Report

Assignment 3 - MongoDB

Group: 34
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INTRODUCTION

The purpose of this practice is to work with a dataset of trajectories, users, activities and trackpoints. We had to create tables, clean and insert data, and make queries to answer some questions using python programming and MongoDB functions. We simulated some features of Strava, a website where users can track activities like running, walking, biking, etc. and post them online with stats about their workout.

We had two tasks to do. In task 1 we had to focus on cleaning and inserting the data into defined tables, and in task 2 we had to focus on writing queries to the database to gain knowledge of the dataset.

In relation to the team, we worked mainly on one computer, but we also worked with GitHub, which allowed us to upload code repositories and code simultaneously.

Since this assignment was very similar to assignment 2, most of the application-side code was recycled, so most of the work was put into elaborating the MongoDB queries.

RESULTS

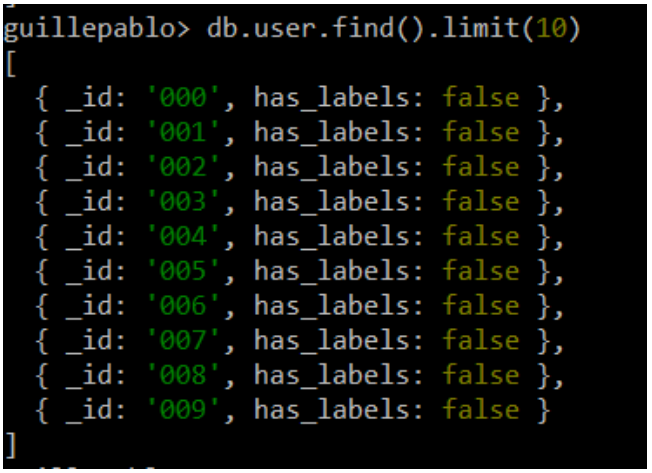
Task 1

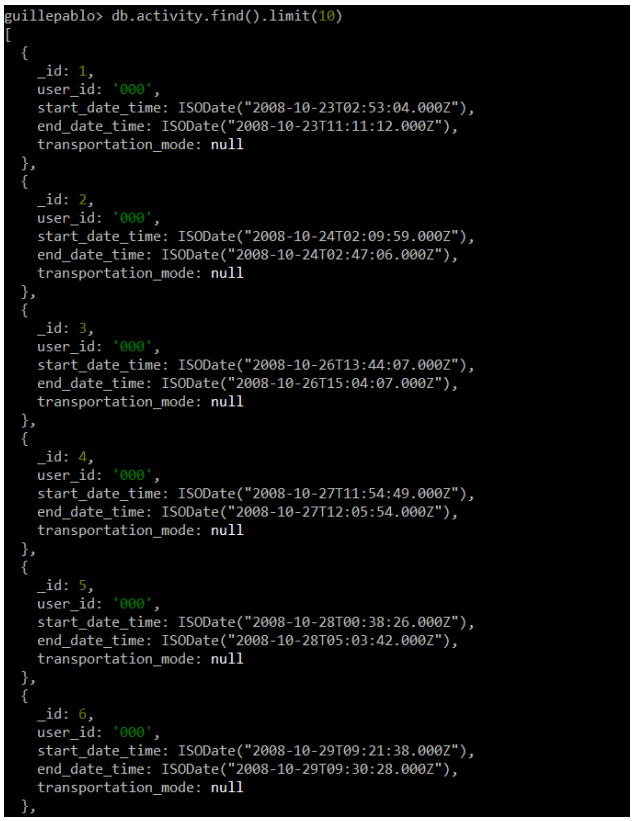
For the first task, we inserted all the data found on the dataset files. This time, we didn't have to create the collections beforehand, since they can be created lazily when inserting objects into them. The data insertion was done similarly to the previous assignment, by first finding which users have labels and then doing a double loop on every user folder and activity subfolder found on the dataset.

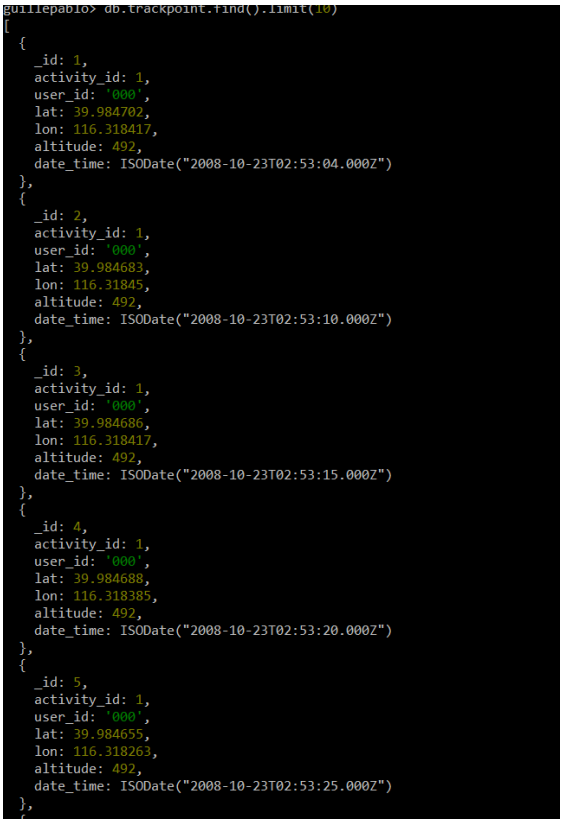
This time, the batch insertion of trackpoints wasn't done on activity packages. Instead, trackpoints were inserted in batches of equal length defined in the variable `trackpoint_batch_size` that was set to 100000. We opted for this approach because of the lack of foreign key constraints and a higher efficiency on the insertion.

We also introduced some *denormalization* to the schema, to make queries on the trackpoint collection easier, we added the `user_id` attribute to it. This way, we compensate for the lack of joins, allowing us to do all the exercises on task 2 in only one query.

We now present 3 screenshots featuring the first 10 documents of every collection inside the DB:







Task 2

We now present a list of the results we got from executing the queries.

- Query 1 - How many users, trackpoints and activities are there in the dataset (after it is inserted into the database):

```
  Total Users    Total Activities    Total Trackpoints
-------------  ------------------  -------------------
          182               16048              9681756

Query done in 5.65 seconds
```

- Query 2 - Find the average number of activities per user:

```
  Average
---------
   92.763

Query done in 0.03 seconds
```

- Query 3 - Find the top 20 users with the highest number of activities:

```
  Users    Activities
-------  ------------
    128          2102
    153          1793
    025           715
    163           704
    062           691
    144           563
    041           399
    085           364
    004           346
    140           345
    167           320
    068           280
    017           265
    003           261
    014           236
    126           215
```

```
    030           210
    112           208
    011           201
    039           198

Query done in 0.02 seconds
```

- Query 4 - Find all users who have taken a taxi:

```
  Taxi Users
------------
          10

Query done in 0.05 seconds
```

- Query 5 - Find all types of transportation modes and count how many activities that are tagged with these transportation mode labels. Do not count the rows where the mode is null:

```
Transportation Mode             Count
---------------------          -------
subway                           133
airplane                           3
bike                             263
boat                               1
walk                             480
run                                1
train                              2
car                              419
taxi                              37
bus                              199

Query done in 0.11 seconds
```

- Query 6
    - a) Find the year with the most activities:

```
  Year    Activities
------  ------------
  2008          5895

Query done in 0.09 seconds
```

- b) Is this also the year with the most recorded hours?:

```
  Year    Hours
------  -------
  2009    11636

Query done in 0.10 seconds
```

As we see, 2008 with the most activities, but 2009 has more hours recorded

- Query 7 - Find the total distance (in km) walked in 2008, by user with id=112:

```
  Total Distance
----------------
         3316.68

Query done in 7.67 seconds
```

- Query 8 - Find the top 20 users who have gained the most altitude meters:

```
  Top    User ID    Altitude gained
-----  ---------  -----------------
    1        128        2.13567e+06
    2        153        1.82074e+06
    3        004        1.08936e+06
    4        041   789924
    5        003   766613
    6        085   714053
    7        163   673472
    8        062   596107
    9        144   588719
   10        030   576377
   11        039   481311
   12        084   430319
   13        000   398638
   14        002   377503
   15        167   370650
   16        025   358132
   17        037   325573
   18        140   311176
   19        126   272394
   20        017   205319
```

```
Query done in 127.55 seconds
```

- Query 9 - Find all users who have invalid activities, and the number of invalid activities per user:

User	Number of invalid activities
000	101
001	45
002	98
003	179
004	219
005	45
006	17
007	30
008	16
009	31
010	50
011	32
012	43
013	29
014	118
015	46
016	20
017	129
018	27
019	31
020	20
021	7
022	55
023	11
024	27
025	263
026	18
027	2
028	36
029	25
030	112
031	3
032	12
033	2
034	88

035	23
036	34
037	100
038	58
039	147
040	17
041	201
042	55
043	21
044	32
045	7
046	13
047	6
048	1
050	8
051	36
052	44
053	7
054	2
055	15
056	7
057	16
058	13
059	5
060	1
061	12
062	249
063	8
064	7
065	26
066	6
067	33
068	139
069	6
070	5
071	29
072	2
073	18
074	19
075	6
076	8
077	3
078	19

079	2
080	6
081	16
082	27
083	15
084	99
085	184
086	5
087	3
088	11
089	40
090	3
091	63
092	101
093	4
094	16
095	4
096	35
097	14
098	5
099	11
100	3
101	46
102	13
103	24
104	97
105	9
106	3
107	1
108	5
109	3
110	17
111	26
112	67
113	1
114	3
115	58
117	3
118	3
119	22
121	4
122	6
123	3

124	4
125	25
126	105
127	4
128	720
129	6
130	8
131	10
132	3
133	4
134	31
135	5
136	6
138	10
139	12
140	86
141	1
142	52
144	157
145	5
146	7
147	30
150	16
151	1
152	2
153	557
154	14
155	30
157	9
158	9
159	5
161	7
162	9
163	233
164	6
165	2
166	2
167	134
168	19
169	9
170	2
171	3
172	9

```
   173                                  5
   174                                 54
   175                                  4
   176                                  8
   179                                 28
   180                                  2
   181                                 14

Query done in 103.09 seconds
```

- Query 10 - Find users who have tracked an activity in the Forbidden City of Beijing:

```
  User ID
---------
      004
      018
      019
      131

Query done in 5.28 seconds
```

- Query 11 - Find all users who have registered transportation_mode and their most used transportation_mode:

```
  User  Most used transportation mode
------  -------------------------------
   010  taxi
   020  bike
   021  walk
   052  bus
   056  bike
   058  car
   060  walk
   062  bus
   064  bike
   065  bike
   067  walk
   069  bike
   073  walk
   075  walk
   076  car
   078  walk
```

```
   080  bike
   081  bike
   082  walk
   084  walk
   085  walk
   086  car
   087  walk
   089  car
   091  bus
   092  bus
   097  bike
   098  taxi
   101  car
   102  bike
   107  walk
   108  walk
   111  taxi
   112  walk
   115  car
   117  walk
   125  bike
   126  bike
   128  car
   136  walk
   138  bike
   139  bike
   144  walk
   153  walk
   161  walk
   163  bike
   167  bike
   175  bus

Query done in 0.02 seconds
```

DISCUSSION

We observe that most of the queries are a bit slower compared to the ones in the previous assignment. However the queries where the Trackpoint table had to be joined with the Activity one, are executed faster, since we introduced denormalization making the process faster.

In this assignment we learned about the differences between SQL and NoSQL database systems, and learned to work with MongoDB.