



Analyzing the effect of activities and step count on sleep patterns

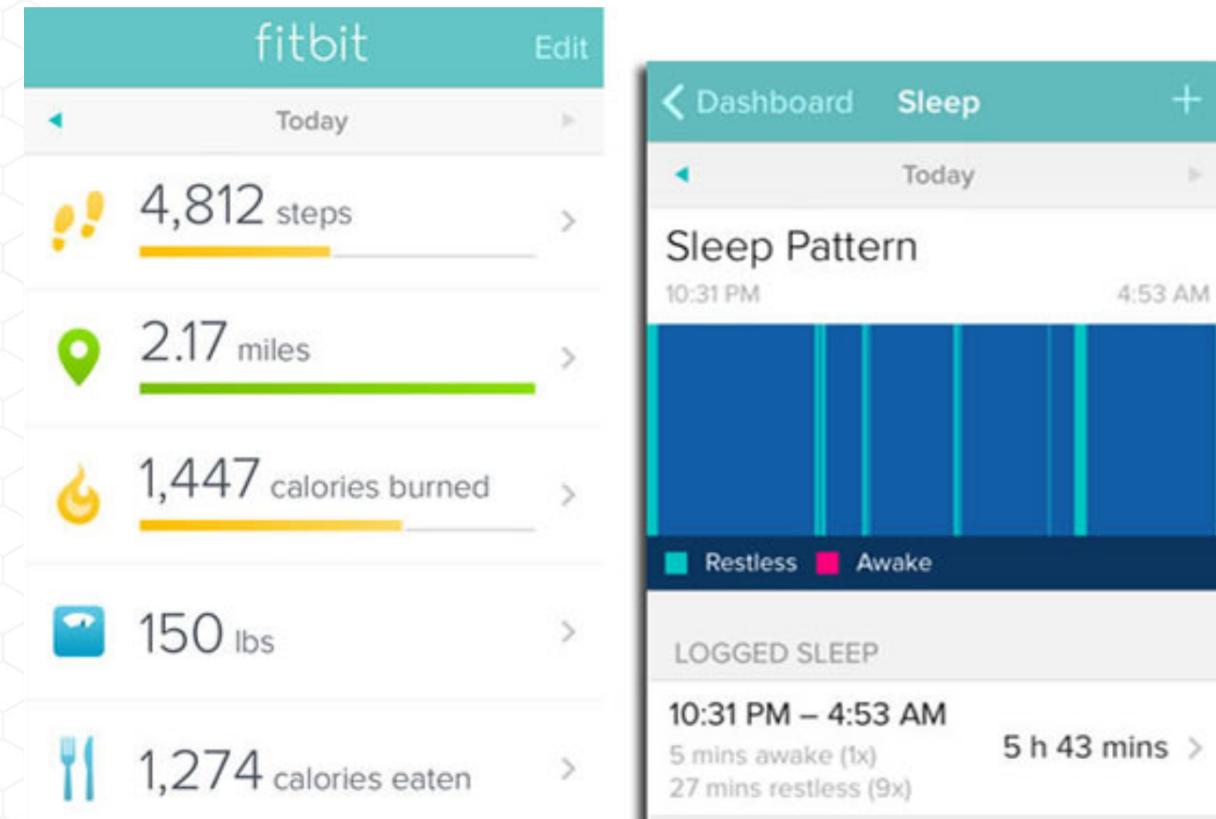
CREATING THE NEXT®

Project Overview

Fitbit: tracks physical activity (e.g. calories burned, steps, distance, and heart rate) and sleep data (e.g. time in bed and awakening count).

Current problem:

- How physical activity affects sleep patterns?



Overall project goals and objectives

- Aim 1: Develop a web platform to pull data from Fitbit app using Fitbit API
- Aim 2: Integrate the converter npm package to convert the data into the FHIR (initial plan)
- Aim 3: Analysis the relationships between the physical activities and sleep quality
- Aim 4: Provide prediction for sleep quality using machine learning techniques
- Aim 5: Provide suggestions on how to improve sleep based on the data (initial plan)

Project Research

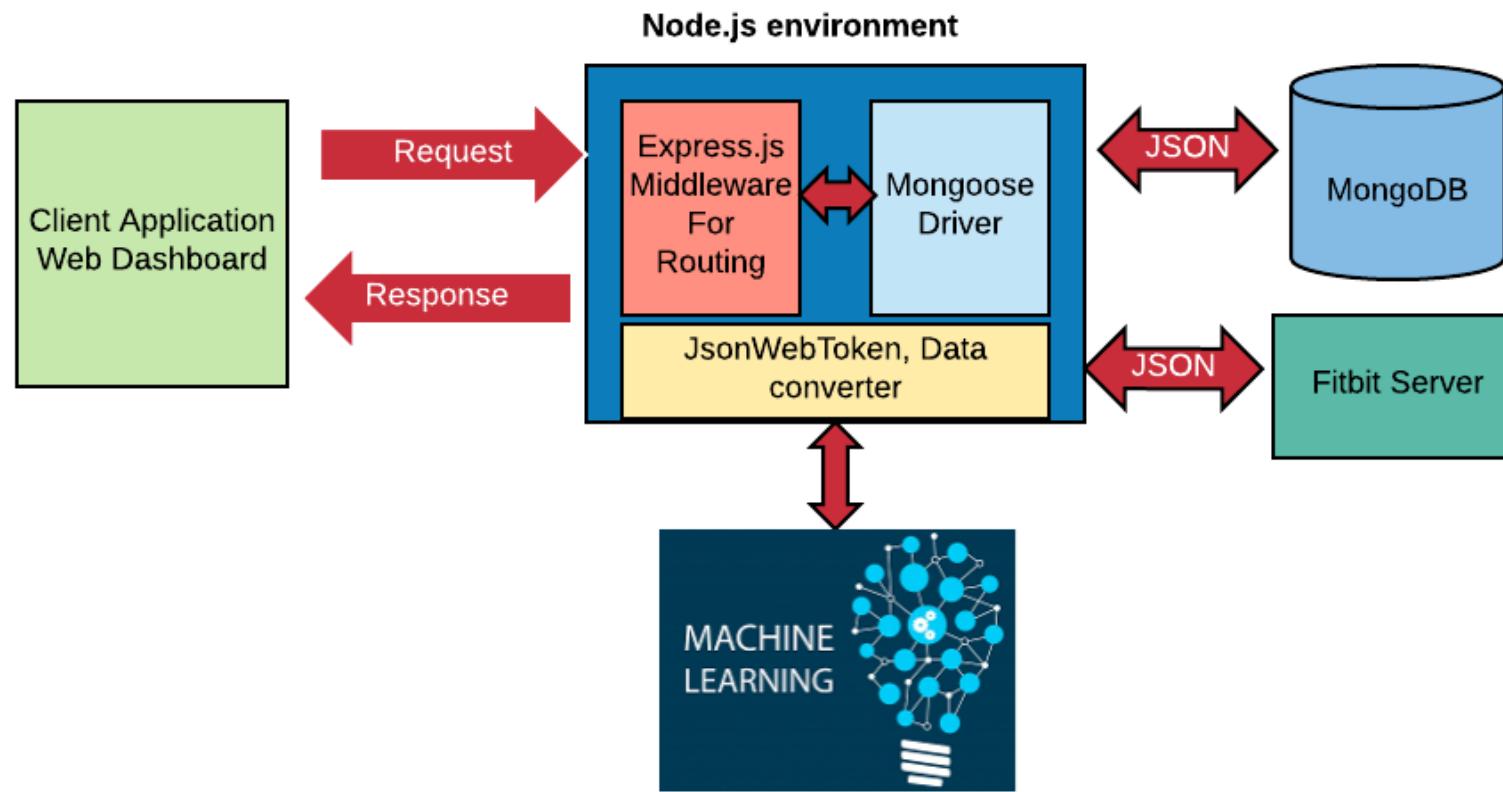
Business cases

- What do customers want in this app?
- Is the app/web ideal compelling to customers?

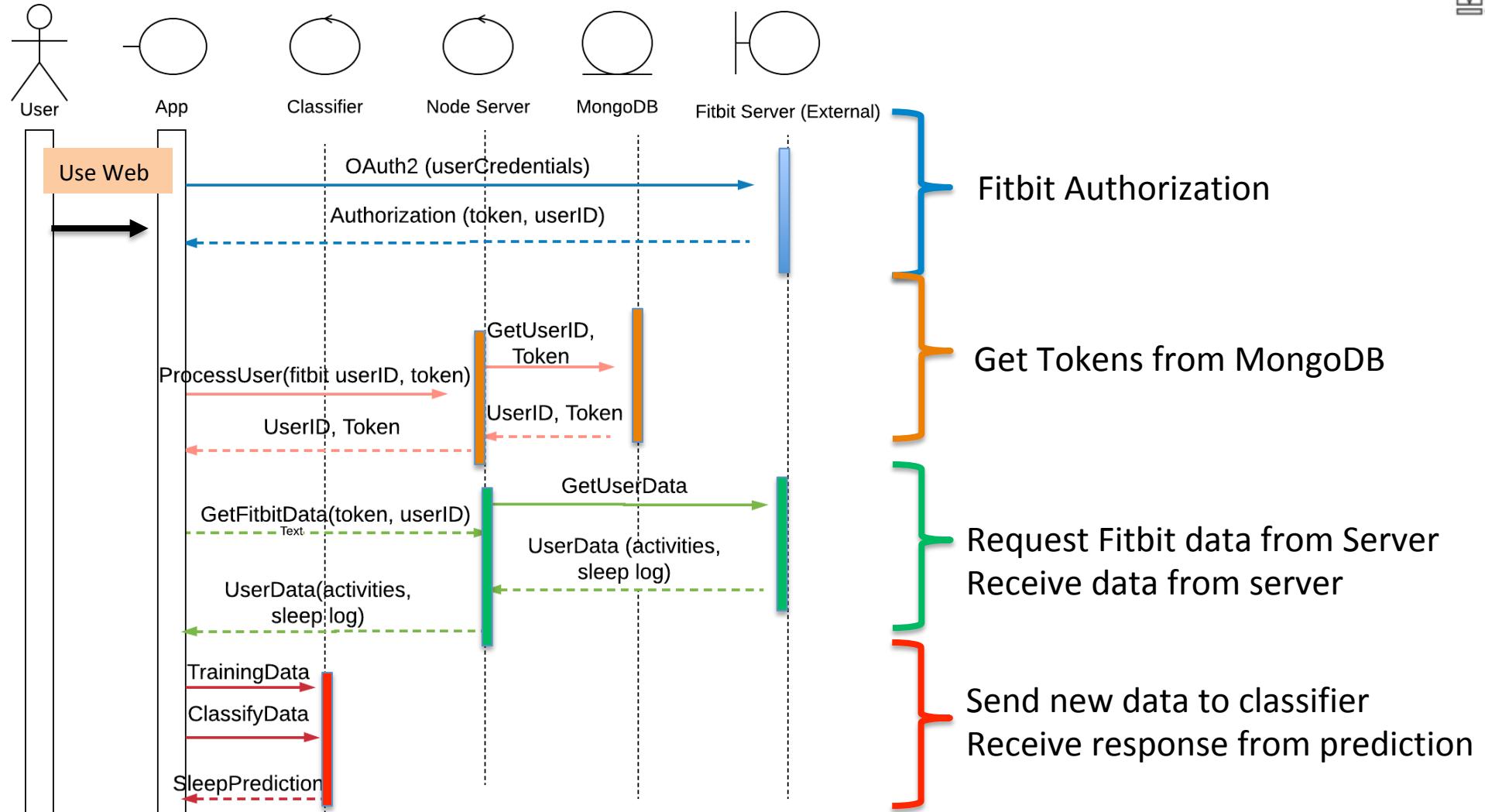
Infrastructure:

- Fitbit: devices (Fitbit HR, Charge 2), Fitbit API
- Database
- FHIR
- Machine Learning
- Web services

Architecture Design

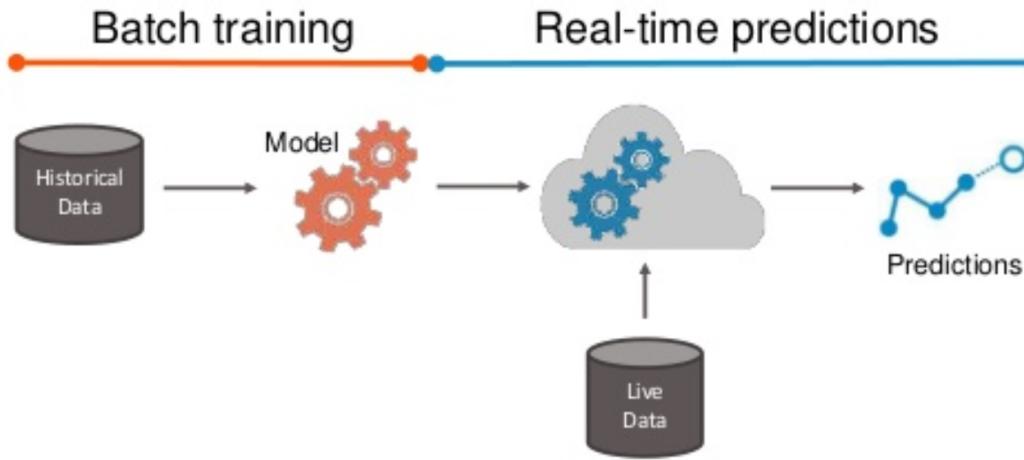


Web Platform Functionality



Machine Learning Pipeline and Concerns

Machine Learning Pipeline



Data preprocessing

- Sleep efficiency was converted to nominal class
- All numerical attributes were normalized to the range[-1, 1]

Algorithms used:

- Decision Trees
- K-Nearest Neighbors
- Support Vector Machines

Dataset for Training:

- ~1 year fitbit data with 8 attributes (calories burned, steps, distance, minutes sedentary, minutes lightly active, minutes fairly active and minutes very active)
- 70% dataset used for training set and 30% used for test set
- Each instance contains sleep quality class (good, fair, poor)
- Sleep Efficiency = Minutes asleep /minutes in bed
- Three classes classification based on sleep efficiency:
Good: 97% ~1
Fair: 93% ~ 97%
Poor: < 93%

Project Demonstration and walkthrough demo



Fitbit Authorization

fitbit

cs6440final by <https://login.gatech.edu/> would like the ability to access and write the following data in your Fitbit account

Warning! This app is not using HTTPS to securely obtain your permission.

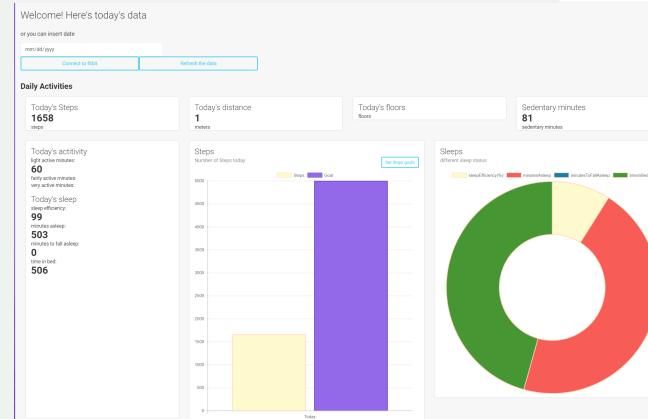
- sleep
- profile
- heart rate
- activity and exercise
- location and GPS

[Deny](#) [Allow](#)

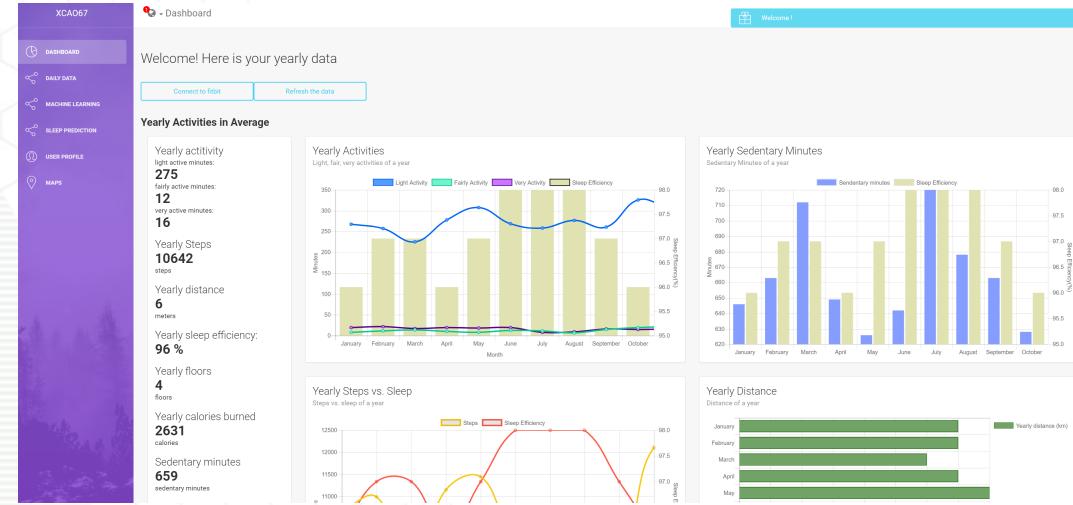
Data shared with cs6440final will be governed by <https://login.gatech.edu/>'s privacy policy and terms of service. You can revoke this consent at any time in your Fitbit [account settings](#). More information about these permissions can be found [here](#).

Signed in as yongyucn@qq.com [Not you?](#)

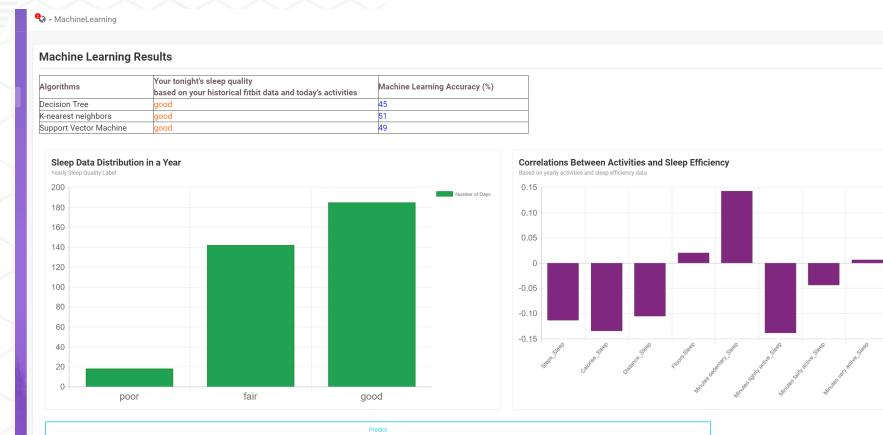
Daily fitbit data



Yearly fitbit data



Machine learning and correlation coefficient analysis



Further Development and deployment

- Extend the “fhir_converter” to convert fitbit activity data
- Extend the “fhir_converter” to fit the old fitbit device
- Store the trained machine learning model into the mongoDB for the quick prediction in the future

Deployment:

- The source code, documentation and project details are in our team’s Georgia Tech github repository.
- All the information is accessible for the further development of the project.



