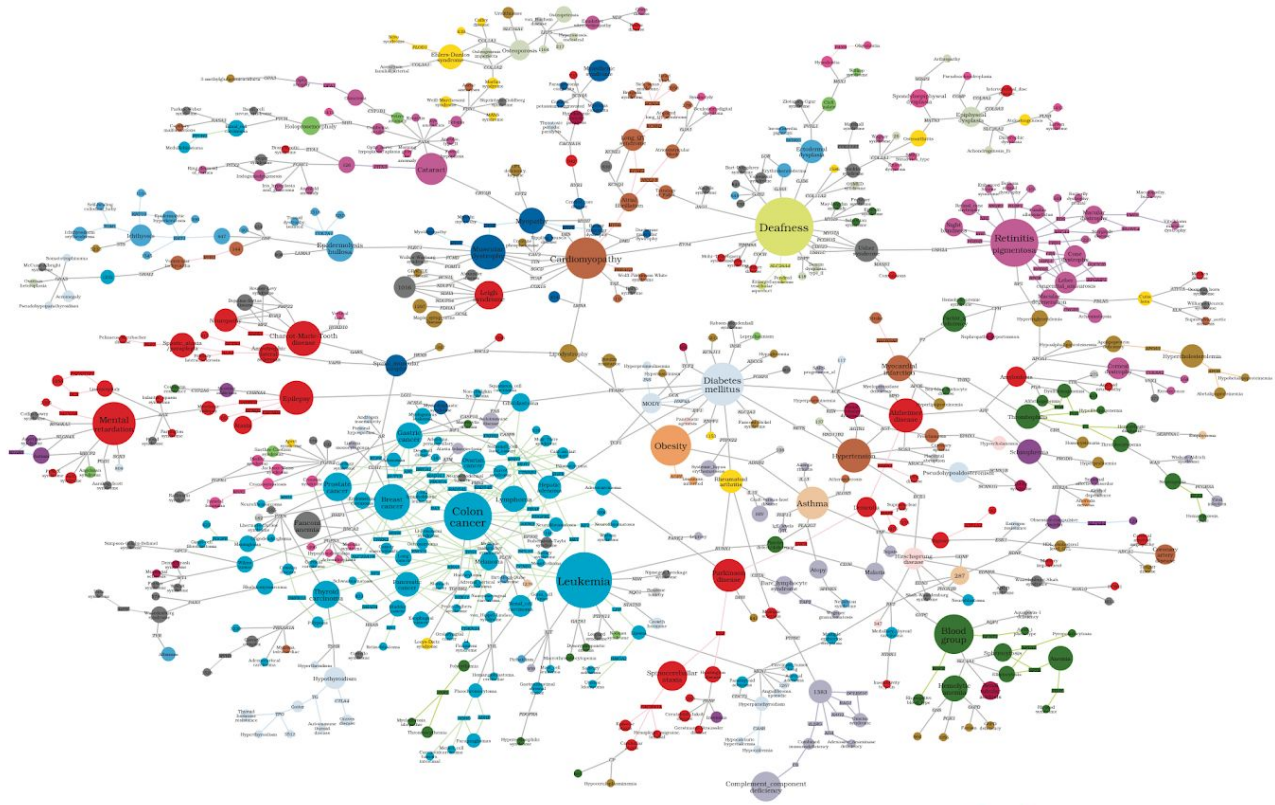
Data Communication & Networking Assignment-4

Task : Creating Social Graph of a person using GPS and Bluetooth.

#Create your social graph using your location trail of one week and the devices near your phone during any instance during this period.



Solution

Approach Taken :

There are fundamental datasets that are needed for performing this task i.e,

1. Location Trail of a person of one week, and
2. List of nearby devices' id at each instant of time during the period of one week

Images of the collected datasets:

Timestamp	Latitude	Longitude	Datetime
1449504643567	28.6491441	77.3225199	07/12/2015 21:40:43
1449504688980	28.6456985	77.3223254	07/12/2015 21:41:28
1449504733980	28.6458539	77.3252785	07/12/2015 21:42:13
1449504778984	28.646146	77.3296132	07/12/2015 21:42:58

Name of device	Bluetooth Address	Device Class	Timestamp
iPhone	BC:9F:EF:E7:F4:92	7995916	1589805837344
Anurag's Oneplus	C0:EE:FB:DA:5F:2A	5898764	1589805837344
HARISH	54:35:30:26:FD:6C	2752780	1589805837346

Having collected the above mentioned data we could further go ahead by ***merging*** both the data using the ***timestamp information*** present in them. After merging we will have a dataset which will contain, for each timestamp, an entry showing a ***person's location*** (latitude and longitude) and information about the ***devices nearby to that person***.

So the merged dataset will have the following fields:

- Timestamp -------- *It can be used to calculate accurate date and time of activity.*
- Latitude -------- *Latitude coordinate*
- Longitude -------- *Longitude coordinate*
- Device Id -------- *Bluetooth address, It is a unique 48 bit Id*
- Device Name -------- *Name of the Bluetooth device (may not be unique)*

Now using the final dataset we could plot the ***social graph*** of a person on a geographical map using ***latitude & longitude coordinates*** and the ***list of nearby devices*** at a particular timestamp. Devices nearby will be in the ***range of 7 to 10 meters*** as the physical range of bluetooth lies in that range, hence using this range we could plot the nearby devices' id or name in the graph.

Step by step procedure :

Step 1: Collection of Location Trail data

For the collection of location trail data of a person I created an android app named *XNavigate*. The android app, once given device's location permission, logs the location trail of the user and the saved location trail can be downloaded as a csv file as per the user's need. It also provides a feature in which a user can see all his location trails on the geographical map.

App can be downloaded from this link : Download XNavigate

Step 2: Collection of Nearby devices data

For the collection of nearby devices data I used python scripting language. There is a ***PyBluez*** package available which can be used to perform many bluetooth related tasks.

I used this package to get the information of all nearby devices near to my android device at a particular instant of time. I also included a code which stores the current timestamp along with the found nearby devices' other information, so that we could recall from collected data which devices were near to the user's device at any particular time.

Link to the code: See code

Step 3: Merging the collected data and plotting user's Social Graph

Merging of the two datasets can be done using the timestamp. Using timestamp information we can get the information on the user's location as well as the devices' id nearby to the user's device.

Final dataset after merging:

Timestamp	Latitude	Longitude	Device ID	Device Name
1449504643567	28.6491441	77.3225199	C0:EE:FB:DA:5F:2A	Anurag's Oneplus
1449504688980	28.6456985	77.3223254	BC:9F:EF:E7:F4:92	Akshat's IPhone
1449504733980	28.6458539	77.3252785	54:35:30:26:FD:6C	Ain't So Smart
1449504778984	28.646146	77.3296132	CD:32:45:FA:44:6E	Kushagra

As you can see after merging the dataset we can get multiple entries with the same timestamp value. We can group the data on the timestamp column to get the list of IDs of all the devices nearby to the user's device at each distinct instant of time.

Using this list of device IDs, latitude and longitude coordinates we can plot the user's social graph.

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