# Early Diagnosis of Neurological Disorders by Detecting Irregularities in Speech
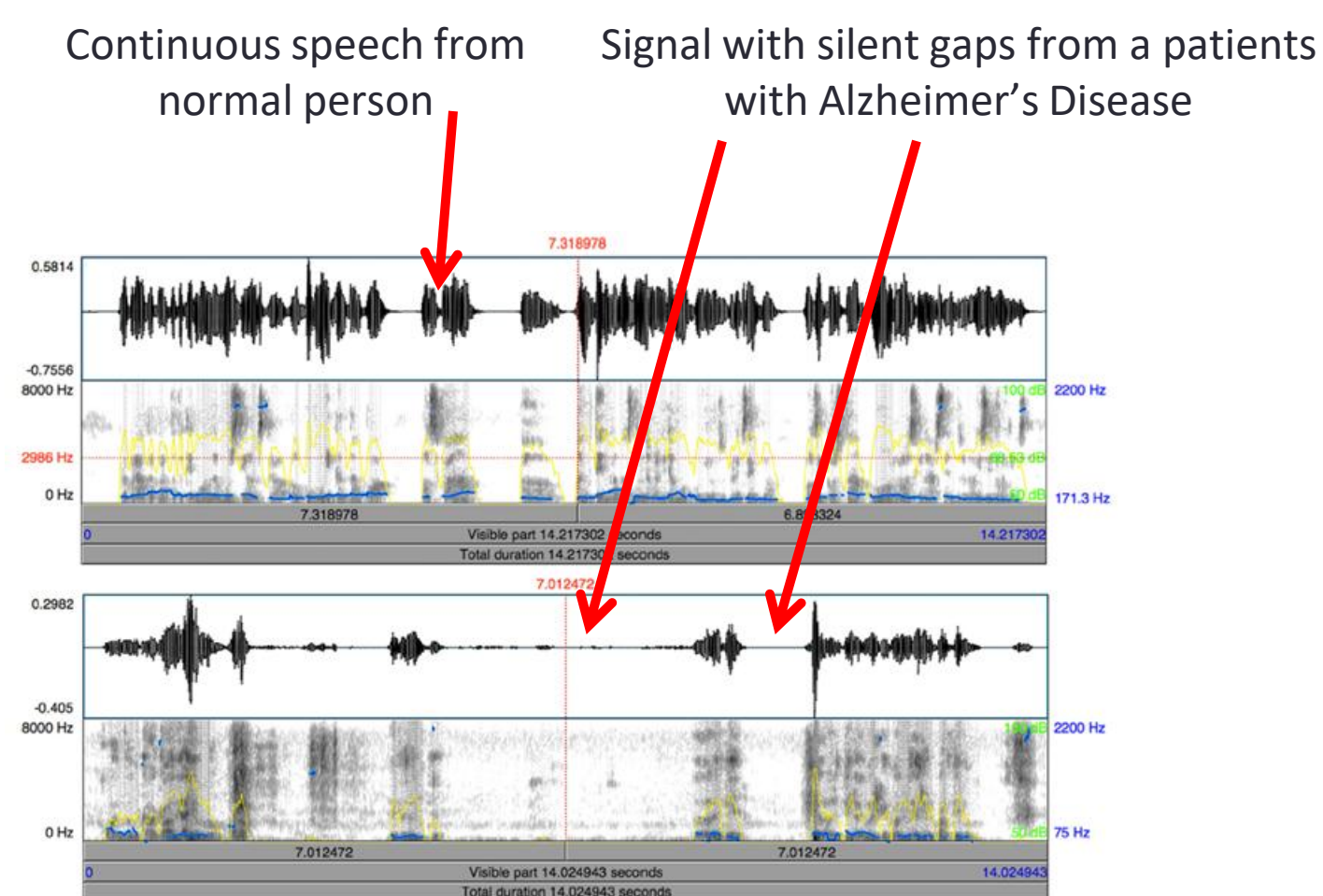
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## MOTIVATION

- ❏ **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**



Continuous speech from normal person

Signal with silent gaps from a patients with Alzheimer's Disease

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.
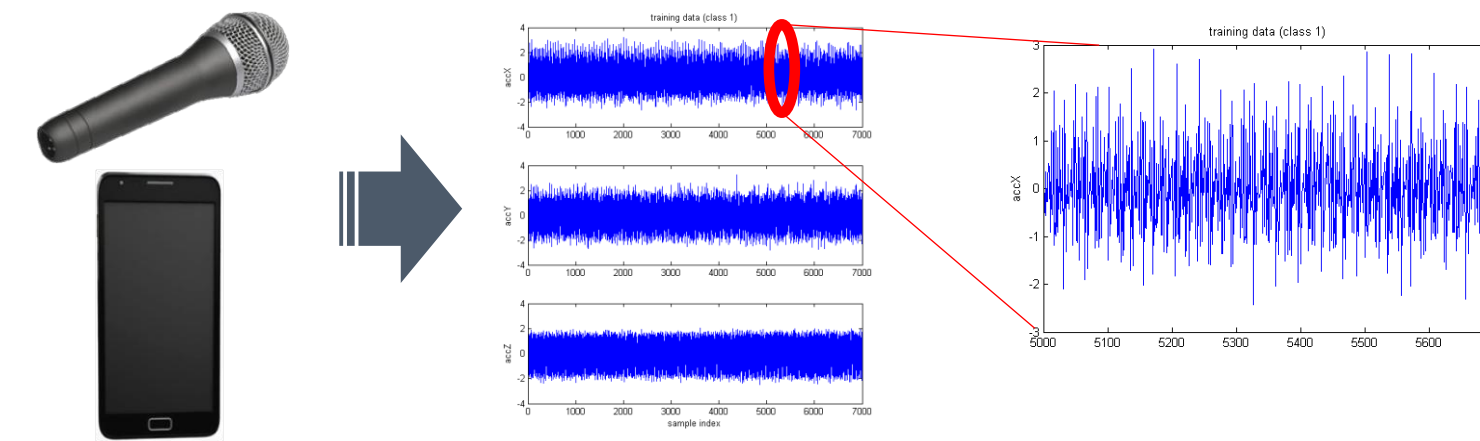


### Feature Extraction from Sensors

- ❏ **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**
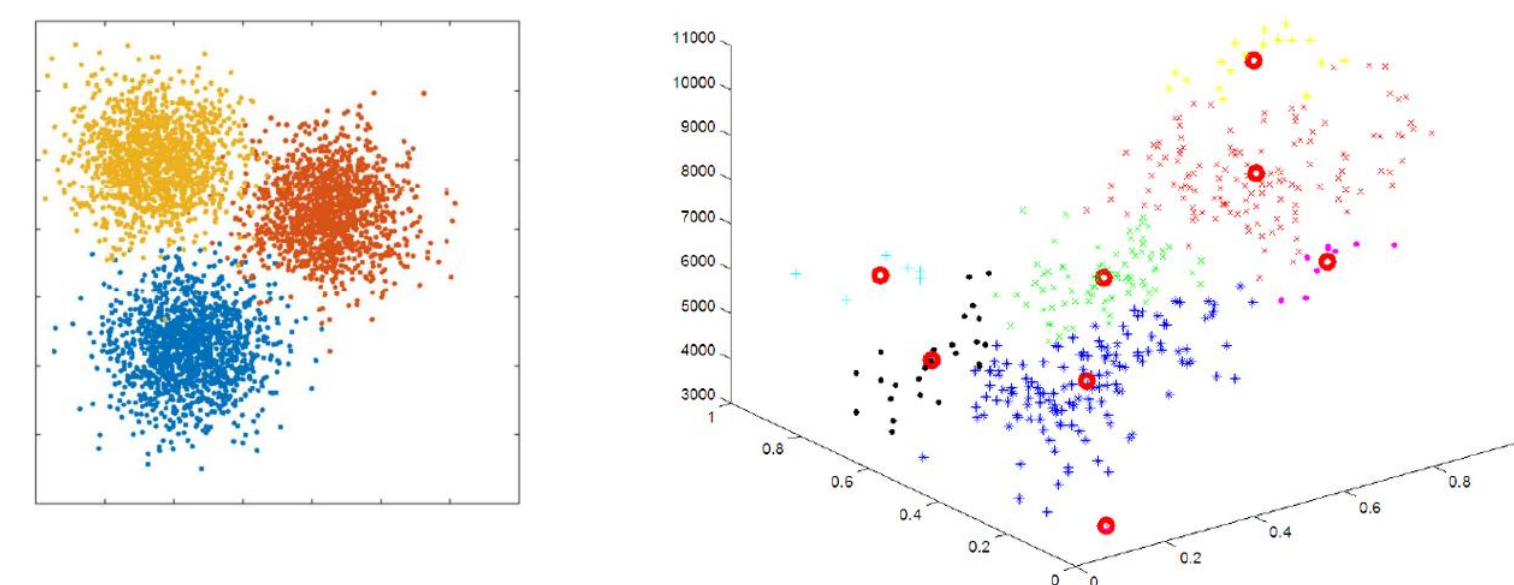


- ❏ **Support Vector Machines (SVM)**

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.
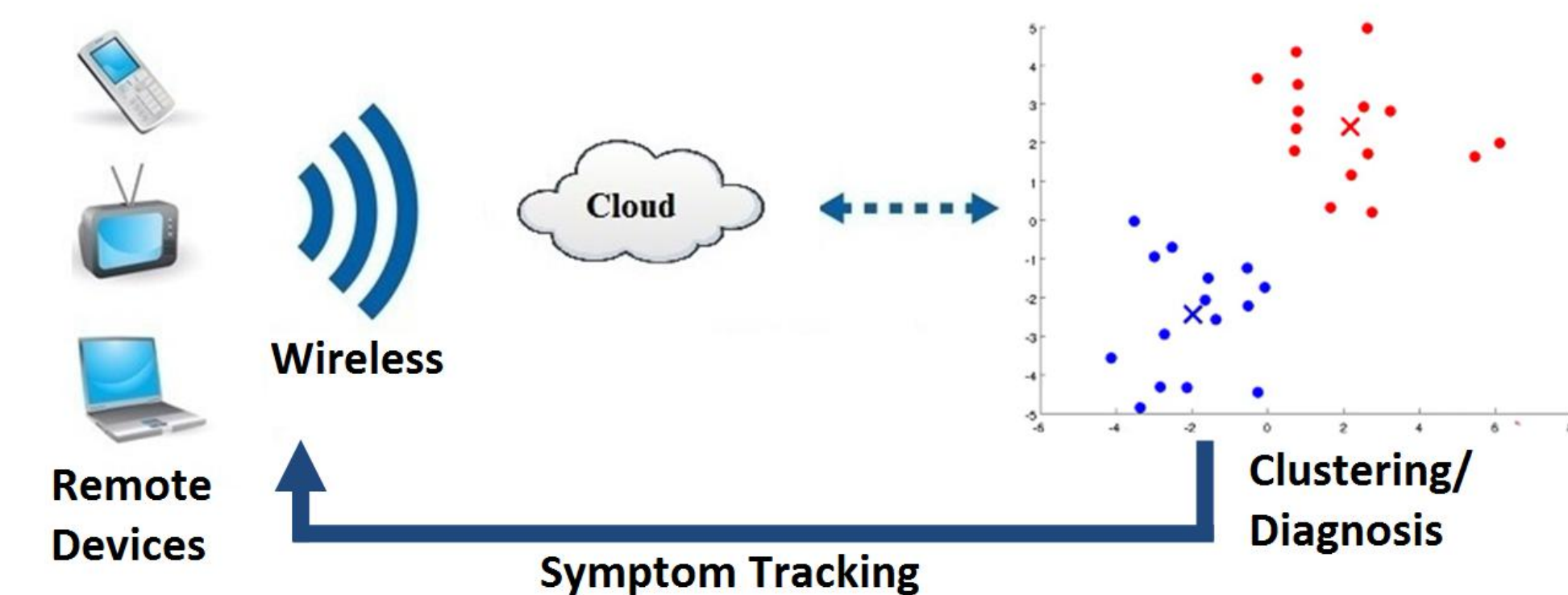


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## ACKNOWLEDGEMENTS