DES535
Ubiquitous Computing

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INFORMATION TECHNOLOGY **DELHI**

Google Classroom Code : pcwnf5t

Motion & Activity Sensing

Module V (Part II)

Human Activity Sensing : UCI-HAR DATASET

https://archive.ics.uci.edu/dataset/240/human+activity+recognition+using+smartphones

Human Activity Sensing : UCI-HAR DATASET

- The experiments was carried out with a group of 30 volunteers within an age bracket of 19-48 years.
- Each person performed six activities (WALKING, WALKING_UPSTAIRS, WALKING_DOWNSTAIRS, SITTING, STANDING, LAYING) wearing a smartphone (Samsung Galaxy S II) on the waist.
- Using its embedded accelerometer and gyroscope, we captured 3-axial linear acceleration and 3-axial angular velocity at a constant rate of 50Hz.
- The experiments have been video-recorded to label the data manually. The obtained dataset has been randomly partitioned into two sets, where 70% of the volunteers was selected for generating the training data and 30% the test data.
- The sensor signals (accelerometer and gyroscope) were pre-processed by applying noise filters and then sampled in fixed-width sliding windows.
- 561-features were derived with time and frequency domain variables.

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Can you provide a critical observation and identify a drawback of this method?

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Activity : Can we detect typing activity from ACC and/or GYRO?

1. Create a simple application with MIT App Inventor to VISUALIZE accelerometer/gyroscope reading during typing and not-typing periods. (Given)

2. Collect these data in an excel form along with the labels(Typing/Not Typing)

3. Apply k-means algorithm on the collected data to see if the clusters are well-separated.

Based on your observations, infer whether ACC and/or GYRO data can indicate fine-grained activities like typing.

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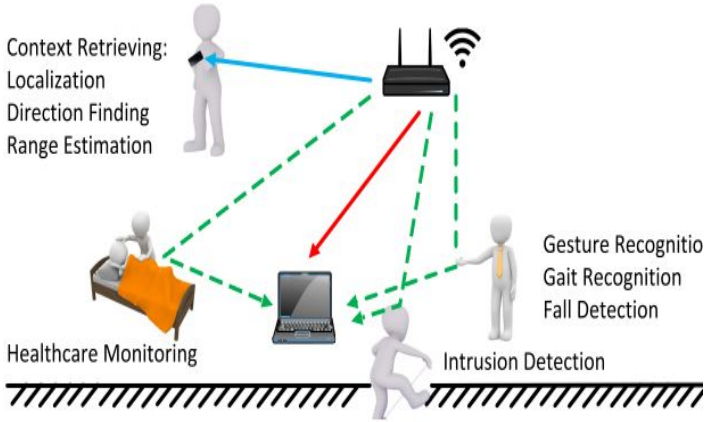
WiFi Sensing

- WiFi has experienced very rapid growth with the increasing popularity of wireless devices.
- One important technology for the success of WiFi is Multiple-Input Multiple-Output (MIMO), which provides high throughput to meet the growing demands of wireless data traffic.
- Along with Orthogonal Frequency-Division Multiplexing (OFDM), MIMO provides **Channel State Information (CSI)** for each transmit and receive antenna pair at each carrier frequency.



https://dl.acm.org/doi/pdf/10.1145/3310194?casa_token=Nj4bFfM0x-4AAAAA:waU7IHXHkf-m9t482ap6cGdvSik8x36klnNjCuyaSYs8I7BEcDUxGRLYCoA8YkWb-Az2BiIKTJY3KOk
https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8307394

WiFi Sensing : Human detection

WiFi Sensing : HAR

WiFi Sensing : Fine-grained movement detection

Preprocessing CSI Signals

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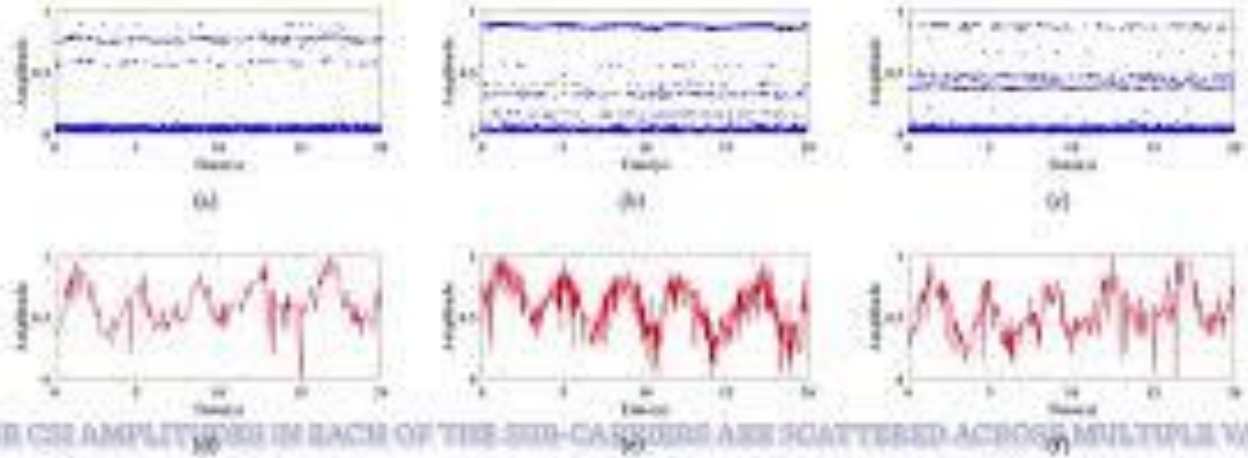
- DBSCAN is a **density-based** clustering algorithm which does not require the predetermination of the number of clusters.



Raw CSI amplitude (upper row) and CSI signal patterns obtained from preprocessing (lower row)