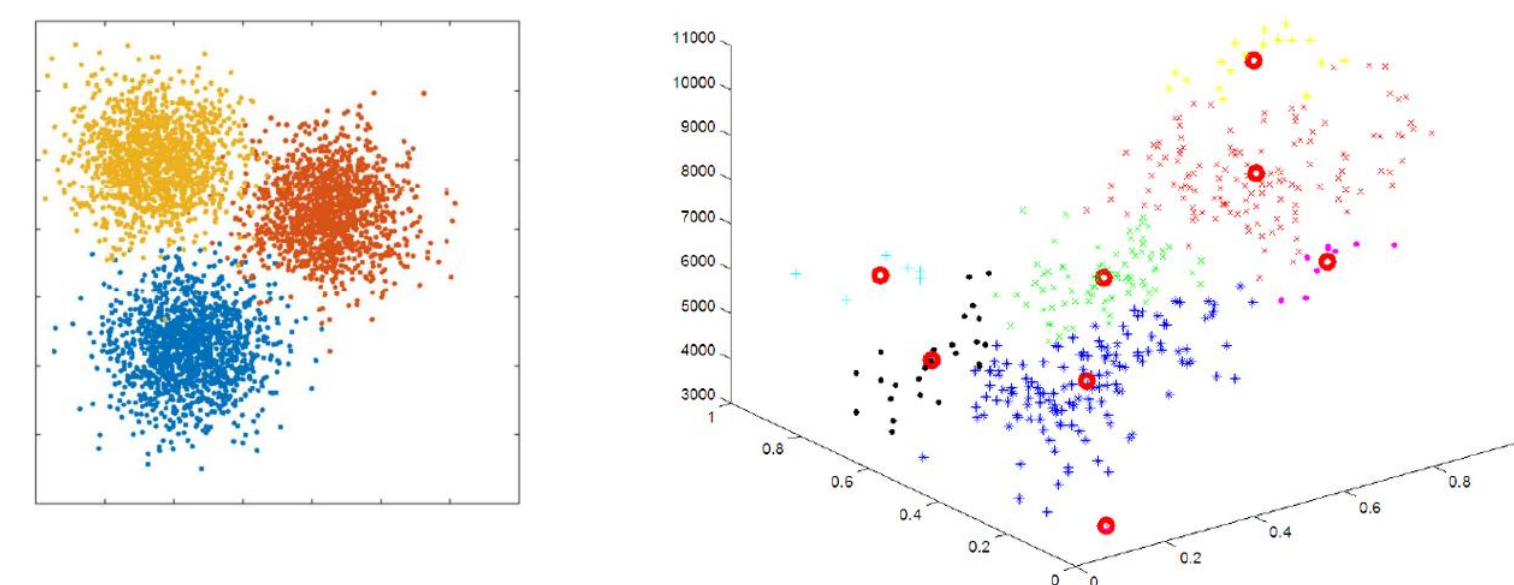


Feature Extraction from Sensors

- Measures of variation in fundamental frequency: Jitter, MDVP: RAP (KayPENTAX MDVP Relative Amplitude Perturbation)
- Measures of variation in amplitude: Shimmer, Shimmer: APQ3, APQ5, APQ7 (Three/Five/Seven point Amplitude Perturbation Quotient)
- Measures of ratio of noise to tonal components in voice: NHR (Noise-to-Harmonics Ratio)
- Nonlinear dynamical complexity measures detrended fluctuation analysis (DFA) Signal fractal scaling exponent: RPDE (Recurrence Period Density Entropy), PPE (Three nonlinear measures of fundamental frequency variation)

MACHINE LEARNING ALGORITHMS

- Clustering Algorithms like K-means and MAP-DP



- Support Vector Machines (SVM)

Classification and Outlier Detection using Kernel methods.

ANALYTICS

Real-Time Symptom Tracking

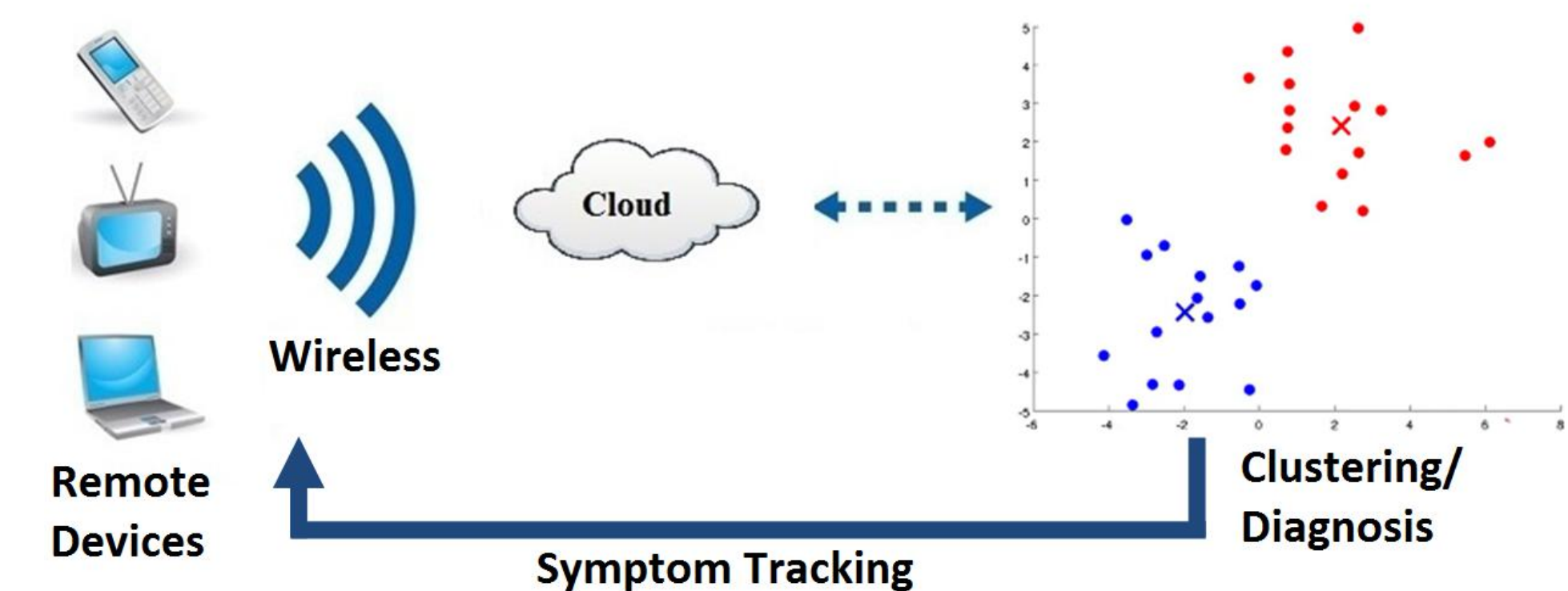
- Mobile Phones: App that tracks patients' progression in disease.
- Online Software: Real-time interaction using speech.

Fusing speech parameters with other signals

- Mixing speech analysis with other sensory parameters such as vision, motor reactions, gait, gestures, facial expressions etc .

Data collection

- Collection of more speech data with remote devices like smart phones and computers.



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