

# Twitter Data Analysis

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fetch data from twitter for

1. deriving sentiment of each tweet
2. getting top 10 hash tags / users
3. retrieving followers of a given twitter user
4. retrieving Tweets and profiles of followers of a given twitter user

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## 1. Introduction

This document provides a report of the project “TwitterDataAnalyis” (see [2. The project](#)) including following information:

- A brief description of the project
- Tools, Modules and Data Structures
- Class diagram
- Listing of necessary functions for each Task
- Program Sequence (flowcharts)

Moreover, the results of the project are described and enriched with screenshots for visualization.

Lastly the source code of the project and instructions how to use the project along with the requirements of my project are provided.

## 2. The Project

The objectives of this project – twitter data analysis – is to fetch data from Twitter by utilizing the twitter API and provide the user requested data. Hereby fetched and filtered data by below criteria shall be provided/displayed to the user in a convenient and clear manner.

Following four Tasks must be considered:

1. Derive the sentiment of each tweet using Python module.
2. Top 10 hash tags and users based on their number of tweets in your data set.
3. Get the followers of a given twitter user from your acquired data set.
4. Given a twitter user, obtain the tweets and profiles of all followers of the user and show it.

### 3. Tools, Modules and Data Structures

#### 3.1 Setup / Tools

For the development of the project Visual Studio Code will be used as integrated development environment (IDE). Python – version 3.10.3 - will be the used programming language leveraged by installing the ‘Python’ and ‘Python for VSCode’ extensions in Visual Studio Code. Additionally, a virtual environment will be utilized to install all required libraries into and having the advantage of keeping the system clean.

As this project requires to utilize the Twitter API for fetching data from Twitter a developer app linked to my Twitter account was created. Also – almost needless to mention – the Twitter dashboard for the developer app will be used to observe the count of requests already made. Furthermore, it will be taken advantage of the tool Postman mainly for quickly testing API requests.

As versioning tool git and the network-based service GitHub will be used.

#### 3.2 Modules

Python has a big advantage in terms of variety of libraries und therefor several python libraries will be used. These required libraries are:

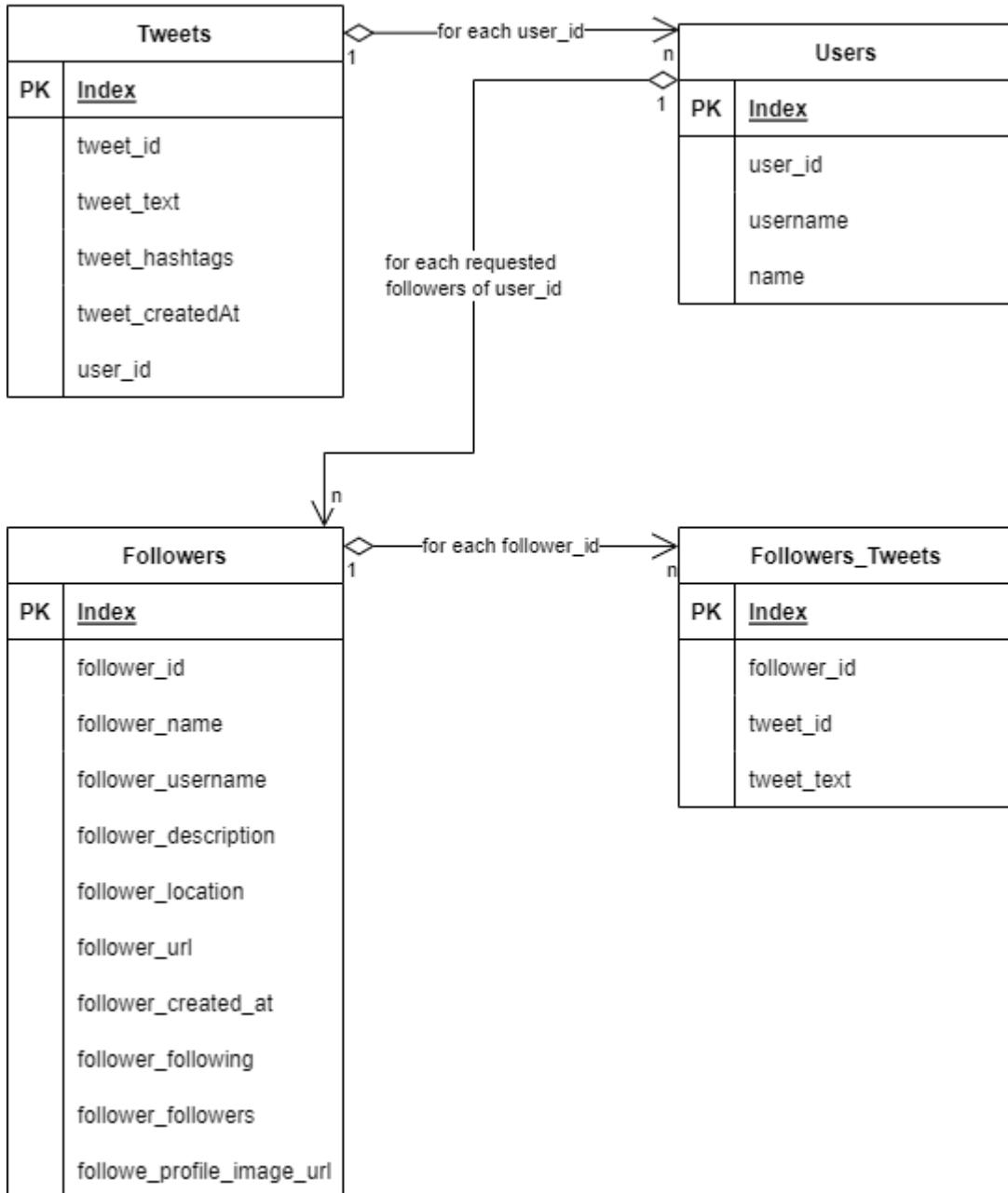
- os: to properly load environment variables, e.g. Access Keys for authentication to Twitter, into the program
- pandas: to process big data sets retrieved from Twitter API
- csv: to generate csv file/data structures and process those
- tweepy: for making API requests to the twitter api endpoint
- textblob: for text processing, particularly for sentiment analysis
- simple-term-menu: creating a easy to use and convenient user menu on the command line
- wordcloud: for creating wordcloud with mask of twitterlogo for most used words
- collections: for importing Counter and counting top 10 hashtags/users
- re (Regular Expressions): to remove eventually misleading URLs for analysing sentiment of Tweets
- tabulate: need for using pandas DataFrame methods to\_markdown()
- pdoc3: for automatically creating html documentation of classes/methods with docstrings
- black: Code formatter for unified formatting of python code

*Annotation:* Also have a look at the *requirements.txt* in the GitHub repository.

#### 3.3 Data Structures

To temporarily store/load data and process available data sets, pandas DataFrames are used. Altogether four DataFrames are needed: One DataFrame for tweets, one for users, one for followers of a user and lastly one for tweets of followers of a given user.

Following diagram will clarify and visualize above written approach:



The '*Tweets*' DataFrame contains the tweets fetched in the API requests with 'tweepy' and consists of 5 columns namely `tweet_id`, `tweet_text`, `tweet_hashtags`, `tweet_createdAt` and the `user_id`. The latter is the author of the tweet. `Tweet_hashtags` is a comma separated string of hashtags as loading DataFrames from csv files can cause a problem if elements are stored as lists. `Tweet_id` is the ID of the tweet and `tweet_text` is the corresponding tweet whereas `tweet_createdAt` is the timestamp when the tweet was sent.

The '*Users*' DataFrame is somehow related to the *Tweets* DataFrame as for each user – exactly for each `user_id` – the user is looked up and the username and name of the user is fetched via tweepy request. The user ID and corresponding username and name is stored within the *Users* DataFrame.

If the user wants to get the followers of a user ([Task 3](#)), the '*Followers*' DataFrame will be utilized to store the fetched followers of the desired user entered by the user of this program. This DataFrame also holds the data for the description – also known as bio or profile of a user - of followers. The user can get these profiles in another option of the main menu which partially fulfills [Task 4](#).

If the user wants to get the profiles and tweets of all followers of entered user as part of [Task 4](#), the last DataFrame ‘*Followers\_Tweets*’ is used to store all tweets fetched for all followers. Hereby this DataFrame consists of three columns namely follower\_id, tweet\_id and tweet\_text which makes it possible to assign every fetched tweet to exactly the follower who has sent this tweet.

#### Naming convention for storing DataFrames in csv files

For each different topic which is entered a new folder – called like the topic/queryString - will be created and within this folder a file with ‘{topic}.csv’ will be created. In this file all fetched tweets for this topic are stored and therefor this is the container for the ‘Tweets’ DataFrame. Also, the ‘Users’ DataFrame is stored at the top level within this folder called like ‘{topic}\_users.csv’. If the user demands the followers of a user or the tweets and profiles of all followers a subfolder ‘followers’ is created in which all DataFrames are stored as csv with this naming convention: {userid}\_followers.csv. For the followers tweets the DataFrame will be stored also within this subfolder as {userid}\_tweets\_followers.csv.

#### Markdown Files

If the user demands to generate Markdown files those are all stored within a subfolder in the chosen topic folder called ‘*markdown*’.

### 3.4 Twitter Keys/Tokens

For loading Twitter Keys, Secrets and Token into the program the ‘os’ library will be utilized get those stored/exported as environment variables. Summed up, there are five environment variables to set to utilize the twitterclient: TWITTER\_ACCESS\_TOKEN\_SECRET, TWITTER\_ACCESS\_TOKEN, TWITTER\_CONSUMER\_SECRET, TWITTER\_CONSUMER\_KEY, TWITTER\_BEARER\_TOKEN.

The only required environment variable is the last one, the TWITTER\_BEARER\_TOKEN. For guaranteeing access all five environment variables should be set, but nonetheless it should work by merely setting this one required variable.

### 3.5 User Interface

For creating an easy to use and conveniently user-interface the library ‘simple-term-menu’ is leveraged. This library allows to easily create a main menu and several submenus where the user can interactively select available options by ‘up’ and ‘down’ keys or pressing the corresponding number.

Although an additional module is used for creating the user interface, it will completely run on the command line which simplifies input handling, e.g. the queryString/topic or choosing an tweet id to derive the polarity of. Additionally to mention is always the option of the user to generate markdown files for each DataFrame (see [3.3 Data Structures](#)), which the user can open with an text editor of his choice to have a permanent file of desired request.

There is one big disadvantage of using this module which should not be concealed: The library ‘simple-term-menu’ is only supported by UNIX distributions and their command lines/shells. Therefor it’s not possible to run this program in Windows on PowerShell. But by installing Windows Subsystem Linux (WSL) it is also possible to run this program on the WSL.

## 4. Class Diagram

Altogether there are four modules and each module contains a class.

The '*TwitterClient*' class provides a client authenticating to the Twitter API endpoint for fetching tweets, users, followers and tweets of followers. It is only responsible for fetching data from the Twitter API endpoint. If anything goes wrong by fetching data from Twitter it catches occurring errors and exceptions and displaying the user the cause of the issue.

The '*DataProcessing*' class instantiates an instance of the TwitterClient class and uses it to fetch the data if it is not already available. This class is entirely responsible for loading the data as DataFrames into member variables either from csv files, if those are available, or to fetch it with the above mentioned instance of the TwitterClient. Furthermore, it handles the generation of markdown files and the calculation of the top 10 most hashtags/users as part of [Task 2](#).

The '*Sentimentanalysis*' class derives the sentiment, particularly the polarity, of each tweet and therefore fulfills [Task 1](#). Furthermore it calculates the average polarity of each tweet, allows to analyse only a single tweet and additionally provides the meaning of the polarity as string. It also facilitates to get the most used words in the fetched dataset of tweets and creates a wordcloud with the mask of the official twitterlogo.

The '*Menu*' class provides the interface between the program and the end user. It possesses an instance of the DataProcessing and Sentimentanalysis class. The first one is needed to get the DataFrames for displaying the data to the user, calculating top 10 hashtags/users and providing markdown files to the user whereas the latter is used to provide the user the possibility to analyze the desired tweet the user entered. This class is entirely responsible for the interaction with the user including creating the menu – main menu and all submenus – and retrieving input from the user. On the one hand for the selection of options in the menus is taken care of whereas on the other hand also text input is handled like getting a new querystring for changing the topic or entering a tweetid (or corresponding index in the DataFrame) to analyze or entering a userid (or corresponding index in the DataFrame) for getting the followers/tweets of followers of given user. Hence, this class provides and controls the entire output on the command line for the user.

The class diagram on the next page shows the relations between above four mentioned classes visually. It also shows the affiliated methods including their return types and member variables of each class.



## 5. Listing of necessary functions for each Task

For better understanding I recommend to first read [4. Class Diagram](#) to get a clear view of the available classes/modules and their functionality. In following subchapters for each Task – Task 1 to Task 4 described in [2. The Project](#) – the methods to fulfill this task are listed and described briefly. How the DataFrames are loaded from csv file or fetched with the twitterclient is documented in [6.1 Logic behind getting DataFrames](#). For loading from csv file the DataProcessing methods `get_{dataframe}_df()` are needed and if not already stored as csv file the twitterclient methods `fetch_{dataframe}()` are needed. For `{dataframe}` there are four options: `tweets`, `user`, `followers` and `followers_tweets`.

**! Annotation:** As those functions are also commented in code with docstrings, the documentation of each method is documented with ‘`pydoc`’ and stored at ‘`html`’ whereas following subchapters only describe the relation between those functions and which methods are needed for which task.

### 5.1 Methods for Task 1

For [Task 1](#), the derivation of the sentiment of each tweet, solely the class `Sentimentanalysis` is responsible. This class firstly gets all tweets as list in the constructor (in python `__init__()` function) and offers the method `analyse_all_tweets()` which analyses those tweets with the ‘`textblob`’ library and returns their polarity also as list. This entirely fulfills Task 1 already as the User no can browse through the dataframe tweets including their polarity. Moreover, it is possible to analyse only a single tweet the user entered with the method `analyse_single_tweet()` doing exactly the same as the method for analysing all tweets but only for one tweet. Additionally the user can the average polarity with the `get_avg_polarity()` method which returns the average/mean polarity of the tweets in the acquired dataset. The last method `get_most_used_words()`, kind of extra bonus for this Task, creates a wordcloud with the officials twitterlogo mask of the 30 most used words and shows it the user.

### 5.2 Methods for Task 2

After the required DataFrame is loaded ([see 6.1 LogicBehindGettingDataFrames](#)) [Task 2](#) , getting the top 10 most used hashtags and 10 most users based on their number of tweets in the acquired dataset, can be fulfilled. This is done by leveraging the `DataProcessing` class and using the methods `get_top_10_hashtags()` and `get_top_10_users()` which are returning the 10 most used hashtags/users.

### 5.3 Methods for Task 3

For [Task 3](#), getting the followers of a given user, only loading of the correct `followers` DataFrame is needed reading the csv file into a member variable of type `pandas.DataFrame`. Alternatively if the corresponding csv file does not exist yet, the twitterclient method `fetch_followers(userid)` is called, where for a given userid the followers are fetched and returned as `pandas DataFrame`. This decision whether to load from csv file or fetching with the twitterclient is done within the method `get_followers_df()` of the [DataProcessing class](#).

### 5.4 Methods for Task 4

For [Task 4](#), obtaining the tweets and profiles of all followers of given user, only loading of the correct `followers_tweets` DataFrame is need. This is either done by reading the corresponding csv file or fetching the data with the twitterclient method `fetch_tweets_of_followers(followerids)` which returns a `pandas DataFrame` of tweets for given followerids of the given user. Afterwards it is stored into a member variable of type `pandas.DataFrame` of the [DataProcessing class and subsequently printed out on the command line to the user](#).

## 6. Program Sequence

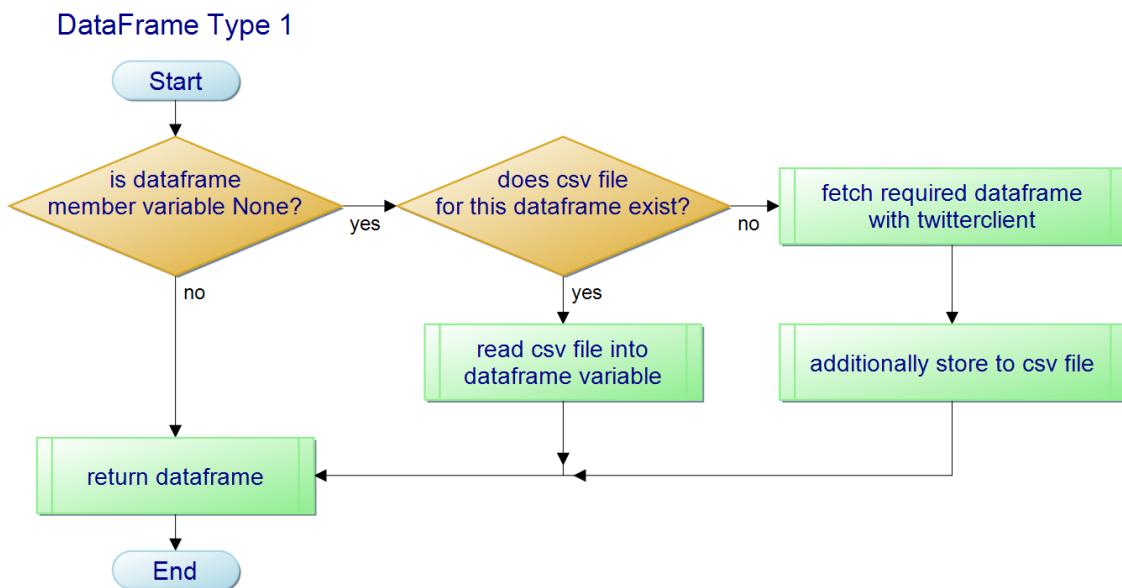
### 6.1 Logic behind getting DataFrames

As documented in [3.3 Data Structures](#) there are four DataFrames. The *Tweets* and *Users* DataFrame are only loaded once either from an existing csv file or by fetching it with the twitterclient as they are permanent for one topic and are always the same. The other two DataFrames *Followers* and *Followers\_tweets* have to be reloaded for each different user id provided from the user. Therefore those are always loaded with the correct `{userid}_followers.csv` respectively `{userid}_followers_tweets.csv` file if those already exists or corresponding requests with the twitterclient for given user ID are made.

Therefor those DataFrames can be divided into two types: the first [DataFrame Type 1](#) considering the *Tweets* and *Users* DataFrame and the second DataFrame Type 2 considering the *Followers* and *Followers\_Tweets* DataFrame.

#### 6.1.1 DataFrame Type 1

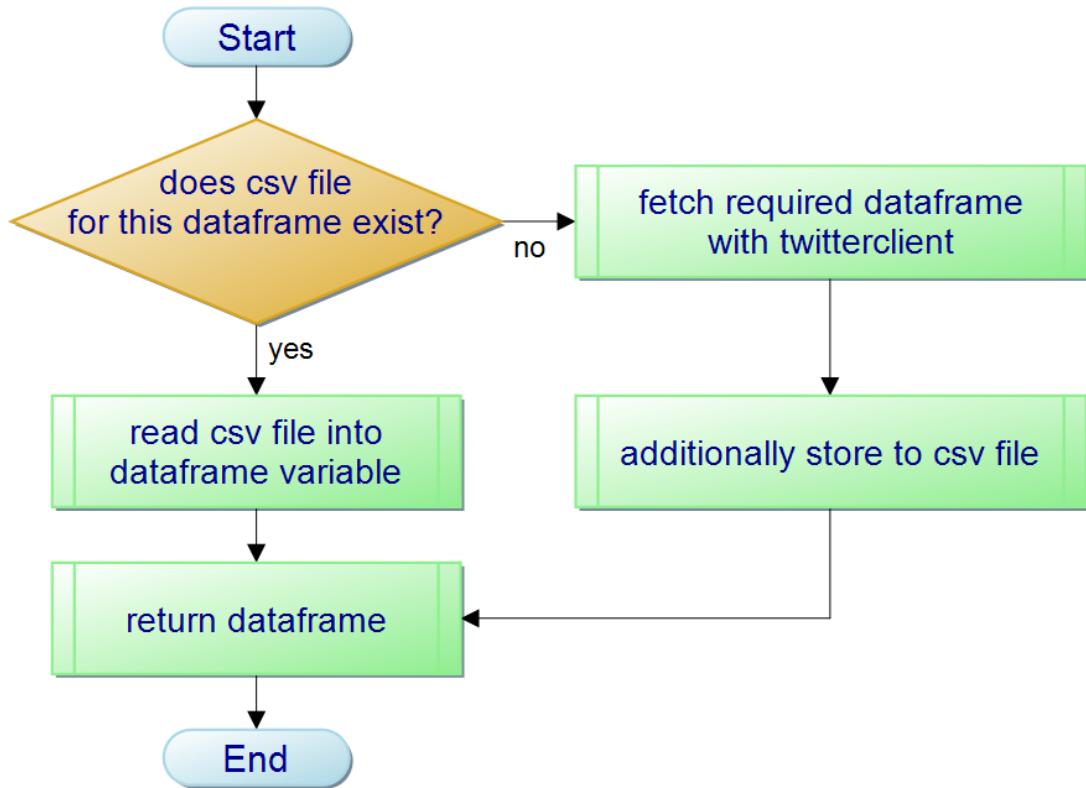
To this DataFrame Type 1 the *Tweets* and *Users* DataFrames are belonging to. Following flowchart explains the procedure getting this type of DataFrames: If the dataframe member variable of the DataProcessing class is already set the dataframe is directly returned. If not, then it will be checked if a csv file for corresponding topic and dataframe exists. If this csv file exists the csv file will be read with the *pandas read\_csv()* method and subsequently returned. If the csv file does not exist, the data for the required dataframe will be fetched with the twitterclient and additionally stored as csv file for the next time. Afterwards the dataframe is returned.



#### 6.1.2 DataFrame Type 2

To this DataFrame Type 2 the *Followers* and *Followers\_Tweets* DataFrames are belonging to. Following flowchart explains the procedure getting this type of DataFrames: If a csv file for the corresponding topic and dataframe exists read it with the *pandas read\_csv()* method and return the dataframe. If the csv file does not exist yet, the data for the required dataframe will be fetched with the twitterclient and additionally stored as csv file for the next time. Afterwards the dataframe is returned.

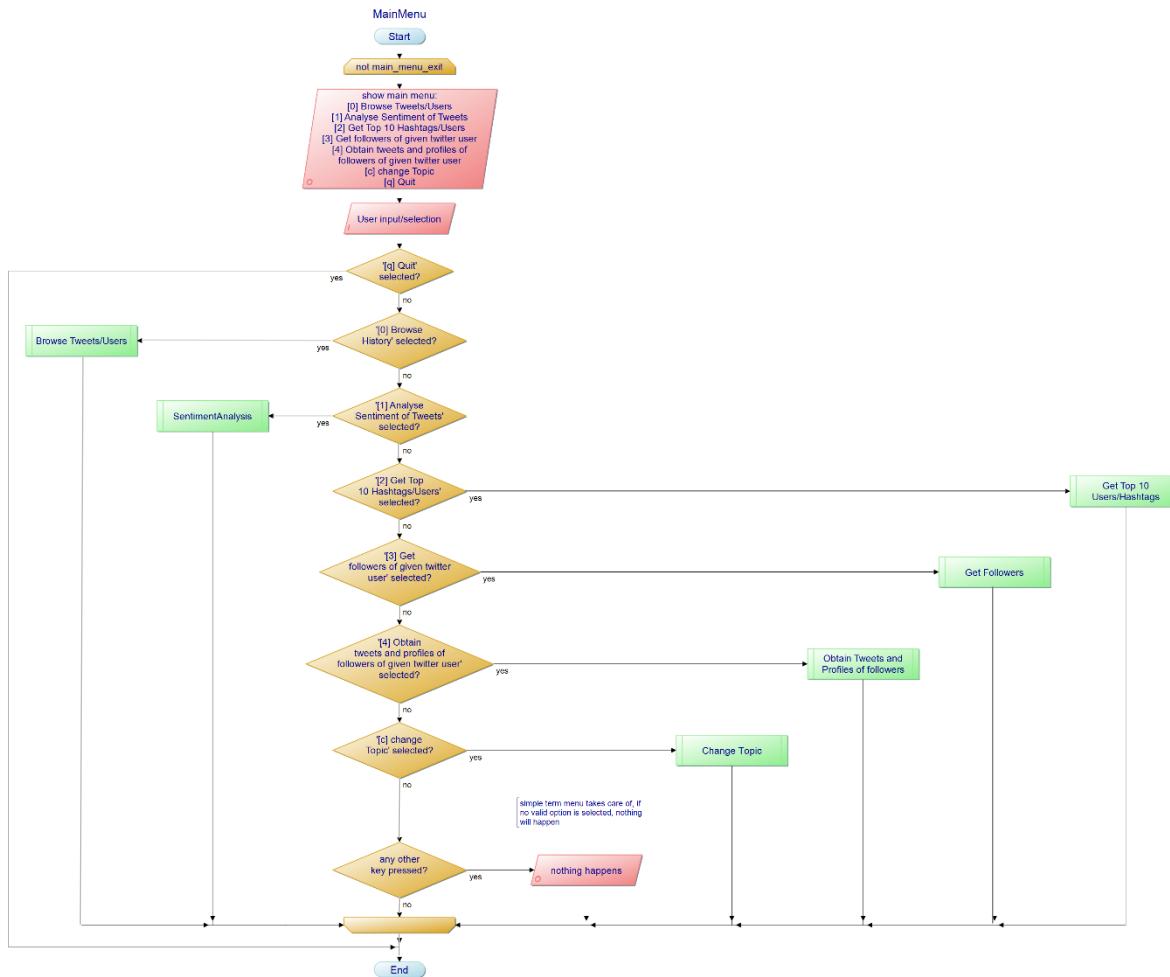
## DataFrame Type 2



## 6.2 Menu

### 6.2.1 Main Menu

Following flowchart shows the main menu and its available options.



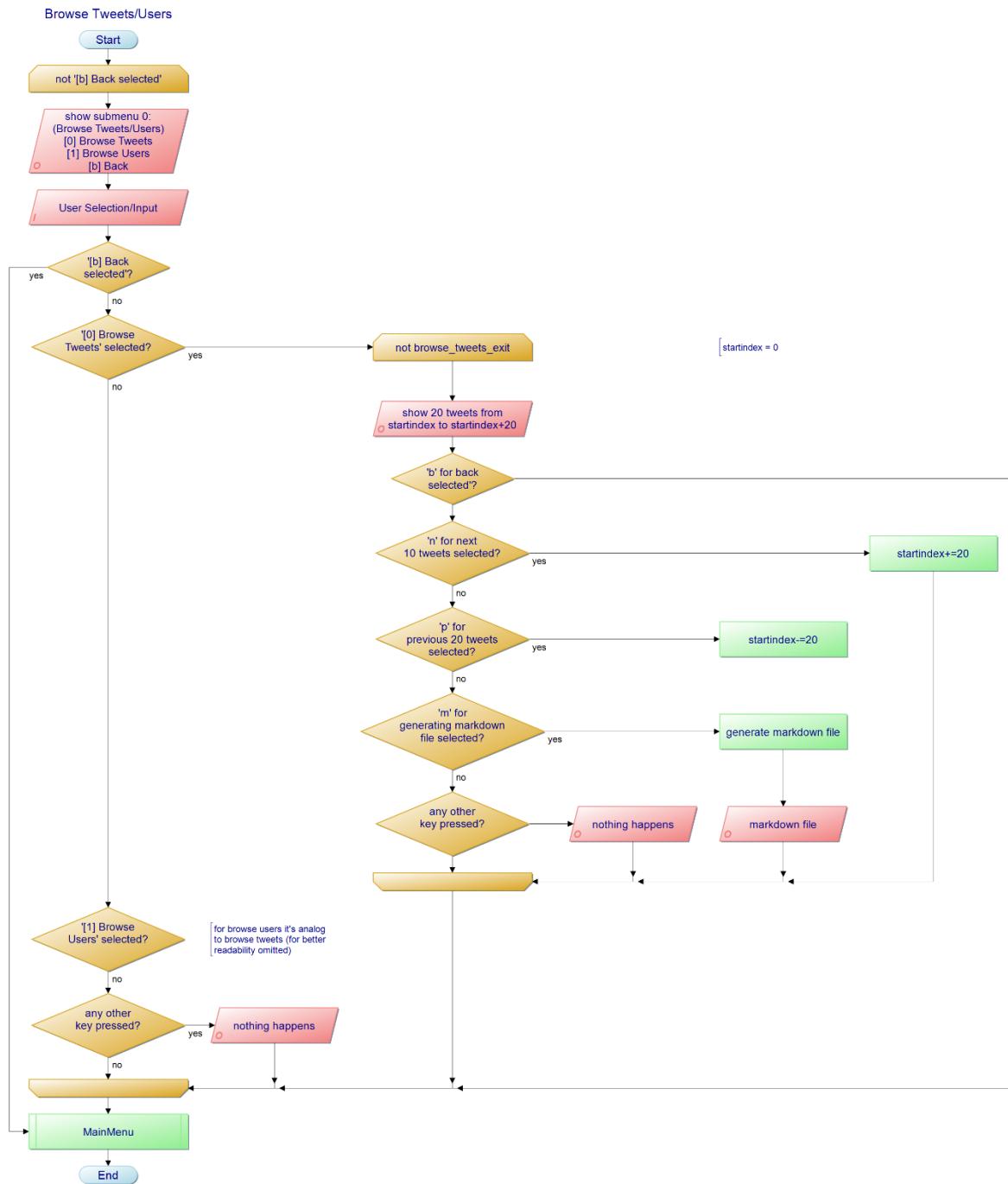
The user has the possibility to select one of seven choices:

If '[q] Quit' is selected, the program quits. If '[0] Browse/Tweets' is selected the user enters the Submenu 0 ([see 5.2.2](#)). If '[1] Analyse Sentiment of Tweets' is selected the user enters the Submenu 1 ([see 5.2.3](#)). If '[2] Get Top 10 Hashtags/Users' is selected the user enters the Submenu 2 ([see 5.2.4](#)). If '[3] Get followers of given twitter user' is selected the user enter the Submenu 3 ([see 5.2.5](#)). If '[4] Obtain tweets and profiles of followers of given twitter user' is selected the user enters Submenu 4 ([see 5.2.6](#)). If '[c] change Topic' is selected the user enters the change Topic submenu ([see 5.2.7](#)) and can enter another topic, for which tweets will be fetched and subsequently processed and analyzed.

### 6.2.2 Browse Tweets/Users (Submenu 0)

In this submenu 0 – Browsing Tweets/Users – the user can either select to browse the acquired dataset of tweets or users. If the user has entered one of both options he can navigate through all tweets/users with keys ‘n’ for next and ‘p’ for previous 20 tweets/users. Additionally, the user has the possibility to get a markdown file of tweets/users generated and opened by pressing ‘m’. With the key ‘b’ the user gets back to the submenu 0 if he/she was browsing tweets or user.

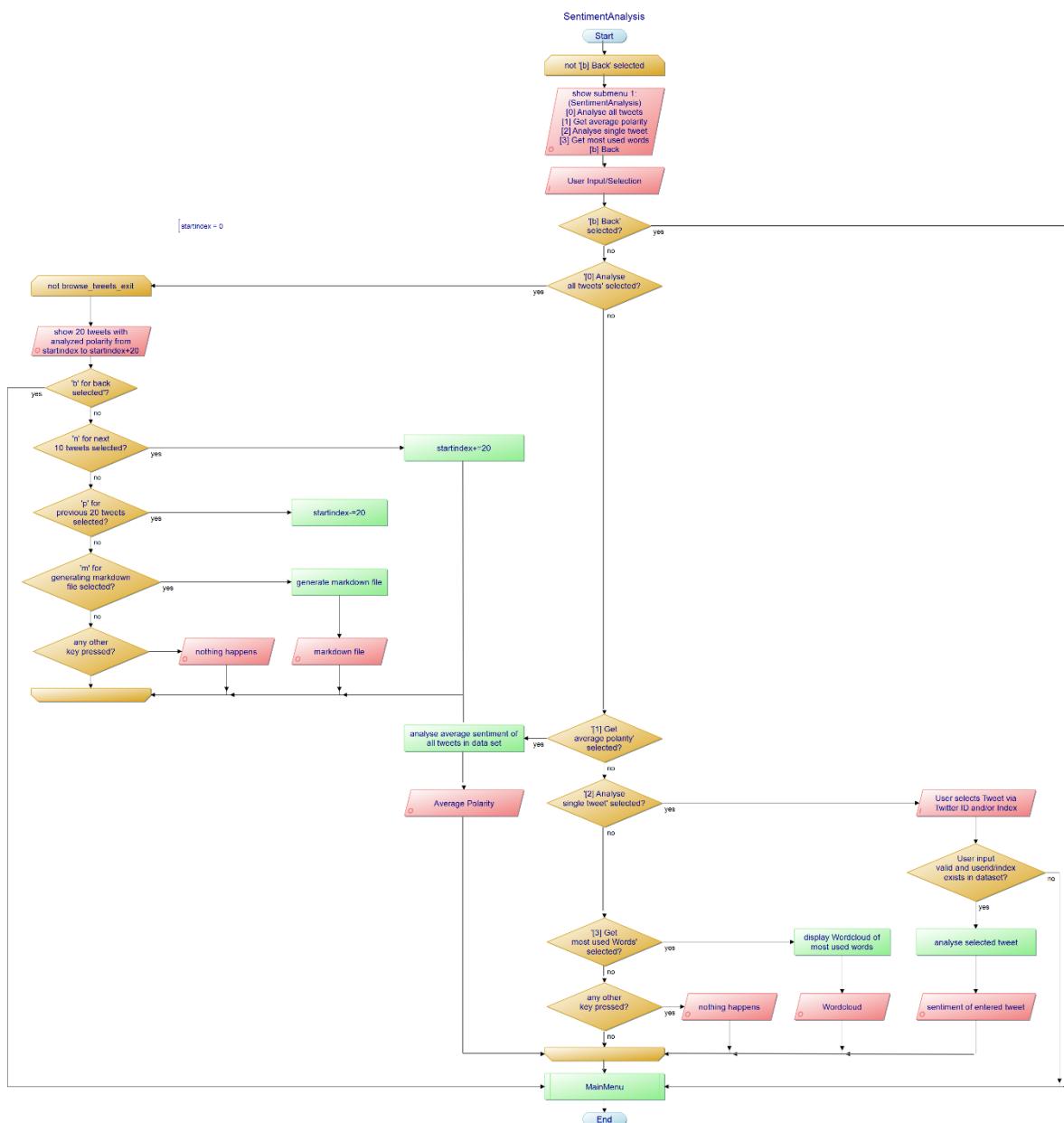
The ‘[b] Back’ option allows the user to go back to the main menu.



### 6.2.3 Sentiment Analysis (Submenu 1)

In this submenu 1 – Sentiment Analysis – the user can basically select between four options: '[0] Analyze all tweets', '[1] Get average polarity', '[2] Analyse single tweet' and '[3] Get most used words'. First of these options analyzes all tweets in the dataset and let the user browse through the tweets and its analyzed polarity values. Second option displays the average polarity of all tweets in the acquired dataset. Third option allows the user to enter any Tweet ID or its corresponding index in the DataFrame and retrieve the polarity of desired tweet. The last of those three options generates a wordcloud with a mask of the official twitter logo including about 30 most used words in the tweets of the acquired dataset. Of course, this wordcloud will be subsequently shown to the user.

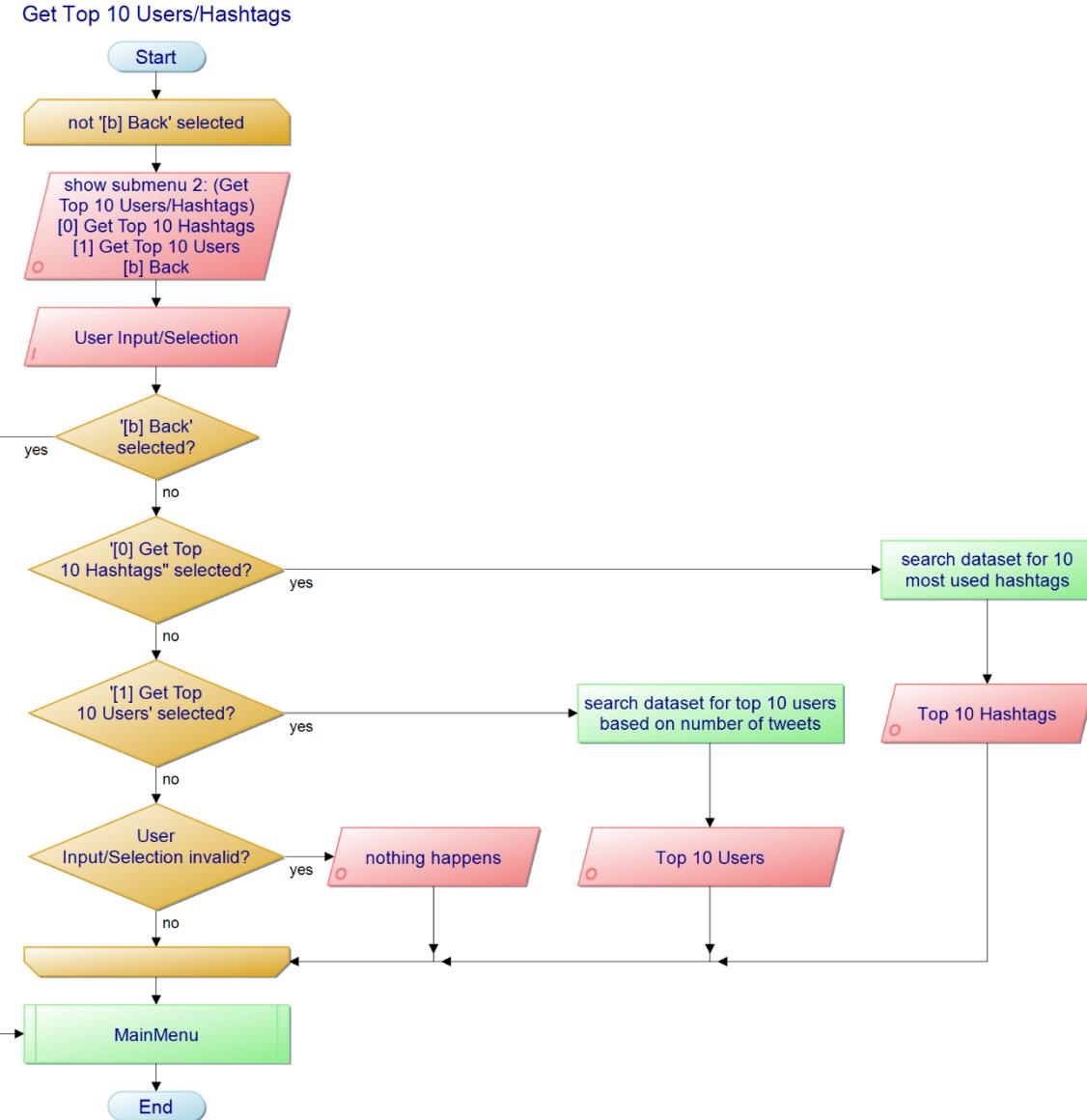
With the 'b] Back' option the user gets back to the main menu.



#### 6.2.4 Get Top 10 Users/Hashtags (Submenu 2)

In the submenu 2 – Get Top 10 Users/Hashtags – the user can select between two options: '[0] Get Top 10 Hashtags' and '[1] Get Top 10 Users'. The first choice prints out the username (+ user ID) and the number of tweets of the top 10 users based on the greatest number of tweets in acquired dataset. The latter choice prints out top 10 most used hashtags of the acquired dataset.

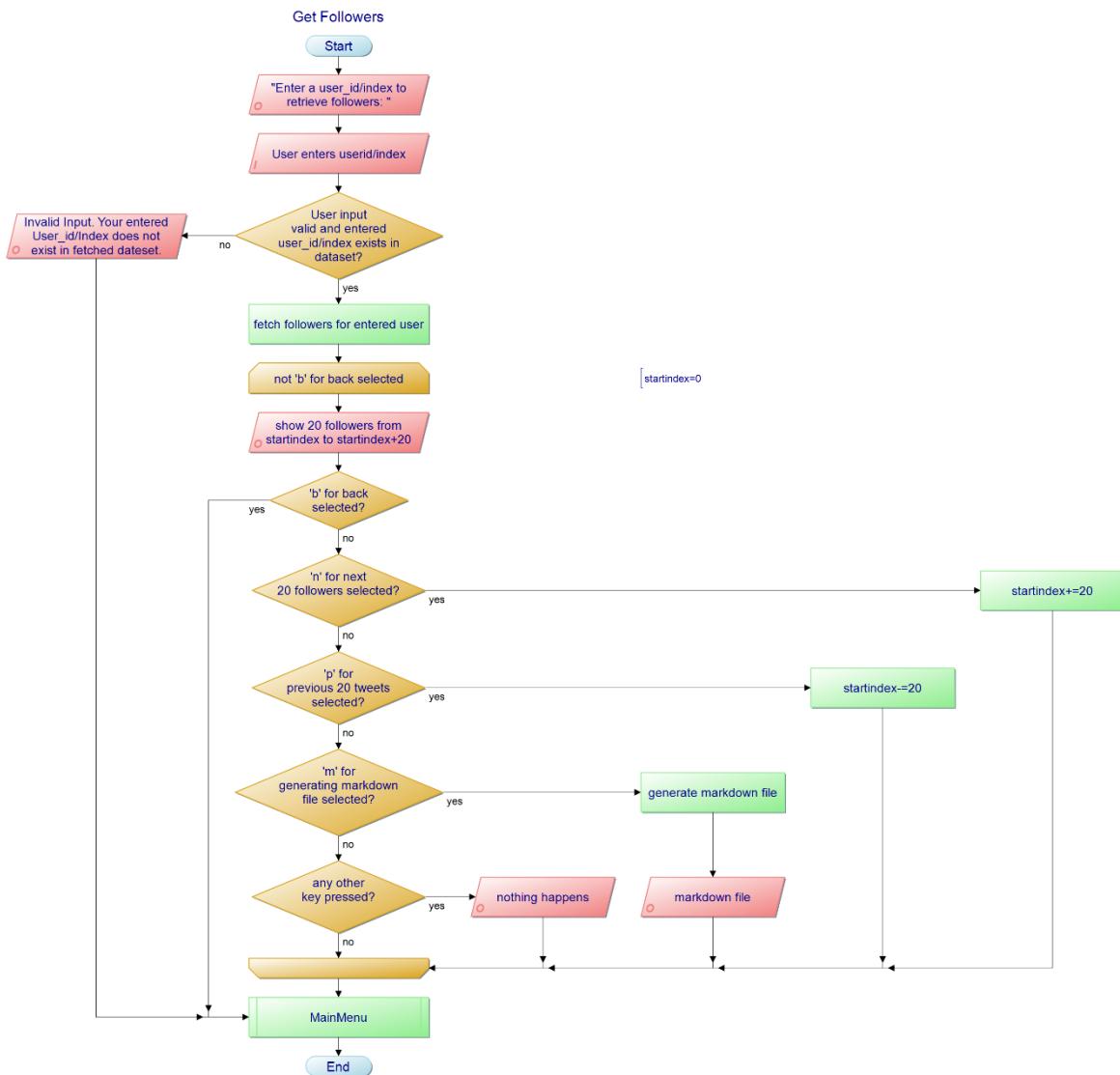
With the '[b] Back' option the user gets back to the main menu.



### 6.2.5 Get Followers (Submenu 3)

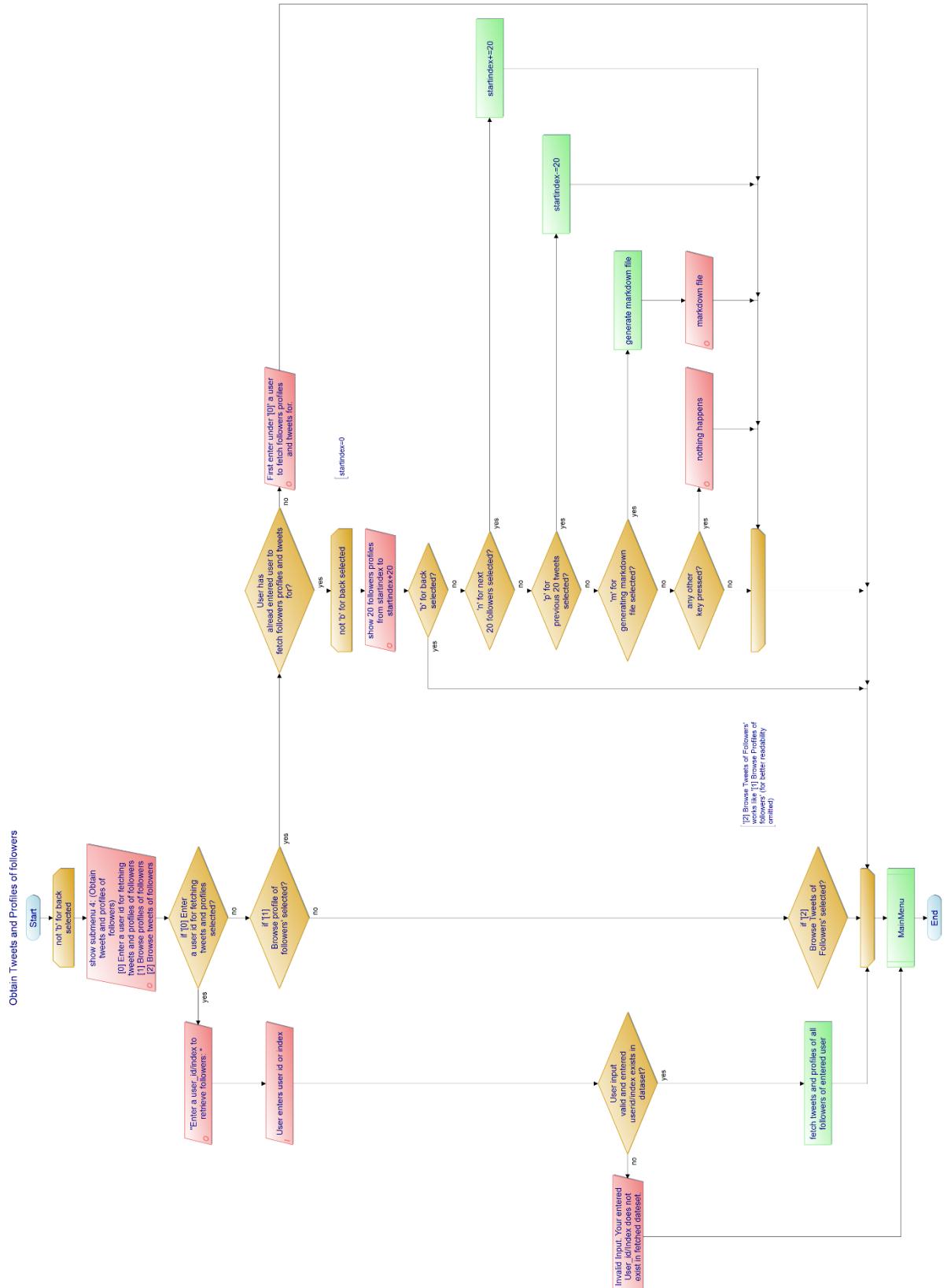
In the submenu 3 – Get Followers – the user can get followers of the entered user. The user can either enter the user ID or the index of the user in the dataframe. If the input is not valid the program will respond with an error message. Providing that the entered user is valid and available in the acquired dataset he/she will retrieve user ID, username and name of all followers. But to not overload the entire output the user can paginate through all followers in steps of 20 followers with the ‘n’/‘p’ for next/previous 20 followers. With the ‘m’ option the user can demand a markdown file of all followers and look through it in a text edit of his/her choice.

With the ‘b’ option the user gets back to the main menu.



#### 6.2.6 Obtain tweets and profiles of followers of given twitter user (Submenu 4)

In the submenu 4 - Obtain tweets and profiles of followers of given twitter user – the user can enter under '[0] Enter a user ID for fetching tweets and profiles of followers' a user ID or the index of the



user in the dataframe and if valid, the program will fetch followers including their profiles and about 20 tweets of each follower. (This amount of tweets per follower can be changed.)

Under '[1] Browse profiles of followers' the user can paginate in steps of 20 followers through the profiles of all followers with 'n'/'p' for next/ previous page. Under '[2] Browse tweets of followers' the user can do basically the same but for the tweets of all followers. Presumably for each follower about 20-50 tweets are fetched. Moreover the user can get a markdown file for the last two options by pressing 'm'.-By pressing the key 'b' he/she will get back to the submenu 4.

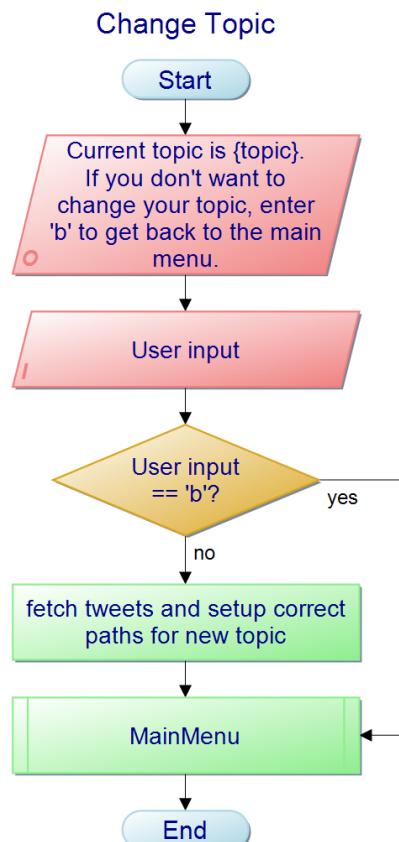
If the user is in the submenu 4, he/she can get back to the main menu by selecting the option '[b] Back'.

#### 6.2.7 Change Topic

The default topic is 'computer', also shown in the main menu, and for this topic tweets are already prefetched and stored as csv files under directory '*fetched/computer*'. Moreover, the instantiations of classes for dataprocessing and sentimentanalysis are done in advance.

But to facilitate it for the user to also use this program for other topics respectively topics of interest of the user it is possible to change the topic. The user can change the topic to (almost) everything but has to accept to retrieve nothing if the topic entered is chosen unfavorable (like only % symbols).

If the user presses enter, he/she will immediately get back to the main menu without choosing a new topic. But if a topic is entered, tweets for the new topic are fetched including also instantiating a dataprocessing and sentimentanalysis object. Additionally, the paths of the new topic are configured within the DataProcessing instance to access desired csv file with given naming convention correctly ([see 3.3](#)).



## 7. Results

### 7.1 Main Menu

The menu and all corresponding submenus are implemented with the library '*simple-term-menu*' and in the screenshot below the main menu is shown.

```
=====Twitter Data Analysis=====
Topic: computer
> [0] Browse Tweets/Users
[1] Analyse Sentiment of Tweets
[2] Get Top 10 Hashtags/Users
[3] Get followers of given twitter user
[4] Obtain tweets and profiles of followers of given twitter user
[c] change Topic
[q] Quit
```

Screenshot 0: Main Menu

### 7.2 [0] Browse Tweets/Users'

Following Screenshot shows the Submenu 00: *Browse Tweets/Users*.

```
=====Submenu 00: Browse Tweets/Users=====
> [0] Browse Tweets.
[1] Browse Users.
[b] Back.
```

Screenshot 1: Submenu 00 – Browse Tweets/Users

Following two Screenshots are showing an example for browsing Tweets/Users.

```
Tweets 0 to 20
Tweet ID          Tweet ID          Tweet text
0 1528990016575156225 Ugreen USB Extension Cable USB 3.0 Cable for Smart TV PS4 Laptop Computer Male to Female 3.0 2.0 Extender Data Cord USB to USB ...
1 1528998865232171008 #newjobs #jobs #Pakistan #PakistanJobs #MayJobs #PunjabJobs #Vacancies Announcement At National University Of Computer ...
2 15289989689020940288 The time when the woman who cannot do a personal computer also gets used to the leading role. https://t.co/76CH7W1vaz #Freedom ...
3 15289964063535879424 IT Web Developer Internnat University of Wisconsin-Madison - Student jobs in Department Overview The Information Technology Dep ...
4 152899819508291584 #100DaysOfMLCode #ArtificialIntelligence #ComputerScience #Cloud #Computer #IoT #PythonCode #Web3 #Data #NFTs #Coding #CodingIn ...
5 152899440374210560 05-23-2022 Create Your Own Programming Language Computers and Internet Top 10 #ComputersandInternet || Exceptional Onsite and ...
6 152899384162394119 Daniel PlusN200L Computer sci #aksu needs 5.8 million naira for spinal cord surgery\nNo amount is little\nPlease help \n\n# ...
7 152899344896788480 Design a responsive computer repair Banner, Landing page and website\nhttps://t.co/eoNTiigrHm\n#InfinixNote12\n#BetterCalls ...
8 1528992725202245633 Ugreen PCTIE to M2 Adapter NMC PCT Express X16/8/4 Adapter SSD M.2 Enclosure 32Gbps PCT-E Card & Key Computer Add On Card ...
9 152899171767029760 #culture as the Operating System of a business? \n@Garyver has such interesting ways of looking at things.\nAccording to Wik ...
10 152899041366282241 @PMOIndia @narendramodi @POTUS @JoeBiden #Windows11 #Amazon #book #UnitedStates #America #USAinthis is my new computer book W ...
11 15289897961999646720 Pay us to do your \nEssays due\n#Thesis\nMath\nEngineering\nExams\nEcology\nEnglish\nProgramming\nPoetry\nAccounting\nHistory ...
12 1528988800793423872 Daniel PlusN200L Computer sci AKSU needs 5.8 million naira for spinal cord surgery\nNo amount is little\nPlease help \n\n# ...
13 152898569771048963 @Hunter77220692 @Jim Jordan Treason? You must mean Dems... Robby Mook, Hillary's Campaign Mgr testified in federal court Clint ...
14 152898314195218432 And above all, his most spectacular contribution was the concept of zero without which modern computer technology would have ...
15 152898283833032704 Strengthen your skills by working with best online MCA from India's Top ranked University. Take Admission in Online #MCA & ...
16 152898274412466179 Digital art, once called computer art or new media art, refers to art made using software, computers, or other electronic devi ...
17 152898233895251968 CyberTech: Computer Fundamental - Evolution and Generations o.... https://t.co/akz4T2te1b \n#cybersecurity #Cyberpunk2077 #tech ...
18 152898127427145730 Here's a 2 hour long #hyperlambda and #Magic session Thomas Hansen held for 30 students studying computer science in #India. T ...
19 1528987961999646720 #deal #sale #discount #shopping #coupon #savings #offer #coupons #sales #fashion #promo #promotion #PCS Bar Chair Base Rubber ...
```

Press 'n'/'p' to get next/previous 20 tweets. Press 'm' to generate a markdown file. Press 'b' to go back to the main menu.

Screenshot 2: Submenu 00 – Browse Tweets – Example

| Tweets 0 to 20         | User ID                                   | User ID          | name    | username |
|------------------------|---|------------------|---------|----------|
| 0 1163703661614239744  | Pakistan jobs Alert                       | shopshop_shop    | JobadPk |          |
| 1 148163875471269881   | shopshop_shop                             | shopshop_shop    |         |          |
| 2 776532503477817344   | Obongowo                                  | iam_jonsnow      |         |          |
| 3 1364482870610427907  | zobjobs - US Remote Jobs                  | zobjobsUS        |         |          |
| 4 93879899875633152    | Gretchen                                  | 6genoregonian    |         |          |
| 5 1505261018653630465  | The Sam                                   | TheSam001001001  |         |          |
| 6 1367347780428079111  | GTIM                                      | gtimeducation    |         |          |
| 7 1528930141031702528  | Deepak Sharma                             | DeepakS43797472  |         |          |
| 8 1299302958421737475  | El Mundo de las Ofertas                   | OOpiniones       |         |          |
| 9 1398350957642145794  | High Impact Careers                       | HighImpact01     |         |          |
| 10 1527302320077168645 | Chloe                                     | okellyabreyz     |         |          |
| 11 1417064369951703043 | 000000000000000000000000                  | dm/line          | dddxry1 |          |
| 12 1265546153032024068 | ShopOnline                                | 24hrs onlineshop |         |          |
| 13 1248615252201066510 | Alexandru Rosu                            | AlexRosu1989     |         |          |
| 14 1464179527593115654 | School of Engineering and Applied Science | seas_ahmedabad   |         |          |
| 15 148945926482203143  | Noctis ♀ ♀                                | incognichrom     |         |          |
| 16 1443543618623610889 | 730Jobs                                   | 730Jobs          |         |          |
| 17 1169455568412540930 | iiinnn                                    | iiinnn_ing       |         |          |
| 18 777916436           | Jingsheng Zeng                            | JingshengZeng    |         |          |
| 19 1389529835878367236 | Danis Kasimov ♀                           | danis_kasimov    |         |          |

Press 'n'/'p' to get next/previous 20 tweets. Press 'm' to generate a markdown file. Press 'b' to go back to the main menu.

Screenshot 3: Submenu 00 – Browse Users – Example

### 7.3 Task 1 ([1] Analyse Sentiment of Tweets)

Task 1: Derive the sentiment of each tweet.

The submenu 01: Sentimentanalysis is shown in Screenshot 4.

```
=====Submenu 01: sentimentanalysis=====
> [0] Analyse all tweets
[1] Get average polarity
[2] Analyse single tweet
[3] Get most used words.
[b] Back.
```

Screenshot 4: Submenu 01 – Sentimentanalysis

By selecting the option '[0] Analyse all tweets' all tweets are analyzed, and the user can browse through all tweets including their polarity (see Screenshot 5).

| Tweet ID | Tweet text  | polarity  |
|----------|---|-----------|
| 0        | Ugreen USB Extension Cable USB 3.0 Cable for Smart TV PS4 Laptop Computer Male to Female 3.0 2.0 Extender Data Cord USB to USB...                       | 0.071429  |
| 1        | #newjobs #jobs #Pakistan #pkjobs #PakistanJobs #MayJobs #PunjabJobs\nVacancies Announcement At National University Of Computer...                       | 0.000000  |
| 2        | The time when the woman who cannot do a personal computer also gets used to the leading role.\nhttps://t.co/76CH7WIVaz ##freedo...                      | 0.000000  |
| 3        | IT Web Developer Internatnol University of Wisconsin-Madison - Student jobs\nDepartment Overview The Information Technology Dep...                      | 0.000000  |
| 4        | #100DaysOfMLCode #ArtificialIntelligence #computerscience #cloud #computer #IoT #pythoncode #WEBS #data #NFTs #coding #codingl...                       | 0.164286  |
| 5        | 1528989408374210560 05-23-2022 Create Your Own Programming Language Computers and Internet Top 10 #ComputersandInternet    Exceptional Onsite and ...   | 0.588889  |
| 6        | Daniel Pius\n200L Computer sci #AKSU needs 5.8 million naira for spinal cord surgery\nNo amount is little\nPlease help \n\n#...                         | -0.187500 |
| 7        | 1528989324896789480 Design a responsive computer repair Banner, Landing page and Website\nhttps://t.co/eoNTigrHm\n#InfinixNote12\n#BetterCallsa...      | 0.000000  |
| 8        | 152898925202245633 Ugreen PCIE to M2 Adapter NVMe PCI Express X16/8/4 Adapter SSD M.2 Enclosure 32Gbps PCI-E Card M&B Key Computer Add On Car...        | 0.000000  |
| 9        | 1528989171767929760 #culture as the Operating System of a business? \n@garyvee has such interesting ways of looking at things.\n\nAccording to Wik...   | 0.300000  |
| 10       | 152898904366282241 @PMOIndia @arendramodi @POTUS @JoeBiden #Windows11 #Amazon #book\n#UnitedStates #America #USA\nThis is my new computer book W...     | 0.256182  |
| 11       | 15289898923309564994 Press us to do your\nEssays due\n#Thesis\n#Math\nEngineering\nExams\nEcology\nEnglish\nProgramming\nPoetry\nAccounting\nHistory... | 0.062500  |
| 12       | 152898800793423872 Daniel Pius\n200L Computer sci AKSU needs 5.8 million naira for spinal cord surgery\nNo amount is Little\nPlease help \n\n#...       | -0.187500 |
| 13       | 152898569771048963 @Hunter77220692 @Jim_Jordan_Treason? You must mean Dems. Robby Mook, Hillary's Campaign Mgr testified in federal court Clint...      | -0.137500 |
| 14       | 1528988314195218432 And above all, his most spectacular contribution was the concept of #zero without which modern #computer technology would have...   | 0.360000  |
| 15       | 152898823833032784 Strengthen your skills by working with best online MCA from India's Top ranked University. Take Admission in Online #MCA &#...       | 0.559891  |
| 16       | 1528988233895251968 Digital art, once called computer art or new media art, refers to art made using software, computers, or other electronic devi...   | 0.001420  |
| 17       | 1528988274421466179 CyberTech: Computer Fundamental - Evolution and Generations o... https://t.co/akz4721elb \n#cybersecurity #Cyberpunk2077 #tech...   | 0.000000  |
| 18       | 1528988127427145730 Here's a 2 hour long #HyperLambda and #Magic session Thomas Hansen held for 36 students studying computer science in #India. T...   | 0.225000  |
| 19       | 1528987961999646720 #deal #sale #discount #shopping #coupon #savings #offer #coupons #sales #fashion #promo #promotion\n#PCS Bar Chair Base Rubber ...  | -0.800000 |

Press 'n'/'p' to get next/previous 20 tweets. Press 'm' to generate a markdown file. Press 'b' to go back to the main menu.

Screenshot 5: Submenu 01 - Sentimentanalysis – example for analysing all tweets

By selecting the option '[1] Get average Polarity' the user will get the output of the average polarity of all tweets in the acquired dataset (see Screenshot 6).

```
The average polarity of your topic 'computer' is: '0.12091667267917268' -> 'slightly positive'
Press enter to continue...
```

Screenshot 6: Submenu 01 - Sentimentanalysis – example for getting average polarity

By selecting the option '[2] analyse single tweet' the user can enter either the tweeted or the corresponding index shown in the first column and will retrieve the polarity of selected tweet (see Screenshot 7).

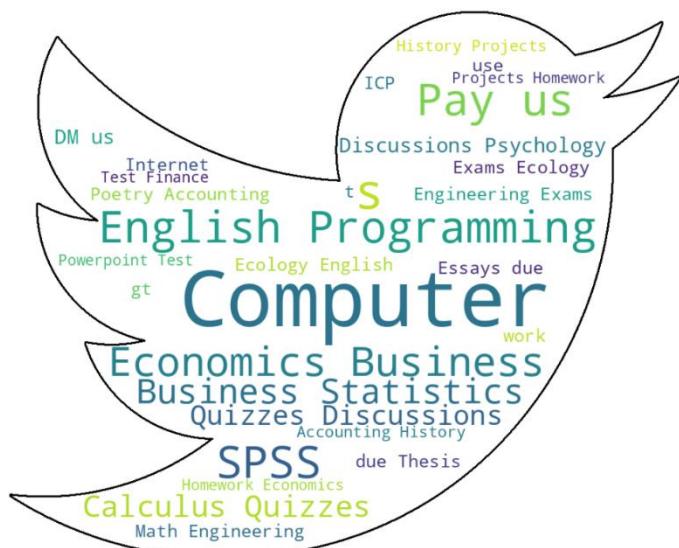
| Tweet ID | Tweet text   | polarity  |
|----------|--|-----------|
| 0        | Ugreen USB Extension Cable USB 3.0 Cable for Smart TV PS4 Laptop Computer Male to Female 3.0 2.0 Extender Data Cord USB to USB...                      | 0.071429  |
| 1        | #newjobs #jobs #Pakistan #pkjobs #PakistanJobs #MayJobs #PunjabJobs\nVacancies Announcement At National University Of Computer...                      | 0.000000  |
| 2        | The time when the woman who cannot do a personal computer also gets used to the leading role.\nhttps://t.co/76CH7WIVaz ##freedo...                     | 0.000000  |
| 3        | IT Web Developer Internatnol University of Wisconsin-Madison - Student jobs\nDepartment Overview The Information Technology Dep...                     | 0.000000  |
| 4        | #100DaysOfMLCode #ArtificialIntelligence #computerscience #cloud #computer #IoT #pythoncode #WEBS #data #NFTs #coding #codingl...                      | 0.164286  |
| 5        | 1528989408374210560 05-23-2022 Create Your Own Programming Language Computers and Internet Top 10 #ComputersandInternet    Exceptional Onsite and ...  | 0.588889  |
| 6        | Daniel Pius\n200L Computer sci #AKSU needs 5.8 million naira for spinal cord surgery\nNo amount is little\nPlease help \n\n#...                        | -0.187500 |
| 7        | 1528989324896789480 Design a responsive computer repair Banner, Landing page and Website\nhttps://t.co/eoNTigrHm\n#InfinixNote12\n#BetterCallsa...     | 0.000000  |
| 8        | 152898925202245633 Ugreen PCIE to M2 Adapter NVMe PCI Express X16/8/4 Adapter SSD M.2 Enclosure 32Gbps PCI-E Card M&B Key Computer Add On Car...       | 0.000000  |
| 9        | 1528989171767929760 #culture as the Operating System of a business? \n@garyvee has such interesting ways of looking at things.\n\nAccording to Wik...  | 0.300000  |
| 10       | 152898904366282241 @PMOIndia @arendramodi @POTUS @JoeBiden #Windows11 #Amazon #book\n#UnitedStates #America #USA\nThis is my new computer book W...    | 0.256182  |
| 11       | 1528988923309564994 Pay us to do your\nEssays due\n#Thesis\n#Math\nEngineering\nExams\nEcology\nEnglish\nProgramming\nPoetry\nAccounting\nHistory...   | 0.062500  |
| 12       | 152898800793423872 Daniel Pius\n200L Computer sci AKSU needs 5.8 million naira for spinal cord surgery\nNo amount is Little\nPlease help \n\n#...      | -0.187500 |
| 13       | 152898569771048963 @Hunter77220692 @Jim_Jordan_Treason? You must mean Dems. Robby Mook, Hillary's Campaign Mgr testified in federal court Clint...     | -0.137500 |
| 14       | 1528988314195218432 And above all, his most spectacular contribution was the concept of #zero without which modern #computer technology would have...  | 0.360000  |
| 15       | 152898823833032784 Strengthen your skills by working with best online MCA from India's Top ranked University. Take Admission in Online #MCA &#...      | 0.559891  |
| 16       | 1528988233895251968 Digital art, once called computer art or new media art, refers to art made using software, computers, or other electronic devi...  | 0.001420  |
| 17       | 1528988274421466179 CyberTech: Computer Fundamental - Evolution and Generations o... https://t.co/akz4721elb \n#cybersecurity #Cyberpunk2077 #tech...  | 0.000000  |
| 18       | 1528988127427145730 Here's a 2 hour long #HyperLambda and #Magic session Thomas Hansen held for 36 students studying computer science in #India. T...  | 0.225000  |
| 19       | 1528987961999646720 #deal #sale #discount #shopping #coupon #savings #offer #coupons #sales #fashion #promo #promotion\n#PCS Bar Chair Base Rubber ... | -0.800000 |

Enter Tweet ID or Index of the Tweet to analyse: 0  
Your selected Tweet at index 0 is slightly positive

Press enter to continue...

Screenshot 7: Submenu 01 - Sentimentanalysis – example for analysing single tweet

By selecting the option '[3] Get most used words' the user will get a wordcloud picture of the official twitterlogo mask with the 30 most used words in the acquired dataset of tweets (see Screenshot 8).



Screenshot 8: Submenu 01 – Sentimentanalysis – example for getting most used words as a wordcloud in form of the twitterlogo

#### 7.4 Task 2 ([2] Get Top 10 Hashtags/Users)

Task 2: Get Top 10 Hashtags/Users based on their number.

The submenu 02: Get Top 10 Hashtags/Users is shown in Screenshot 4.

```
=====Submenu 02: Get Top 10 Hashtags/Users=====
> [0] Get Top 10 Hashtags
[1] Get Top 10 Users
[b] Back.
```

Screenshot 9: Submenu 02 – Get Top 10 Hashtags/Users

By selecting the option '[0] Get Top 10 Hashtags' the user will retrieve a list of the top 10 Hashtags like in Screenshot 10.

```
Top 10 Hashtags based on frequency:
1.: #computer
2.: #amazon
3.: #ComputersandInternet
4.: #aliexpress
5.: #rt
6.: #IoT
7.: #music
8.: #AI
9.: #NFTs
10.: #coding

Press enter to continue...■
```

Screenshot 10: Submenu 02 – Get Top 10 Hashtags/Users – example for Top 10 Hashtags

By selecting the option '[1] Get Top 10 Users' the user will retrieve a list of the top 10 Users like in Screenshot 11.

```
Top 10 Users based on their number of tweets:
1.: ComputerHelpHi (601151719) with 4 tweets.
2.: shopshop_shop_ (1481638754712698881) with 3 tweets.
3.: iam_jonsnow (776532503477817344) with 2 tweets.
4.: JUTTG55943333 (1344893419756417025) with 2 tweets.
5.: JobadPk (1163703661614239744) with 1 tweets.
6.: SideBusinesscom (476809068) with 1 tweets.
7.: zobjobsUS (1364482870610427907) with 1 tweets.
8.: AlexRosu1989 (1248615252201066510) with 1 tweets.
9.: None (1522875876341334018) with 1 tweets.
10.: Brend_Lev (483080566) with 1 tweets.

Press enter to continue...■
```

Screenshot 11: Submenu 02 – Get Top 10 Hashtags/Users – example for Top 10 Users

## 7.5 Task 3 ([3] Get Followers)

Task 3: Get the followers of given twitter user.

The user can enter a user\_id or its corresponding index in the DataFrame and fetch the selected users followers. All these followers are displayed, and the user can paginate with 'n'/'p' to the next/previous 20 followers. Additionally a markdown file can be generated with choosing 'm'. With 'b' the user gets back to the main menu.

```
Enter a twitter user:  
Enter User ID: 0  
Followers 0 to 20  
Follower ID          name      username  
0   1104962500884348929      Maleeha     Maleeha_94  
1   1527636848083968001      @surriyasaba infarction67  
2   1513567185674854404      Innovative Star innovative_star  
3   1111113460207751168      Shumaila Nadeem ShumailaNadee15  
4   1526471974012301312      M ADEEL KAZIM MADEELKAZIM1  
5   4157350635                iamkhan     Iamkhan3010  
6   1524652691686936577      saira shabeer SairaShabeer  
7   1509226451421347844      Zainab1821  Zainab18211  
8   1523722132034932740      # 00000000 00000000 # ZaheerK23022674  
9   816374332523851777      Engr Hisam Hissamuddin8  
10  1522311599318573057      Umair Ahmad Khushabi AhmadKhushabi  
11  1325660035586928640      H@Mz@ b@DsH@H hamzabadshah374  
12  1509921875425648645      doctaara123  
13  1342140931248631813      cmeee     cmeee9  
14  1382240116777787393      Rehan Kaleem RehanKaleem5  
15  1512842217307713536      Usman Ghani UsmanGh28997352  
16  1434118453707911171      Jamil Ur Rehman Jeyme03  
17  1419986116523003913      Muhammad Naeem Muhamma79264175  
18  1518399637375311872      Chef Usman ChefUsman4  
19  871737730119675908      KainosZw@ KainosTeqkaino  
  
Press 'n'/'p' to get next/previous 20 followers. Press 'm' to generate a markdown file. Press 'b' to go back to the main menu.  
-
```

Screenshot 12: Submenu 03 –Get Followers

## 7.6 Task 4 ([4] Obtain Tweets & Profiles of Followers)

**Task 4:** Given a twitter user, obtain the tweets and profiles of all followers of the user and show it.

The submenu *04: Obtain Tweets & Profiles of Followers* is shown in Screenshot 13.

```
=====Submenu 04: Obtain Tweets & Profiles of Followers=====
> [0] Enter a user ID for fetching tweets and profiles of followers
  [1] Browse profiles of followers
  [2] Browse Tweets of Followers
  [b] Back.
```

Screenshot 13: Submenu 04 –Obtain Tweets & Profiles of Followers

By selecting the option '[0] Enter a user ID for fetching tweets and profiles of followers' the user will retrieve a prompt to enter any userid or the index of the userid like in Screenshot 14. Note: The first 20 users are printed automatically to give the user an impression what he can choose from.

| Unnamed: 0            | User ID             | name                                      | username        |
|-----------------------|---------------------|---|-----------------|
| 0                     | 1163703661614239744 | Pakistan jobs Alert                       | JobadPk         |
| 1                     | 1481638754712698881 | shopshop_shop                             | shopshop_shop_  |
| 2                     | 776532503477817344  | Obongowo                                  | iam_jonsnow     |
| 3                     | 1364482870610427907 | zobjobs - US Remote Jobs                  | zobjobsUS       |
| 4                     | 938798999875633152  | Gretchen                                  | 6genoregonian   |
| 5                     | 1505261018653630465 | The Sam                                   | TheSam001001001 |
| 6                     | 1367347780428079111 | GTIM                                      | gtimeducation   |
| 7                     | 1528930141031702528 | Deepak Sharma                             | DeepakS43797472 |
| 8                     | 1299302958421737475 | El Mundo de las Ofertas                   | 0Opiniones      |
| 9                     | 1398350957642145794 | High Impact Careers                       | HighImpact01    |
| 10                    | 1527302320077168645 | Chloe                                     | okellyabreyz    |
| 11                    | 1417064369951703043 | dm/line                                   | dddxry1         |
| 12                    | 1265546153032024068 | ShopOnline                                | 24hrsonlineshop |
| 13                    | 1248615252201066510 | Alexandru Rosu                            | AlexRosu1989    |
| 14                    | 1464179527593115654 | School of Engineering and Applied Science | seas_ahmedabad  |
| 15                    | 1489459264842203143 | Noctis ♀                                  | incognichrom    |
| 16                    | 1443543618623610889 | 730Jobs                                   | 730Jobs         |
| 17                    | 1169455568412540930 | iiinnn                                    | iiinnn_ing      |
| 18                    | 18                  | Jingsheng Zeng                            | JingshengZeng   |
| 19                    | 777916436           | Danis Kasimov ♀                           | danis_kasimov   |
| Enter a twitter user: |                     |   |                 |
| Enter User ID:        | -                   |   |                 |

Screenshot 14: Submenu 04 –Obtain Tweets & Profiles of Followers – [0] Enter a user ID for fetching tweets and profiles of followers

By selecting the option '[1] Browse Profiles of Followers' the user can browse through all profiles of its followers like in Screenshot 15.

| Followers         | #                    | to                  | Followers        | ID                                 | name                | username  | bio                       | location | URL  | created_at | Following | Followers |
|-------------------|----------------------|---------------------|------------------|------------------------------------|---------------------|---|---------------------------|----------|------|------------|-----------|-----------|
| 1                 | 11040626950884384929 | Maleeha             | Maleeha_94       | A 28 year old adventure enthu.     | Islamabad, Pakistan | <a href="https://t.co/oGlxMuQdAG">https://t.co/oGlxMuQdAG</a> | 2019-03-11 04:29:24+00:00 | 293      | 23   |            |           |           |
| 1                 | 152763888839688001   | @suriyasaba         | infarction67     | Star innovative_star               | Islamabad, Pakistan | <a href="#">NaN</a>   | 2022-05-20 13:06:52+00:00 | 1        | 1    |            |           |           |
| 1                 | 151356718544854404   | Innovative Star     | innovative_star  | "Dreamer who makes living at it"   | Islamabad, Pakistan | <a href="#">NaN</a>   | 2022-04-11 17:18:51+00:00 | 61       | 1    |            |           |           |
| 1                 | 151111346207751168   | Shumaila Nadeem     | ShumailaNadeem15 | WomanExecutive Assistant @Moth...  | Islamabad, Pakistan | <a href="#">NaN</a>   | 2019-03-28 03:51:07+00:00 | 15999    | 64   |            |           |           |
| 1                 | 1526471974102381312  | M ADEEL KAZIM       | MADEELKAZIM1     | Mechanical Engineer                | Islamabad, Pakistan | <a href="#">NaN</a>   | 2022-05-17 07:58:05+00:00 | 412      | 0    |            |           |           |
| 1                 | 1524652616569365577  | sairishahakar       | sairishahakar    | psychologist                       | Islamabad, Pakistan | <a href="#">NaN</a>   | 2022-05-11 10:43:43+00:00 | 89       | 1    |            |           |           |
| 1                 | 1509226451421734784  | Zainab1821          | Zainab1821       | Proud Pakistani                    | Islamabad, Pakistan | <a href="#">NaN</a>   | 2022-03-12 07:47:10+00:00 | 1        | 0    |            |           |           |
| 1                 | 15237223203494232740 | # Zaheer            | Zaheer2302674    |                                    | Islamabad, Pakistan | <a href="#">NaN</a>   | 2022-03-03 17:58:12+00:00 | 35       | 1    |            |           |           |
| 1                 | 81637343252851777    | Engr Hisan          | Hisamuddin8      | Engineer                           | Pakistan            | <a href="#">NaN</a>   | 2021-01-08 20:03:03+00:00 | 324      | 31   |            |           |           |
| 10                | 1522315931918573857  | Umar Ahmad Khushabi | AhmadKhushabi    | umairahmadkhushabih@gmail.com      | Pakistan            | <a href="#">NaN</a>   | 2022-05-05 20:26:53+00:00 | 2        | 0    |            |           |           |
| 1                 | 1522315931918573857  | Hmzb#05             | hmzbabdullah14   | Motivation                         | Pakistan            | <a href="#">NaN</a>   | 2022-05-05 20:26:53+00:00 | 145      | 1    |            |           |           |
| 1                 | 1522315931918573857  | Dot                 | Dotabdullah123   |                                    | Pakistan            | <a href="#">NaN</a>   | 2022-05-05 20:26:53+00:00 | 5        | 0    |            |           |           |
| 1                 | 132440931248631813   | cmeeq               | cmeeq9           | ◆                                  | Islamabad, Pakistan | <a href="#">NaN</a>   | 2020-12-24 16:12:09+00:00 | 113      | 3    |            |           |           |
| 1                 | 1382240117777787393  | Rehan Kaleem        | RehanKaleem5     | ArrKay'z Gallery® Photographer     | Pakistan            | <a href="#">NaN</a>   | 2021-04-14 07:51:52+00:00 | 15       | 16   |            |           |           |
| 1                 | 1512842213707713536  | Usman Ghani         | UsmanHg28997352  |                                    | Pakistan            | <a href="#">NaN</a>   | 2022-04-04 17:18:14+00:00 | 8        | 0    |            |           |           |
| 16                | 13431184537097911171 | Jameel Ur Rehman    | Jeyeme03         |                                    | Islamabad, Pakistan | <a href="#">NaN</a>   | 2021-09-01 04:37:56+00:00 | 247      | 12   |            |           |           |
| 17                | 149861165280893919   | Muhammad Naem       | Muhammada7926475 |                                    | Pakistan            | <a href="#">NaN</a>   | 2021-07-27 11:40:54+00:00 | 19       | 4    |            |           |           |
| 17                | 15189963735311879    | Chef Usman          | ChefUsman4       | Natl North-west Frontier, Pakistan | Pakistan            | <a href="#">NaN</a>   | 2022-04-25 01:21:36+00:00 | 162      | 7    |            |           |           |
| 87173773811967598 | KainosZxW            | KainosZxW           | KainosZxW        | Direktor and CEO of Teqkain        | Africa              | <a href="#">NaN</a>   | 2021-06-05 14:37:25+00:00 | 1342     | 1270 |            |           |           |

Screenshot 15: Submenu 04 –Obtain Tweets & Profiles of Followers – [1] Browse Profiles of Followers

By selecting the option '[2] Browse Tweets of Followers' the user can browse through all tweets of the followers of the given userid like shown in Screenshot 16.

Screenshot 16: Submenu 04 –Obtain Tweets & Profiles of Followers – [1] Browse Tweets of Followers

## 7.7 [c] Change Topic

By selecting the option '[c] change Topic' the user can enter a new topic/querystring to fetch tweets for. Following submenu is displayed to the user:

```
Current Topic is: computer
Enter your querystring (or 'enter' to abort): -
```

Screenshot 17: Change Topic

## 7.8 [q] Quit

This option simply quits the program.

## 7.9 Markdown Files

As the user has the possibility for every DataFrame in almost all submenus to generate a markdown file as Output, following four screenshots are showing sample markdown files.

|    |    | Tweet ID            | Tweet Text  |
|----|----|---------------------|---|
| 0  | 0  | 1528990016575156225 | Ugreen USB Extension Cable USB 3.0 Cable for Smart TV PS4 Laptop Computer Male to Female 3.0 2.0 Extender Data Cord USB to USB \$2.59<br>click&gt;&gt;https://t.co/07EUldqAa81<br>#amazon #jobs #pakistan #pkjobs #pakistanjobs #funjobs #funjobjobs<br>#alexpress #rt https://t.co/f0klGvsnhj  |
| 1  | 1  | 1528998985232171008 | Vacancies Announcement At National University Of Computer And Emerging Sciences<br>https://t.co/0800V7D1Qz  |
| 2  | 2  | 152899689028940288  | The time when the woman who cannot do a personal computer also gets used to the leading role.-https://t.co/76CH7WIVaz ##freedom.ws<br>IT Web Developer Intern<br>at University of Wisconsin-Madison - Student jobs<br>Department Overview The Information Technology Department manages the technology and computer infrastructure that ...<br>https://t.co/5ZM2HNSUFT  |
| 3  | 3  | 1528996486358794242 | #100DaysOfCode #ArtificialIntelligence #computerscience #cloud #computer #IoT #pythoncode #Web3 #data #NFTs #coding #codinglife #javascript #html #InternetOfThings #100DaysOfCloud #python #100DaysOfCode<br>Limited promo available   |
| 4  | 4  | 1528989519508291584 | Class reference &gt; https://t.co/ous1UEIjIn<br>05-23-2022 Create Your Own Programming Language Computers and Internet Top 10 #ComputersandInternet    Exceptional Onsite and In Home Windows, Apple Computer and Mobile Phone Training, Tutoring<br>Daniel Plus<br>200L Computer sci #akus needs 5.8 million naira for spinal cord surgery   |
| 5  | 5  | 1528989448374210560 | No amount is Little<br>Please help  |
| 6  | 6  | 1528989384162394119 | #SaveDanielPlus Maguire #Ashewo<br>\$5.8million<br>2179638165<br>USA  |
| 7  | 7  | 1528989324896788480 | Design a responsive computer repair Banner, Landing page and Website<br>https://t.co/e0nITigrim<br>#InfinidNote12<br>#WeAreAllSail<br>#HonLoveAndThunder<br>#GodivaGo<br>#MeRaw<br>#Worldie339<br>#PapayaColor<br>#PhilyanaChopra<br>#BangChan  |
| 8  | 8  | 152898922502245633  | Ugreen PCIE to M2 Adapter NVMe PCI Express X16/8/4 Adapter SSD M.2 Enclosure 32Gbps PCI-E Card M&#amp;B Key Computer Add On Cards \$10.99<br>click&gt;&gt;https://t.co/kfjgJ29b9y8<br>#amazon #alexpress #rt https://t.co/d3qF1Q2Q  |
| 9  | 9  | 1528989171767829760 | #culture as the Operating System of a business?<br>@garyvee has such interesting ways of looking at things.   |
| 10 | 10 | 1528989041366282241 | According to Wikipedia, the Free Encyclopedia "An operating system (OS) is system software that manages computer hardware, software resources, and...https://t.co/u6imH4FDkk<br>#amazon #narayanramoli #POTUS #JoeBiden #Windows11 #Amazon #book<br>#WindowsState #Book #USA<br>This is the new computer book Windows 11 (Windows 11 by Vijay Kumar Yadav) is available on Amazon, USA.<br>https://t.co/0skgbpdy3yB |

Screenshot 18: Markdown Files - Tweets

users\_markdown.md - Notepad

| File | Edit | Format | View | Help | User ID | name  | username        |
|------|------|--------|------|------|---------|---|-----------------|
|      |      |        |      |      | 0       | Pakistan jobs Alert   | :-----          |
|      |      |        |      |      | 1       | shopshop_shop   | JobadPk         |
|      |      |        |      |      | 2       | Obongowo  | shopshop_shop_  |
|      |      |        |      |      | 3       | zobjobs - US Remote Jobs  | iam_jonsnow     |
|      |      |        |      |      | 4       | Gretchen  | zobjobsUS       |
|      |      |        |      |      | 5       | The Sam   | 6genoregonian   |
|      |      |        |      |      | 6       | GTIM  | TheSam001001001 |
|      |      |        |      |      | 7       | Deepak Sharma   | gtimeducation   |
|      |      |        |      |      | 8       | El Mundo de las Ofertas   | DeepakS43797472 |
|      |      |        |      |      | 9       | High Impact Careers   | OOpiniones      |
|      |      |        |      |      | 10      | Chloe   | HighImpact01    |
|      |      |        |      |      | 11      | 1527302320077168645   ชั้นการเรียน งานเข้มข้น dm/line                   | okellyabreyz    |
|      |      |        |      |      | 12      | 1265546153032024068   ShopOnline  | 24hrsonlineshop |
|      |      |        |      |      | 13      | Alexandru Rosu  | AlexRosu1989    |
|      |      |        |      |      | 14      | School of Engineering and Applied Science                               | seas_ahmedabad  |
|      |      |        |      |      | 15      | Noctis ☽  | incognichrom    |
|      |      |        |      |      | 16      | 730Jobs   | 730Jobs         |
|      |      |        |      |      | 17      | iiinnn  | iiinnn_ing      |
|      |      |        |      |      | 18      | Jingsheng Zeng  | JingshengZeng   |
|      |      |        |      |      | 19      | Danis Kasimov 🇹   | danis_kasimov   |
|      |      |        |      |      | 20      | Deeohzuh  | deeohzuh        |
|      |      |        |      |      | 21      | 358253618   Wevolver  | WevolverApp     |
|      |      |        |      |      | 22      | 17685555   Justin Moorhouse   | justinmoorhouse |
|      |      |        |      |      | 23      | Bubbafox  | bob4punk        |
|      |      |        |      |      | 24      | 14799932   Jason Lee Wei Zheng  | zorocaster      |
|      |      |        |      |      | 25      | 15576637   zeroPage's 8 bit pop music                                   | gavindi         |
|      |      |        |      |      | 26      | 1049585267772968960   DigitalTrans4m ☽                                  | digital_trans4m |
|      |      |        |      |      | 27      | 66613340   Kitae Kwon   | KitaeKwon       |
|      |      |        |      |      | 28      | 2740222595   Gary @ Office of the Cheated Voter                         | 1146e20d70a1438 |
|      |      |        |      |      | 29      | 82334315   Prabhu INP>  | Prabhu_DS       |
|      |      |        |      |      | 30      | 484444272   Vijay Kumar Yadav   | VKYUA           |
|      |      |        |      |      | 31      | 431366273   sachin kumar saxena   | sachin36500081  |
|      |      |        |      |      | 32      | 728569855184605184   TaneTimpi (\$TIMPI = #web3 decentralized search)   | rigduud         |
|      |      |        |      |      | 33      | 1525588194669907968   LivebookAI  | LivebookAI      |
|      |      |        |      |      | 34      | 1468256106455519232   Star Geek Command (SGC)                           | stargeek13      |
|      |      |        |      |      | 35      | 778465996138909696   Guru Kashi University                              | gurukashiuniv   |
|      |      |        |      |      | 36      | 1029389652950765569   Blues Radio                                       | All_Blues_Radio |
|      |      |        |      |      | 37      | 1212481646563217408   In A Mad World                                    | InAMadWorld111  |
|      |      |        |      |      | 38      | 1065120577801867264   Isuru Sampath                                     | OnlineTutor100  |
|      |      |        |      |      | 39      | 910421518714310657   Trusted Computing                                  | TrustedCompUK   |
|      |      |        |      |      | 40      | 277010058   Satyajit Saurabh  | SatyajitSaurabh |
|      |      |        |      |      | 41      | 1278926285696143362   Nehru Institute Of Management Technology Haridwar | NimtHaridwar    |
|      |      |        |      |      | 42      | 1450778321344614402   pcshop.in   | pcshop_in       |
|      |      |        |      |      | 43      | 1481237608063979522   ITDigest  | ITDigestmag     |
|      |      |        |      |      | 44      | 1013430755316420610   ScienceTech                                       | TheScienceTech1 |
|      |      |        |      |      | 45      | 773584681514242050   Moon Man   | moonman_bot     |
|      |      |        |      |      | 46      | 2531645584   Kimberly Assignment help                                   | kimberly_help   |
|      |      |        |      |      | 47      | 1481953133593088005   adealsweden                                       | adealsweden     |
|      |      |        |      |      | 48      | 4891284635   Theta Solutions  | ThetaSolutions  |
|      |      |        |      |      | 49      | 1119999371053895686   kamala  | kamala20483499  |
|      |      |        |      |      | 50      | 1487311811351576576   Aria Cameron                                      | AriaCameron6    |

Screenshot 19: Markdown Files - Users

|    | File       | Edit                 | Format                               | View               | Help   |
|----|------------|----------------------|--------------------------------------|--------------------|--|
|    | Unnamed: 0 | Follower ID          | name                                 | username           | bio  |
| 0  | 0          | 1168252908808488929  | Maleeha                              | Maleeha_94         | • A 28 year old adventure enthusiast who loves sushi • سہیت کے پسند کرنا اور اپنے زندگی میں سفر کرنے کا بھروسہ!  |
| 1  | 1          | 1276521889898898929  | @surveenababa                        | IntroducingSurveen | *Yours truly who makes living at it*   |
| 2  | 2          | 1513567185574554048  | Innovative Star                      | ShumailaNadeem15   | Woman#Executive Assistant #Mother#Wife   |
| 3  | 3          | 111111346027751168   | Shumaila Nadeem                      | MADEELKAZIM1       | Mechanical Engineer  |
| 4  | 4          | 1526471974081238132  | M ADEEL KAZIM                        | IamKhank3010       | Sagittarius ☽   Psychologist     Certified Hypnotist ABH   |
| 5  | 5          | 4715750565           | iamkhan                              | SairahKhan         | Proud Pakistani  |
| 6  | 6          | 1524652465186956777  | saira shabeer                        | ZahraB1201         |  |
| 7  | 7          | 1509226451308495479  |                                      | ZahraB1201         |  |
| 8  | 8          | 18273223120834932748 | امیریت حکومت اپنے نظرے #             | ZaheerK25262741    | nan  |
| 9  | 9          | 816374325238521777   | Engr Hisam                           | Hissamuddin08      | Engineer   |
| 10 | 10         | 15223115951857057    | Umar Ahmad Khushabi                  | AhmadKhushabi      | umairahmadkhushabi@gmail.com   |
| 11 | 11         | 1325660835586528648  | HMGz bgDShgH                         | hamzabhadash74     | Motivation   |
| 12 | 12         | 1325660835586528648  |                                      | doctorata123       | nan  |
| 13 | 13         | 1342149935124861513  | cmeew                                | doctortata123      |  |
| 14 | 14         | 13822401176772793    | Rehan Kaleem                         | RehanKaleem5       | ArrKay's Gallery® Photographer, Traveller, Foodie, Banker, Islamabad. Snapchat: arrkayall Insta: arrkayhere  |
| 15 | 15         | 1512842217377091356  | Usman Ghani                          | UsmanGh9899752     |  |
| 16 | 16         | 143411845379791171   | Jamil Ur Rehman                      | Jyeme03            | nan  |
| 17 | 17         | 141989611652309913   | Muhammad Naeem                       | Muhamma7926415     | nan  |
| 18 | 18         | 1518399637375311872  | Chef Usman                           | ChefUsman4         |  |
| 19 | 19         | 1518399637375311872  | KainosTekkaino                       | KainosTekkaino     | Director and CEO of @Tekkaino pbc..... Supply Computerized Diagnostics Machine® ... \$NOWHAIL FX 33 MANCHESTER CITY!!  |
| 20 | 20         | 1424125378998214656  | Usman Usman                          | Usman4850481       | dada da dada   |
| 21 | 21         | 14643778086531510991 | haiza virk                           | haizew120343942    | nan  |
| 22 | 22         | 1484997528082056693  | Nadeem Ahmad                         | Haider_Engineer    | MEC Engineering  |
| 23 | 23         | 156898981518065693   | Umar Rafique                         | UmarRafique32      | nan  |
| 24 | 24         | 92984948822431746    | Shujat Umar                          | ShujatUmar         | nan  |
| 25 | 25         | 151461131634106369   | Asqa Moelz                           | AsqaMoelz          | Too mxx sensible for my blood relations  |
| 26 | 26         | 151338424227106369   | Asia Zia                             | Asimimir5458290    | nan  |
| 27 | 27         | 151253696525050716   | Zainab Khan                          | ZainabKhan004      | Software Engineer  |
| 28 | 28         | 1828459846           | Muhammad Arslan                      | arslan1njt         | nan  |
| 29 | 29         | 9591168197542299393  | DELIGHT Inc.                         | DLT_fit            | Official account of DELIGHT Inc. Sports platform business. We are providing multilingual AI powered telephony bot. <a href="https://t.co/uenihzV">https://t.co/uenihzV</a> |
| 30 | 30         | 1508793193579622401  | Subha Khokhar                        | khokhar_subha      | nan  |
| 31 | 31         | 82719822386123137    | Avis Ali                             | avisali114         | eBay virtual assistant, woocommerce Virtual assistant, Ecommerce manager, chess  |
| 32 | 32         | 1371209182386123137  | awaisali114                          | awaisali114        |  |
| 33 | 33         | 106556538158471158   | Javed Malik                          | JavedMalik114      | IG: JavedMalik114  |
| 34 | 34         | 626258452            | Talib Ali =                          | talibgular         | W: A Pakistani Patriot   |
| 35 | 35         | 15612159525871626    | gamer                                | masad0117          | Cyber Security Researcher  |
| 36 | 36         | 1567237345847224797  | Job Tips Repost Page - Updated Daily | dailyjobrepos      | Follow for daily job-related repost content.   |
| 37 | 37         | 1562339212912567942  | anisa                                | anisa32027108      | nan  |
| 38 | 38         | 156228220551159820   | Aliya                                | Aliya33658401      | العنصرية   |
| 39 | 39         | 7906937543895496     | Dr.Ahmed Albaloooshi                 | dr1pp0d655         | MBS, M.Phil Physiology, PhD scholar  |
| 40 | 40         | 149934789510738245   | Satyadeva Pharmaceuticals            | Satyadeva          | Satyadeva is an US FDA approved and ISO 9001:2015 Certified Company and is currently having ever appreciating international and domestic                                   |

Screenshot 20: Markdown Files - Followers

Screenshot 21: Markdown Files – Followers\_Tweets

## 8. Source Code / Instructions

### 8.1 Source Code

This project is available on GitHub: <https://github.com/danielgruber99/TwitterDataAnalysis>.

### 8.2 Instructions (README.md)

Remark: Following instructions can also be found in the README.md in the GitHub Repository.

#### ***## Prerequisites***

- For executing the project any python version higher than python3.8 is required.
- This project only works on Linux System due the use of the simple-term-menu library! Please user either a Linux VM (of any distribution) or setup the Windows Subsystem Linux (WSL) on Windows.
- Create a twitter developer account and app. Save your generated bearer token, which you will have to set (see [Usage](#usage)).
- (optional) To keep your system clean the recommendation is to create a venv with 'python3 -m venv'.

#### ***## Installation***

Clone the GitHub repository or download the source code and de-zip it.

Install all needed modules listed in requirements.txt or run: \$ pip install -r requirements.txt

#### ***## Usage***

To start the program, ensure you are on the toplevel of this project. To enable the Twitterclient set your bearer token as environment variable: 'export TWITTER\_BEARER\_TOKEN=<your bearer token>'

Then run: '\$ python3 main.py'

#### ***## Usage without TwitterClient***

Actually this program is even usable without setting the bearer token for the Twitterclient. Obviously it's not possible to fetch data from twitter then but besides that the program is fully usable for prefetched dataset.

Only run following command to start the program: 'python3 main.py'

## 9. Outlook

As there is always room for improvement following list of possible enhancements shows a short summary what could be done in the future to enrich the functionality of this project:

- Currently it is only possible to fetch maximum 100 tweets. By looping over a higher number in sets of 100, as Twitter only allows to fetch 100 tweets per request, almost infinite tweets can be fetched (until the Twitter API raises TooManyRequest).
- Create more graphical output, e.g. in terms of the sentimentanalysis part, by using seaborn to generate graphs/diagrams about the different polarity of the entire dataset of tweets.
- Utilizing keyboard library to make the user interface better to use.