

# EQ2341 Project Guidelines

## Project Activity Recognition

**Objective:** The objective of this final project is to implement a classifier for activity recognition based on data from the phone's sensors. The algorithm should be able to accurately discriminate between three activities: standing still, walking, and running, using a single data file where the state changes.

### Part A: Data Recording

- Download and install an appropriate mobile app for recording accelerometer data. You can choose either the Android **Sensor Fusion** app or the iOS **Accelerometer** app.
- The recorded data will be represented as a three-dimensional vector  $x_t \in \mathbb{R}^3$ , where each component indicates the acceleration in the corresponding axis of the Euclidean space.
- Perform the three activities (standing still, walking, and running) while the app records the accelerometer data. Make sure to record multiple instances of each activity to create a diverse dataset.
- Export the recorded data to a file, which will be used for training and evaluation of your classifier.

### Part B: Classification Task

- For this project, you will utilize the Hidden Markov Model (HMM) framework for sequence classification.
- You can pre-process the recorded data, for example by filtering out high-frequency noises using a simple moving average or any other suitable technique that you deem appropriate.
- Design a Hidden Markov Model to represent the underlying states (standing, walking, and running) and the with a parametric distribution of your choice.
- Learn the model parameters for each state based on the observation sequences  $\{x_0, x_1, \dots, x_T\}$ , where  $x_i \in \mathbf{R}^3$  and  $T$  is a finite positive integer

representing the length of the sequence. You are encouraged to use the expectation-maximization (EM) algorithm.

- Once the model parameters are learned, classify the state of a given sequence based on the state probabilities computed from the trained HMM.
- Test your method on data that has not been used in training and record the accuracy.

## Submission

Your final project submission should include the following components:

- A comprehensive presentation that highlights the motivation, methodology, experimental results, and analysis of your activity recognition classifier.
- Well-documented and organized code that implements the HMM-based classifier. You can either include the code directly in the submission or provide a link to an accessible repository where the code is hosted.
- The recorded data used for training and evaluation. Include the data in the submission or provide a link to an accessible repository where the data is hosted.
- A README file that provides clear instructions on how to run and reproduce the results obtained from your code. Include any specific dependencies or setup requirements, if applicable.

## Peer Review

Please keep in mind that another group of your peers will be assigned to review your project. When preparing your submission, consider the clarity of your presentation, the readability of your code, and the availability of necessary documentation. Provide enough information and details so that the reviewing group can understand your approach and replicate your experiments if desired.