Mini-project (midterm) announcement

Presentation Due date: May 15, 2022

Mini-Project: Q-Learning for Human Activity Recognition

- **Collected IoT Data:**

  IoT Dataset:

  Dataset Name: "WISDM Smartphone and Smartwatch Activity and Biometrics Dataset"

  Link to the Dataset:
  https://archive.ics.uci.edu/dataset/507/wisdm+smartphone+and+smartwatch+activity+and+biometrics+dataset

  For a detailed description of the dataset, please study the attached PDF file:

  WISDM-dataset-description.pdf (It is stored with the dataset as well)

  Description: This dataset contains sensor readings from smartphones and smartwatches worn by individuals performing various activities, such as walking, jogging, and climbing stairs. It includes accelerometer and gyroscope measurements, as well as biometric data such as heart rate. The data is collected at regular intervals and can be used for human activity recognition and other related tasks.

- **Objective:**

  The objective of this assignment is to identify the problem to recognize human activities based on sensor data collected from smartphones and smartwatches. And, do experimental task in apply Q-Learning.

- **Tasks:**

  1. Dataset Exploration:
     - Download and explore the WISDM Smartphone and Smartwatch Dataset.
     - Understand the structure of the dataset and the meaning of its various features.
  2. Applying RL-based solution and Implementation:
     - Implement the Q-learning algorithm in Python.
     - Design MDP environment: Define states, actions, and rewards based on the features available in the dataset.
     - Design a Q-learning agent to learn an optimal activity recognition policy over time.
  3. Training and Evaluation:
     - Train the Q-learning agent using a portion of the dataset.
     - Evaluate the performance of the trained agent on a separate portion of the dataset.
     - Measure metrics such as **accuracy**, **precision**, and **recall** for activity recognition.

4. Analysis and Optimization:
    - Analyze the results obtained from the Q-learning implementation.
    - Identify any misclassifications or areas for improvement in activity recognition.
    - Propose strategies to optimize the Q-learning algorithm or the features used for state representation.
5. Discussion:
    - Discuss the effectiveness of Q-learning for human activity recognition based on the results obtained.
    - Reflect on the challenges faced during the implementation process and potential solutions.
    - Consider the broader implications of using reinforcement learning techniques for wearable technology applications.

- **Deliverables:**
    - Report documenting the entire process of dataset exploration, identifying the problem, Q-learning implementation, training, evaluation, analysis, and discussion.
    - Any additional visualizations or supplementary materials that aid in understanding the results.
    - Upload your source code in Github and share the link in your presentation date. It should include your Python script (or any other AI/ML/RL Library) implementing the Q-learning algorithm for human activity recognition.
    - Discuss the pros and cons of using the mentioned algorithm in this Dataset. In case of the weakness of the Q-learning for this Dataset, which other learning algorithms your suggest to use?