Workflow document

Profiling Internet Users

Sudarshan Sampathkumar

Project Overview:

This project is done as part of the course CIS 6930 Information Security in Distributed Systems. The main objective of this project is to demonstrate if we can statistically distinguish the internet usages of two different users over time. The project is developed in the **Python3** programming language. Please make sure you have the Python installed on your computer.

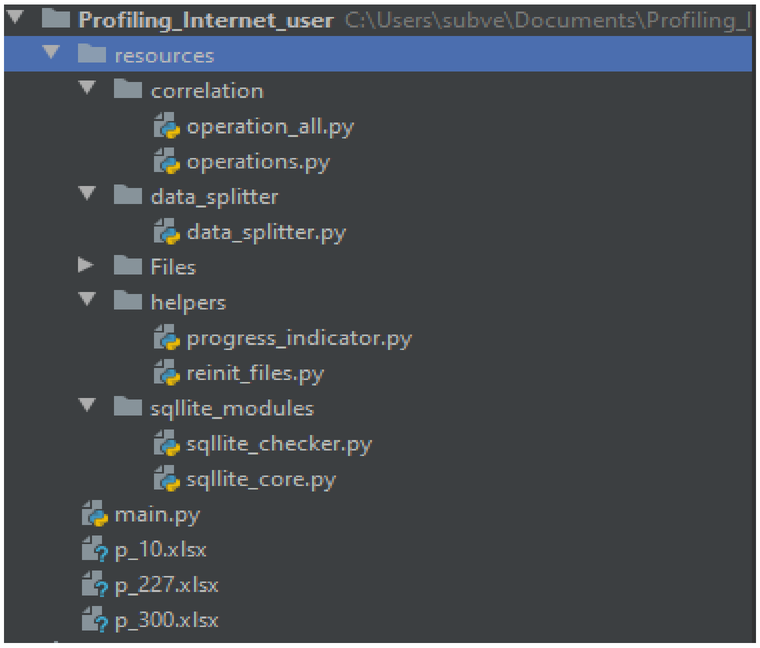
Libraries Required:

This project requires some external libraries that may not be included with the Python installation. If you don't have the libraries, please install the following modules before proceeding.

- **SciPy**
- **Pandas**
- **Sqlite3**
- **Csv**

Project Structure:

To further ease the understanding of this project, I have included this section that gives a brief introduction to the file structure of the project.



```
▼ Profiling_Internet_user  C:\Users\subve\Documents\Profiling_I
    ▼ resources
        ▼ correlation
              operation_all.py
              operations.py
        ▼ data_splitter
              data_splitter.py
        ▶ Files
        ▼ helpers
              progress_indicator.py
              reinit_files.py
        ▼ sqllite_modules
              sqllite_checker.py
              sqllite_core.py
          main.py
          p_10.xlsx
          p_227.xlsx
          p_300.xlsx
```

Figure 1 – File Structure

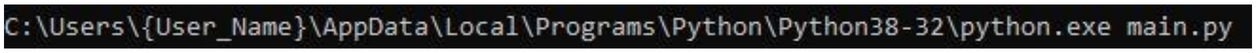
The project is divided into 5 modules: -

- **Correlation**
- **Data Splitter**
- **Files**
- **Helpers**
- **SQLite Modules**

The main function is located at the parent directory. All these 5 modules are grouped into one single module called **Resources.** Each of these 5 modules has python files that encapsulate several procedures. Feel free to check out the comments on the code for a better understanding of every function.

Execution Procedure

To quicken the process of this execution, I took the freedom to already import and split the data into the three specified time windows; **10, 227**, and **300** seconds. Hence by running this command, the project will skip to the calculation of the Spearman correlation algorithms and the P Values. To execute the python file, please navigate to the parent directory where *main.py* is present and type the following:



```
C:\Users\{User_Name}\AppData\Local\Programs\Python\Python38-32\python.exe main.py
```

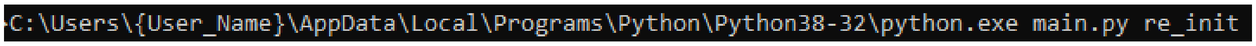
Figure 2- Run command (operation)

Or you can simply double click on the python file to execute it on Windows.

Here the *{User_Name}* is your Username on your computer. This is where the python.exe is installed on most **Windows** Operating Systems. If you're using Linux or Mac, please locate the python.exe in your computer and provide that path along with the python file.

If you wish to test the project from scratch, then please follow these **instructions** carefully to avoid any errors.

- Navigate to Resources/ Files and move or delete the *users.db* file.
- Go to the command prompt or terminal and set the current directory as the parent directory
- Run the same command with a command-line argument **re_init**



```
C:\Users\{User_Name}\AppData\Local\Programs\Python\Python38-32\python.exe main.py re_init
```

Figure 3- Run Command (From Scratch)

If you're using **PyCharm IDE** to test the project, I have already added two configurations for you. The "**main**" configuration will handle the operation part with the data that has been imported and split with, to reduce run time. On the other hand, the **"main_init"** will run the project from scratch. Make sure, you delete the *users.db* file by following the bullet point instructions given above. If by any chance, you don't find the configuration due to compatibility issues, please add the *main.py* to your configuration if you don't want the trouble in locating the *python.exe*

For **Linux OS**, type the following command in the terminal from the parent directory.

```
$ python main.py
```

If you want to run it with the parameter,

```
$ python main.py re_init
```

If in any case, the program is failing to run, please read the last section "Important notes" to look for a potential reason to why this is happening.

Workflow Diagram:

To completely understand the project's workflow, I have included a workflow diagram that may help you visualize the code flow with ease. To include all parts of the project, the diagram will show the execution of the code when the project is run with *re_init* argument.

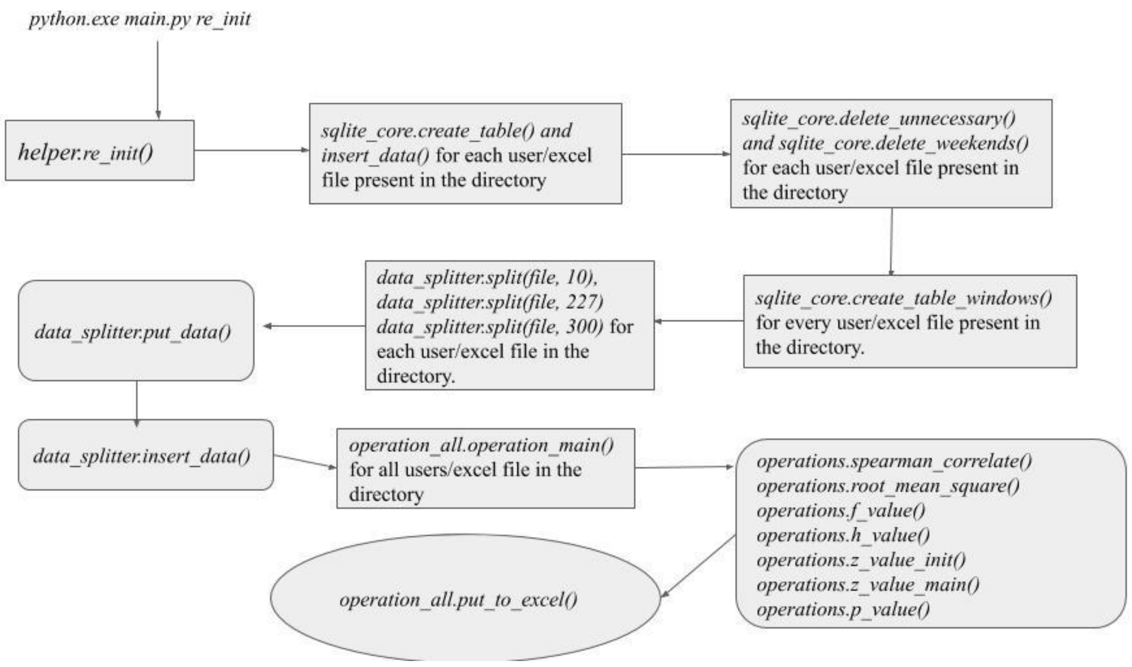

python.exe main.py re_init
helper.re_init()
sqlite_core.create_table() and insert_data() for each user/excel file present in the directory
sqlite_core.delete_unnecessary() and sqlite_core.delete_weekends() for each user/excel file present in the directory
sqlite_core.create_table_windows() for every user/excel file present in the directory.
data_splitter.split(file, 10), data_splitter.split(file, 227) data_splitter.split(file, 300) for each user/excel file in the directory.
data_splitter.put_data()
data_splitter.insert_data()
operation_all.operation_main() for all users/excel file in the directory
operations.spearman_correlate()
operations.root_mean_square()
operations.f_value()
operations.h_value()
operations.z_value_init()
operations.z_value_main()
operations.p_value()
operation_all.put_to_excel()

Figure 4 - Workflow Diagram

Workflow by points:

- The python script executes the *sqllite_core.create_and_insert files()* function for all the files in the directory when the argument re_init is passed. This function imports all the data into the SQLite database.
- Once the data is imported, the *delete_unecessary() and delete_weekends*() are called to delete data which is not a weekday and which is not between 8 am to 5 pm for weekdays.
- Now, for every user, two tables are created for each window. Here each table will consist of data of one week. Two tables for each window infers that every user will have 6 tables

in total when you consider the other two windows as well. This is handled by the function *create_table_window()* in the same module.

- In this step, the splitting happens. The splitting algorithm here forwards the start date to Monday if the data starts from Friday for the user. This algorithm creates a time window as provided in the argument and checks if the real_first_packet falls into the window or not. If yes, the octets/duration is calculated for that packet and appended to the existing result, if it exists.
- As week 2 starts, the *insert_data()* function is called to insert the split data and its ratio for the first week into the corresponding table. The process repeats until week 2 ends and the next user is called.
- When this process completes, the *operation_all.operation_main()* is called for all the users in the directory. Two files are compared at one time and the ratios of these files are fetched using the function *sqllite_core.get_split_ratio_data* in *operations.py* file.
- The *spearman_correlate()* calculates the correlation value of these two files. With the resulting values, the *root_mean_square()* is used to calculate the root mean square values as the function name says. The f and h value is returned by the functions *f_value()* and *h_value().*
- Lastly, the z values are initialized by the *z_value_init()* and the *z_value_main*() is called to calculate the main Z value. The Z value is then passed to the PFunction that was provided in the project documentation.
- Each P value is stored in a dictionary where the keys are the two users that are being compared.
- The *put_to_excel()* exports the dictionary into the corresponding excel sheet.

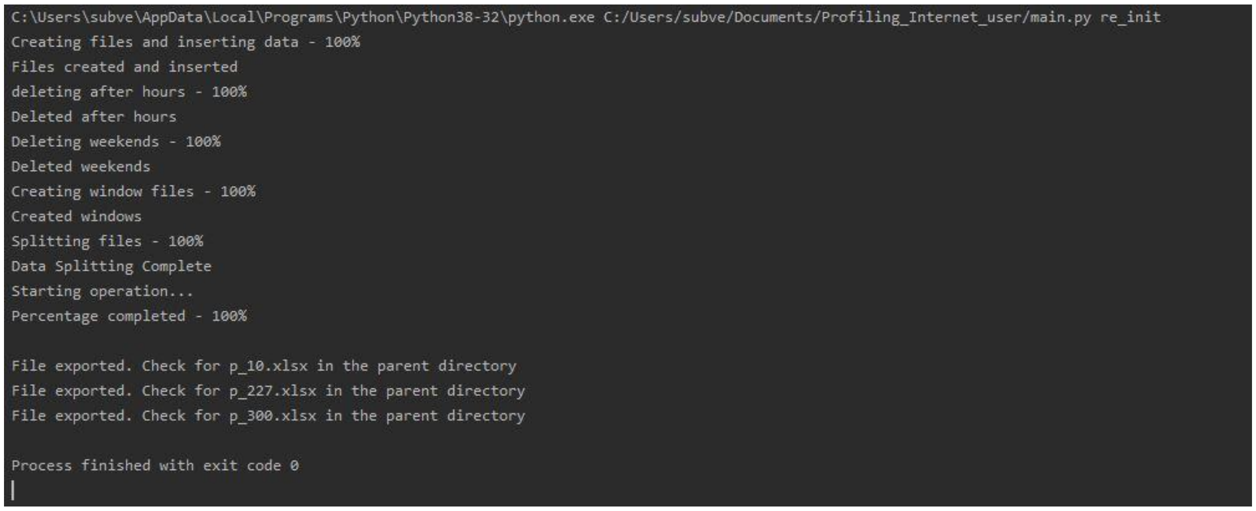
Input and Output:

If you want to run just the operation part of the project, that is, if you're running the script without any argument, then the *users.db* file will serve as the input.

If you're running the code with the *re_init* argument, the excel files will serve as the primary input, however, in the end they are added to *users.db* files.

Irrespective of the way you would like to run the program, the output will always be three excel files named *p_10*, *p_227***,** and *p_300* which will be generated in the parent directory.

The output should look like this if you're using the re_init.



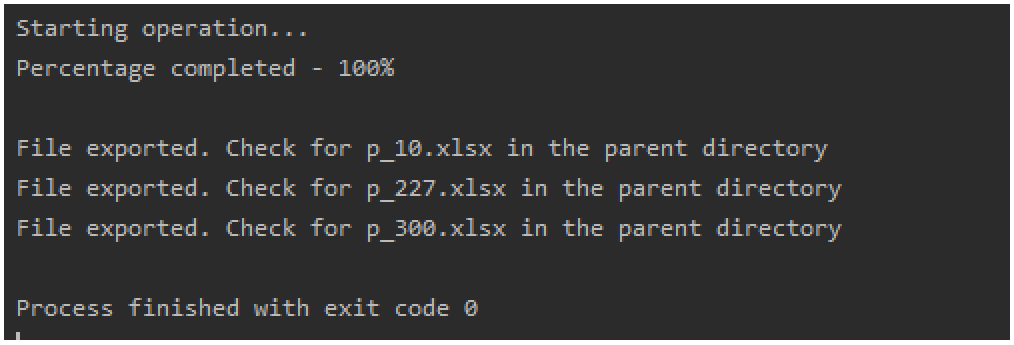
```
C:\Users\subve\AppData\Local\Programs\Python\Python38-32\python.exe C:/Users/subve/Documents/Profiling_Internet_user/main.py re_init
Creating files and inserting data - 100%
Files created and inserted
deleting after hours - 100%
Deleted after hours
Deleting weekends - 100%
Deleted weekends
Creating window files - 100%
Created windows
Splitting files - 100%
Data Splitting Complete
Starting operation...
Percentage completed - 100%

File exported. Check for p_10.xlsx in the parent directory
File exported. Check for p_227.xlsx in the parent directory
File exported. Check for p_300.xlsx in the parent directory

Process finished with exit code 0
```

Figure 5- Output for main re_init argument

The output would look like this if you're running the main without an argument



```
Starting operation...
Percentage completed - 100%

File exported. Check for p_10.xlsx in the parent directory
File exported. Check for p_227.xlsx in the parent directory
File exported. Check for p_300.xlsx in the parent directory

Process finished with exit code 0
```

Figure 6- Output for main without an argument

Important Notes:

This section, being the final section of this document, contains some possible human errors that may happen due to which the program could fail to run.

- Make sure all the *excel files (.xlsx)* are present in the **Resources/Files** folder.

- If you’re using the **re_init** argument, please make sure that you delete or move it from the original position.
- Do not keep any excel sheet open during the process of running. This action will not give the program the access to write and the program will crash.
- The **re_init** will significantly take a long time to run. Therefore, I *recommend* that you run it without the argument first.

Further analysis of the output is present in the Report.pdf file in the same folder.