Internet of Things – CIS3011-N

Week 8 Practical

Human Activity Recognition using KNN technique

Introduction

Human Activity Recognition or HAR for short is the problem of predicting what a person is doing based on a trace of their movement using sensors.

Movements are often normal indoor activities such as standing, sitting, jumping, and going up stairs. Sensors are often located on the subject's smartphone or vast and record accelerometer data in three dimensions (x, y, z). Even though we are using one sensor, but we are using three sensor measurements, and using data fusion of the three accelerometer reading so that we can identify user's or subject's activity.

It is a challenging problem because there is no clear analytical way to relate the sensor data to specific actions in a general way. It is technically challenging because of the large volume of sensor data collected (e.g., tens or hundreds of observations per second). Use of K Nearest Neighbour (KNN) fusion algorithm canbe used to automatically identify the activities by grouping them into activity sets based on the sensor measurements' patterns.

Task 1: Downloading and exploration of the dataset using Python (code added as a separate file)

- Go to the following and download the dataset

https://archive.ics.uci.edu/ml/datasets/Activity+Recognition+from+Single+Chest-Mounted+Accelerometer

The dataset is comprised of un-calibrated accelerometer data from 15 different subjects, each performing 7 activities. Each subject wore a custom-developed chest-mounted accelerometer and data was collected at 52 Hz (52 observations per second).

Figure: sensors used for data gathering

Data Description

Un-calibrated Accelerometer Data are collected from 15 participants performing 7 activities. The dataset provides challenges for identification and authentication of people using motion patterns.

Data Set Information:

— The dataset collects data from a wearable accelerometer mounted on the chest
— Sampling frequency of the accelerometer: 52 Hz
— Accelerometer Data are Un-calibrated
— Number of Participants: 15
— Number of Activities: 7
— Data Format: CSV

Attribute Information:

— Data are separated by participant
— Each file contains the following information
—- Sequential number, x acceleration, y acceleration, z acceleration, label
— Labels are codified by numbers
— 1: Working at Computer
— 2: Standing Up, Walking and Going updown stairs
— 3: Standing
— 4: Walking
— 5: Going UpDown Stairs
— 6: Walking and Talking with Someone
— 7: Talking while Standing

- Explore the dataset to understand the patterns of different activities using sensor readings (code are available in the blackboard)

Task 2: KNN-based data fusion and Activity Classification

Please use the slide (uploaded in the blackboard) to understand the basic working principle of KNN.

Run the provided code and understand the mechanism.

Task 3: Activity Data gathering

Use your smartphone's accelerometer to record data (500 samples/activity) for three different activities and save them in a file:

- Sitting on the chair
- Walking
- Running

Please share your data with others to form a bigger and multi-subjects dataset.

Task 4: Use the given code to explore your dataset and KNN-based classification of activities