Sleepify

There's a nap for that.

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At a glance...

- Sleepify improves sleep quality depending on temperature
- App + the cloud + machine learning + web interface
- Non intrusive – wearable

- Industry / Our Promise / High Level Design / Backend / Web Interface / Machine Learning / Demo / Testing and Evaluation

The State of the Industry | Competitors

- Focused on sleep tracking
- None on temperature and heating

http://sleep.urbandroid.org/wp-content/uploads/screen11-36-44_framed_small.png
https://cnet3.cbsistatic.com/img/s18hHRa4dlAM1fNdtAgfkODoHqY=/770x433/2014/12/16/65bbc9cf-b9d8-4fcb-8b8a-c7ada25c9811/fls-resmed.jpg

Our Promise

1. Better sleep quality can be achieved by sleeping in an ideal sleeping temperature; we want the environment to not be too cold nor too hot.
2. Through machine learning, prolonged usage of the app will improve performance and classification accuracy.
3. Provide a slick, and intuitive app and web interface for the user

4. The feeling of tiredness can be reduced by:
   - Reducing the effects of jet-lag by notifying the user to sleep
   - Setting the alarm to go off when the user is not in deep sleep

High Level Design

- Utilize the cloud
- Multiple points of failure
- Users have control over data

Backend / Web Interface

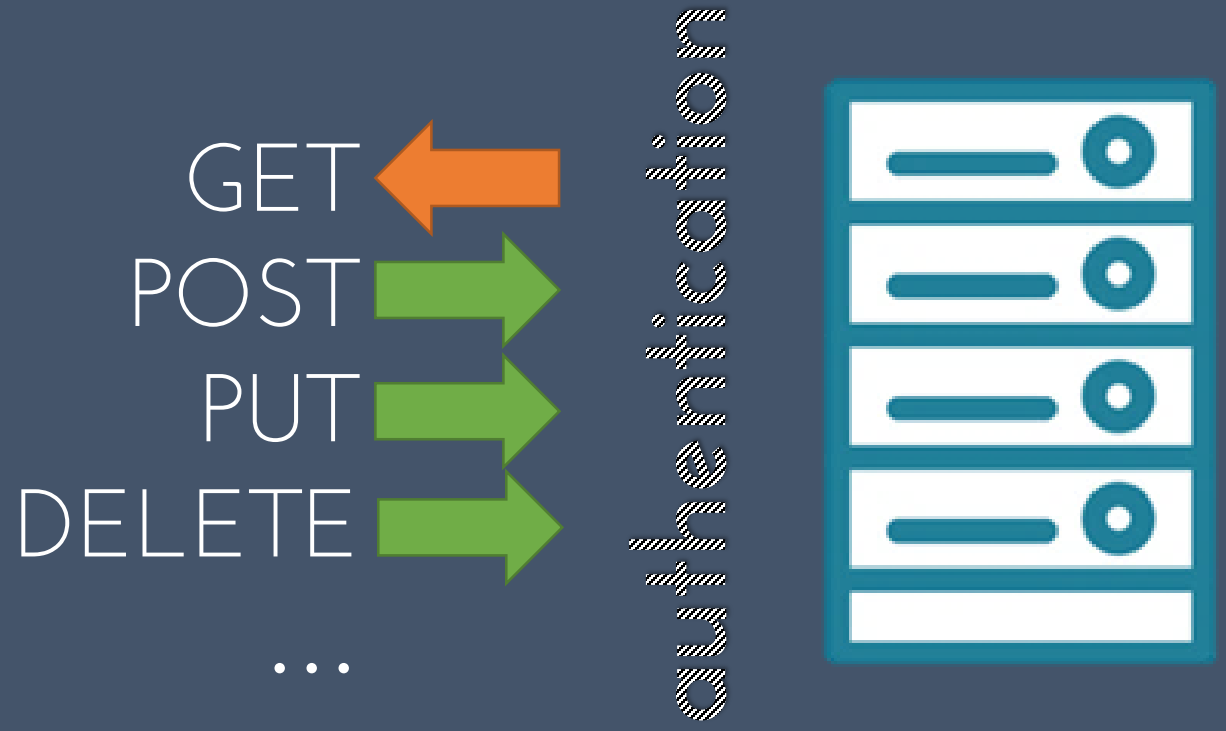
python + django =

django-bootstrap3
djangorestframework
django-sendfile
Sphinx

django-ical
django-cron
django-rest-auth
django-push-notifications

- Extremely fast development
- Tried, tested, scalable framework
- Security issues mostly taken care of

RESTful API



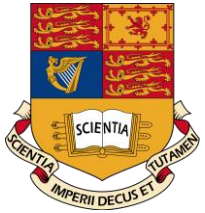
- Empowers the other sections
- Raw data, graphs, machine learning results, calendar events, notifications
- Authentication using sessions/cookies

Machine Learning – Sleep Quality Classification

1. Polysomnography
   - ✖ Requires EEG / ECG
   - ✖ Expensive, and intrusive to the user
2. Pittsburgh Sleep Quality Index
   - ✖ Suited for long term classification (1 week+)
   - ✖ Requires constant user feedback via a questionnaire
3. Actigraphy
   - Compromise between accuracy and resources

- Prioritize real-time aspect
- Reduce accuracy problems using machine learning

Machine Learning – Hardware



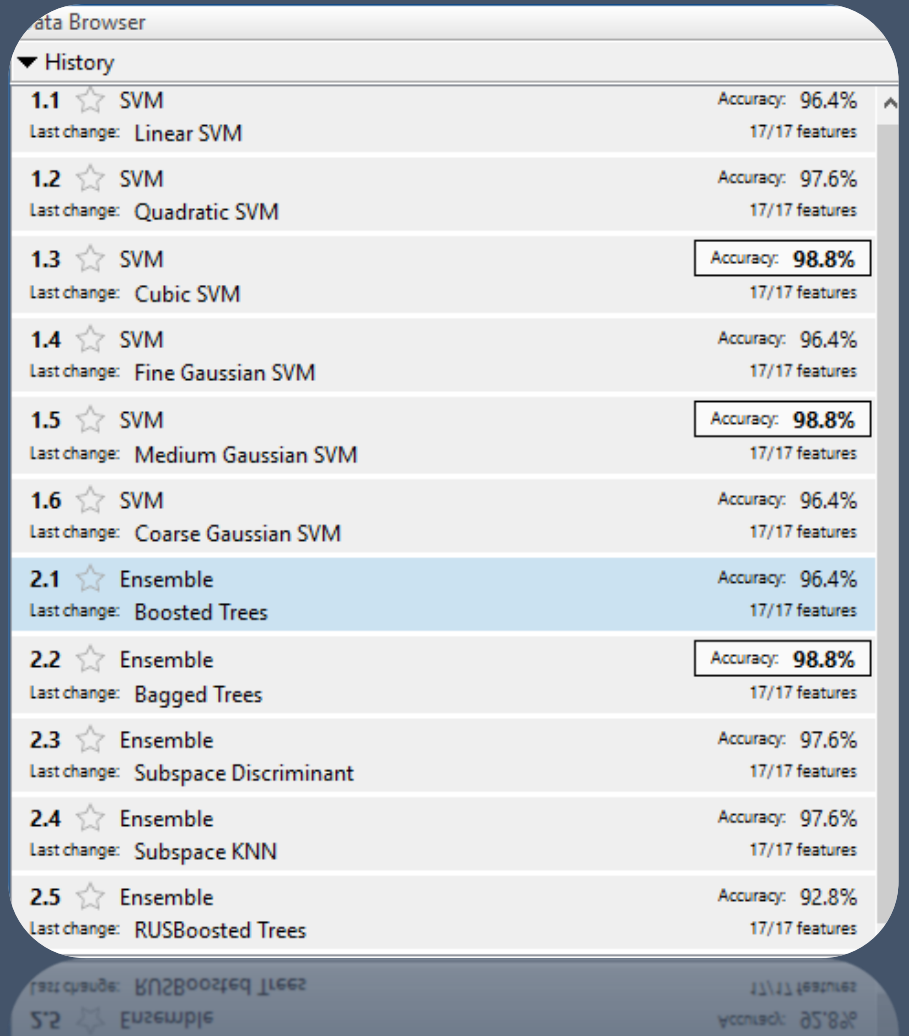
1. Microsoft Band 2
   - Heartrate
   - GSR
   - Body Temperature
   - Acceleration
2. Elgato Eve Room Smart Plug
3. iOS Device

- Existing sensors and hardware
  - +Temp, +GSR
- Smart plugs replace thermostat integration

Machine Learning – Software

1. MATLAB Benchmarking
2. Python scikit-learn
   - Extends RESTful API

Choose random forest
Fast training and testing times
Enables online training



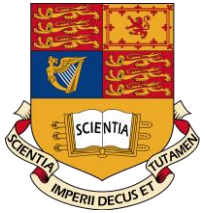
Machine Learning – Software

- Frequent model updates
- Continuous learning

- Model is trained in batches
- Load the model as a binary file

- Initial prediction from user feedback
- Obtain optimum temperature from database

Demo

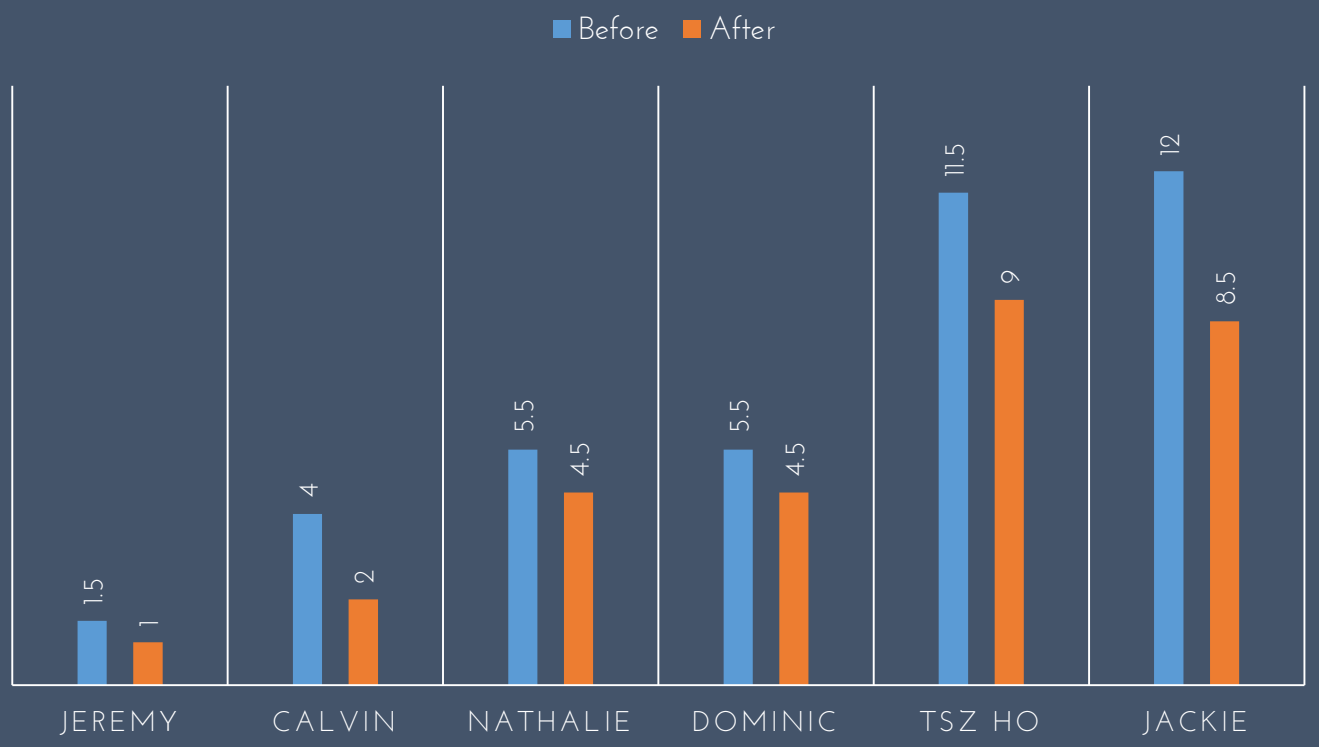


Modifications

1. Refresh interval set from 10 minutes -> 10 seconds
2. Calendar ‘time-to-sleep’ push notification is manually sent.

Hypothesis Testing

1. Use the Pittsburgh Sleep Quality Index
2. Before and after a week's* usage
3. 6 differing subjects
   - 1x good sleeper
   - 3x mediocre sleepers
   - 2x bad sleepers



*) in cases where a full week wasn't done, the results are scaled accordingly
PSQI Questions - http://uacc.arizona.edu/sites/default/files/psqi_sleep_questionnaire_1_pg.pdf

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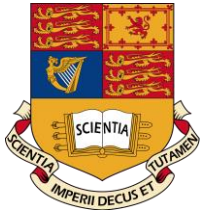
Give it a try!



http://sleepify.zapto.org/download/