**Using the Fitbit Web API with Python, MongoDB**

**and Streamlit**

Diagram

Description automatically generatedA Beginner's Guide for Storing and Visualizing FitBit data

*Photo from* [*FitBit*](https://www.fitbit.com/dev) *site*

In today's data-driven world, the ability to collect, store, and analyze data has become more critical than ever before. Public APIs offer an excellent way to acquire data from various sources, and the Fitbit Web API is a perfect example of this.

It provides access to a wealth of fitness-related data, including step counts, heart rate, and sleep patterns, making up a rich source of information for developers, data scientists, and fitness enthusiasts.

In this tutorial, we will explore how to use the Fitbit Web API to acquire data, store it in a NoSQL database and visualize it on a web platform using [Streamlit](https://streamlit.io/), an open-source Python library for building beautiful custom web apps for machine learning and data science.

With this tutorial, you will learn how to extract insights from your fitness data and create a custom dashboard that displays your progress over time. Whether you are a fitness enthusiast or a data scientist, this tutorial is a valuable resource for anyone interested in working with Fitbit Web API data.

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**Creating a Fitbit developer account and registering an application**

The wearable that was used to collect fitness data from Fitbit Web API is **Fitbit Sense 2**, a health and fitness-based smartwatch.

Before starting data collection, we need to follow some steps, which are based on this [tutorial](https://towardsdatascience.com/using-the-fitbit-web-api-with-python-f29f119621ea).

*Fitbit Sense 2*

Firstly, we must create a Fitbit account from [here](https://accounts.fitbit.com/signup?targetUrl=https%3A%2F%2Fwww.fitbit.com%2Fglobal%2Fus%2Faccount). Just use a valid email and a password.

Graphical user interface, text, application, email

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After you successfully create an account, go to [dev.fitbit.com](https://dev.fitbit.com/getting-started/) and from the upper right corner of the page, select **Manage/Register An App.**

You will see a page like the below one (taken from the tutorial we attached before):

Graphical user interface, application

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You need to specify **Personal** Application Type to be able to ask to download intraday data. The callback URL is http://127.0.0.1:8080 because the Python API we will use has it as the default redirect URL.

Next steps are pretty straightforward, so we will not mention them here. As mentioned in the tutorial, keep in mind to write down the CLIENT\_ID and CLIENT\_SECRET provided during the registration, as there are useful for the next step.

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**API authorization in Python**

Fitbit authorizes users and authenticates API calls using OAuth 2.0. The OAuth 2.0 framework requires your application to obtain your own Access Token when the Fitbit user authorizes your app to access their data. The Access Token is used for making HTTPS requests to the Fitbit API.

The authorization process is enabled by the Python code below

A picture containing text, font, screenshot, line

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After authorization and login, the page should appear as shown.

A screenshot of a computer

Description automatically generated with medium confidence

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**API requests for data acquisition**

Fitbit Web API provides a wide range of [endpoints](https://dev.fitbit.com/build/reference/web-api/), including exercise details, activities summary (calories, steps, distance covered etc.), heart rate, sleep measures and many other interesting health categories.

For this tutorial, we will acquire data for **Sleep & User Engagement**. The code we used is the following:

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Description automatically generated

where **base\_date** and **end\_date** specifies the data range in which we retrieve the data from Fitbit API and **activity** is the activity types, which include in our case:

|  |  |
| --- | --- |
| *activities-minutesSedentary* | *activities-heart* |
| *activities-minutesLightlyActive* | *activities-steps* |
| *activities-minutesFairlyActive* | *sleep* |
| *activities-minutesVeryActive* |  |
|  |  |

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**Data storage in MongoDB**

We built 3 main functions to get the information we need from the API response. In all these functions, for each metric we collect data for, we create a new dictionary with a random hash ID, the metric type, and the metric value for that day. We use a NoSQL database, the famous MongoDB. This is a document-based database, which uses JSON-like (BSON) documents to store data. You can download MongoDB from [here](https://www.mongodb.com/try/download/community) and then, we recommend you to use [MongoDB Compass](https://www.mongodb.com/products/compass) or [Studio 3T](https://studio3t.com/) for visualizing the contents.

The following code is used to transform the data in the above-mentioned form.

A picture containing text, font, screenshot

Description automatically generated

Figure 1: create\_data function

Then, we insert each new dictionary into a MongoDB collection within a MongoDB database. An example of the data we acquire looks like that:

A screenshot of a computer

Description automatically generated with low confidence

We have multiple types of records and each document contains **only one Fitbit record.**

The first function used to get data from Fitbit API is the ***getSleepData( ).*** It retrieves the sleep data for each day, within the date range, and for each main sleep session on that day, it extracts various sleep metrics such as sleep duration, start time, minutes spent in deep, light, REM, and wake sleep stages etc.

The other two are ***getActivityData( )*** and ***getStepsData( )*** functions and we use them to get insights on the engament of the user.

The ***getActivityData()*** function retrieves activity data from the Fitbit API for a specified date range and activity types. The activity types include sedentary minutes, lightly active minutes, fairly active minutes, very active minutes, and heart rate. The function then loops through the date range and creates new data entries for each type of activity. It also creates a new data entry for the total wear time for the day.

The ***getStepsData()*** function retrieves the step count data from the Fitbit API for a specified date range. It then loops through each item in the step count data and gets the steps count data for the current date.

The following figure shows an example of the code used to retrieve, transform, and store step data into mongoDb. The procedure is similar for the rest of the data. The full code can be found in our GitHub repository (add link).

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**Setting up a Streamlit website with Python**

After creating the database, it is interesting to create some visualizations to get a better understanding of the data. For a faster way to build and share our data app, we used [Streamlit](https://streamlit.io/), an open-source Python library that makes it easy to build beautiful custom web apps for machine learning and data science.

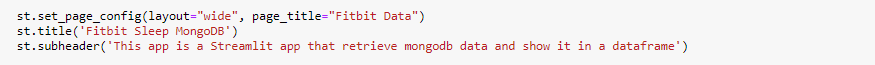
It is quite simple to install Streamlit using pip in your dedicated Python environment.



Then, in a Python file, let’s say app\_st.py, import the library.



There are various functions of the library to define the layout of the application in Streamlit. For example, we can set the screen size, add a main title and a main text.



After writing the code to create the visuals, it is easy to plot them in the Streamlit dashboard. In our case, we first created plots using matplotlib library and then displayed those plots in Streamlit using the following line of code.



When the code is ready, we can run the web application locally with Streamlit. We can do it by using the following command in the terminal.



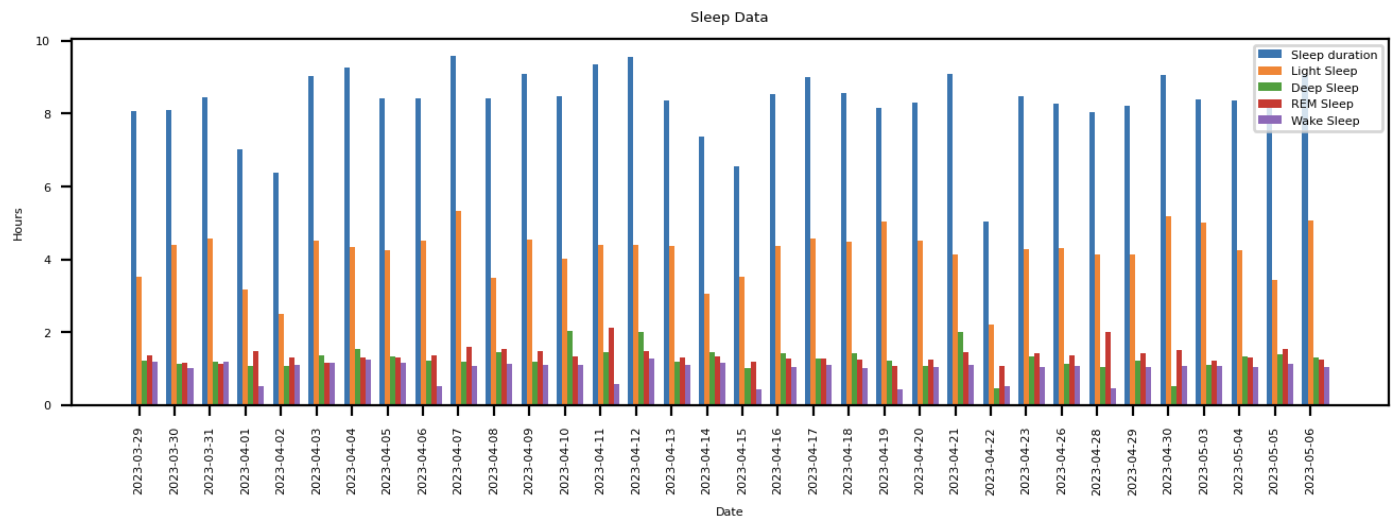
This code will open a new tab in your browser with the web application.

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**Visualizations with Streamlit for understanding Fitbit data**

Now that we have obtained the data we want, we can make some interesting visualizations for better understanding of the data. This will also help us to reach into useful conclusions.

***Sleep time***

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This bar chart provides a detailed breakdown of the different stages of sleep, including light sleep, deep sleep, REM sleep, and wake time, as well as the total sleep duration. This chart can be useful in identifying any irregularities or patterns in a person's sleep. By monitoring sleep patterns regularly, a person can identify any trends or improvements in their sleep, and adjust their habits accordingly.

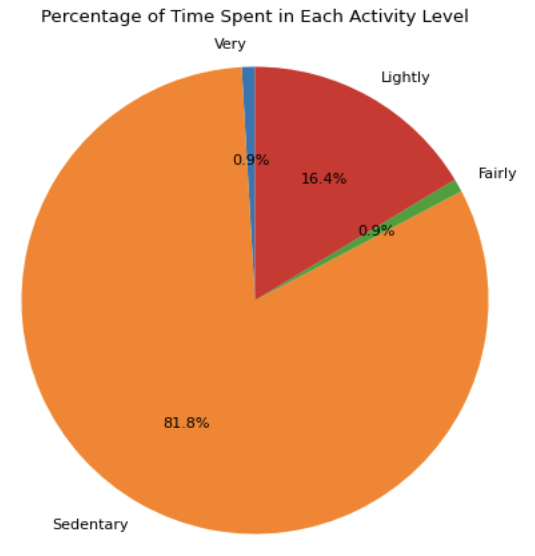
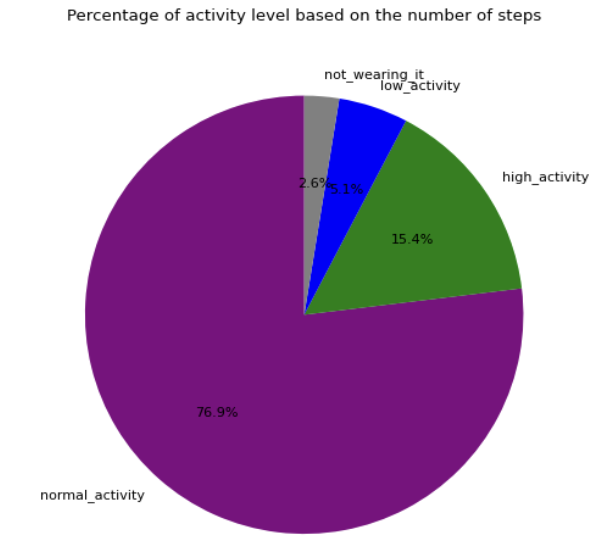
***Steps per Day***

***Chart, line chart

Description automatically generated***

This chart shows the number of steps the user took on each date. The green line shows the baseline to 10000 steps, where the user’s high activity starts. The pink line shows where the low activity ends (500 steps).

***Steps and activity levels pipes***



The left pie indicates the percentage of the days that the used had a specific activity level. The *low\_activity* is the days that user did less than 500 steps, *normal\_activity* the days the user did more than 500 steps but also less than 10000 and *high\_activity* the days that user did more than 10000 steps. *not\_wearing\_it* is the days with 0 steps, which means that the user wasn’t wearing the smartwatch.

The right pie chart provides a quick summary of how the user spends their time across different activity levels. By breaking down the total time into four distinct categories - sedentary, lightly, fairly, and very active - it offers valuable insights into their daily physical activity patterns. Based on the pie chart, it appears that the user spends a significant amount of time in sedentary and lightly active activities. It might be beneficial for the user to aim for a higher level of physical activity by increasing their time spent in fairly active activities.

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**Insightful conclusions**

From the given set of sleep diagrams, it can be inferred that the user has a consistent sleep pattern, with a bedtime around midnight and a sleep duration of approximately 8 hours. The user experiences minimal periods of wakefulness throughout the night, with the majority of their sleep time being spent in light and REM sleep.

Based on the diagrams provided on steps and activity levels, we understand that the user is moderately engaged with their Fitbit device, as indicated by their average daily step count of around 8000 steps. The bar chart showing the user's total wear time and sleep duration per day indicates that the user is consistently wearing their Fitbit device. From the available data, it can be inferred that the user wears the Fitbit device on most days, as there are only a few days with missing data in the diagrams.

Overall, the diagrams suggest that the user is aware of their physical activity and sleep patterns and is engaged with their Fitbit device, but there is potential for improvement in their activity level.

*I hope you find this tutorial useful. Please let us know if you have any thoughts or concerns.*

*Thanks for reading!*