Prediction of the individual with over-weighted based on the center of mass acceleration data during the gait cycle.

Project Midterm Report

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Obesity is a prevalent issue in the U.S. The prevalence of obesity is increasing over the decade. Many underlying risks can lead to a critical health problem. Moreover, obesity is also a potential risk factor for cardiovascular disease (CVD) and diabetes. Recent advances in wearable motion sensor technologies offer an opportunity to translate laboratory findings to the clinical environment with similar gait balance measures. Inertial measurement units (IMU) combine accelerometers, gyroscopes, and magnetometers into a single sensor and could be used to estimate COM acceleration. The use of wearable sensors to detect mobility impairments has grown rapidly and provides a time-efficient and user-friendly measurement of gait and balance performance. The IMU is placed at COM's proxy location. This project aims to investigate whether the gait pattern would change in an individual with obesity. We hypothesized that obesity could be detected by using the COM acceleration data from self-selected speed walking.

1. Introduction

Obesity is a prevalent issue in the U.S. The prevalence of obesity is increasing over the decade. There are over 32.2 % of the adult were obese. Many underlying risks can lead to a critical health problem—for instance, the mortality rate increases due to chronic disease. Moreover, obesity is also a potential risk factor for cardiovascular disease (CVD) and diabetes.

Recent advances in wearable motion sensor technologies offer an opportunity to translate laboratory findings to the clinical environment with similar gait balance measures. Inertial measurement units (IMU) combine accelerometers, gyroscopes, and magnetometers into a single sensor and could be used to estimate COM acceleration. The use of wearable sensors to detect mobility impairments has grown rapidly and provides a time-efficient and user-friendly measurement of gait and balance performance. The IMU is placed at a fixed body landmark, such as the 5th lumbar vertebra (L5), as a COM's proxy location. However, such a fixed landmark location does not account for any instantaneous changes in body segment alignment that could result in the relocation of whole-body COM.

A support vector machine (SVM) is a supervised machine learning model that uses classification algorithms for two-group classification problems. After giving an SVM model set of labeled training data for each category, they're able to categorize new text.

This project aims to investigate whether the gait pattern would change in an individual with obesity. We hypothesized that obesity could be detected by using the COM acceleration data from self-selected speed walking.

2. Related Work

In Biomechanics, lots of researchers were still engaging in running kinematics. As the growing human age, the running kinematics changed due to the decrease of the muscle mass. This kind of change was detected by using classical inferential statistics. However, the traditional methodology was time-consuming and with insufficient sensitivity. Data mining techniques have been applied in recent biomedical studies to solve this problem using a more general approach.

3. Method

Data were collected at the Biomechanics Laboratory of the university. Besides, a single IMU (OPAL, APDM wearable Technologies, Inc., Portland, OR, USA) was placed at the L5 as the COM's proxy location.

Firstly, before utilizing the SVM classifier, the data must be split into a training set and test set. The scikit-learn function can be easily implemented to split the data. The train_test_split function takes as input a single dataset and a percentage value. The percentage value is used to determine the size of the test set. The function returns two datasets: the test dataset and the training dataset. Typically, around 70-80 percent of the data can be considered as a training set, and the remaining data are viewed as the test set. After having an instance of an SVM classifier, a training dataset, and a test dataset, we are able to train the model with the training data.

The single wearable sensor collects training and testing data. The only medial-lateral direction of the tri-axials data will be used. The sampling rate is 150 Hz. Individuals with obesity will be labeled as +1, otherwise -1. Medial-lateral direction of the COM acceleration may have a particular

predictive function for human walking's dynamic stability. Data collected from IMU were separated into a trained set and test-set.

4. Preliminary Result

The SVM model has an accuracy of 0.67 for this dataset, and the performance is fair.

5. Future Plan

The linear perceptron will be use to compare to the result of SVM.

6. Reference

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