Introduction

With development of commercially-available wrist-worn activity trackers and wireless connections to portable electronics, such as smartphones or tablets, monitoring by activity tracker is an easy-to-use, accessible means of providing personalized information to peoples’ health and daily activities [1].

Patient-Reported Outcomes Measurement Information Systems (PROMIS®) questionnaires are publicly available, efficient, and flexible measurements of patient reported outcomes (PROs), that have been validated in domains of physical and mental health as compared to clinical decisions made by physicians [2].

Machine learning algorithms may then be used to analyze this data to actively track patients’ health, possibly allowing for the earlier detection and intervention of problems. Hence, we intended to construct a machine learning model to predict patient’s health status by data collected from Fitbit.

Data Description

- A cohort of 191 patients with stable ischemic heart disease (SIHD) were recruited for a feasibility study conducted by Cedars-Sinai Medical Center from 2017 to 2018
- To predict surrogate markers of major adverse cardiac events (MACE), using biometrics, wearable sensors, patient-reported surveys, and other biochemical markers
- The desired monitoring period was 12 weeks with PROMIS Global-10 short form as a self-report assessment of their health status
- 14 types of physiological indices collected by Fitbit every day:
  - Steps
  - Total Distance(km)
  - Very Active Distance(km)
  - Moderate Active Distance(km)
  - Light Active Distance(km)
  - Very Active Minutes
  - Fairly Active Minutes
  - Light Active Minutes
  - Sedentary Minutes
  - Calories
  - Calories BMR (basal metabolic rate)
  - Marginal Calories
  - Resting Heart Rate (BPM)

Methods

The T metric method standardizes scores for each category to a mean of 50 and a standard deviation of 10, with a range between 0 and 100. There are eight categories in this Global-10 short form:

- Global Physical Health
- Global Mental Health
- Fatigue
- Social Isolation
- Physical Function
- Anxiety
- Depression
- Sleep Disturbance

Results and Discussion

- ROC AUC was measured for each type of PROMIS survey shown in Fig. 2
- * indicates the statistical significance against random classification

Using real-time activity tracker data, we were able to classify patients with moderate to severe physical symptoms. Such a classification system could contribute to real-time remote surveillance of patients’ health status, allowing for faster symptom identification and intervention.

References