Project 4: Epub

CS 4373: Data Mining Fall 2023

Instructor: Dr. Mohammad Imran Chowdhury

Total Points: 75

Due: 11/09/2023 11:59 PM

In this project, I invite you to do the following:

1. Import and prepare the dataset `Epub.csv`.
2. Apply the apriori algorithm to the data.
3. List the rules in a readable table.
4. Plot the rules.

Task 1: Import and prepare the dataset `Epub.csv` **(15 points)**

The Python library `apyori` contains the implementation of the Apriori algorithm, which can be installed with Python's `pip` command. This command only needs to be done once per machine.

The standard, shorter approach may work:

In [1]:
```
# pip install apyori
```

If the above command didn't work, it may be necessary to be more explicit, in which case you could run the code below.

In [2]:
```
# import sys
# !{sys.executable} -m pip install apyori
```

Once `apyori` is installed, then load the libraries below.

In [3]:
```
import pandas as pd              # For dataframes
import matplotlib.pyplot as plt  # For plotting data
from apyori import apriori       # For Apriori algorithm
%matplotlib inline
```

```
C:\Users\imran\Anaconda3\lib\site-packages\pandas\compat\_optional.py:138: UserWarning: Pandas requires version '2.7.0' or n
ewer of 'numexpr' (version '2.6.8' currently installed).
  warnings.warn(msg, UserWarning)
```

After that load the Epub dataset provided to you as **'data/Epub.csv'** file into the Jupyter Notebook, your code should open the dataset and converts it to list format, which is necessary for the `apriori()` function. You can name the list variable as transactions. Here is the output of the first three (03) itemset with the command transactions[:3]. Your output should match mine.

```
Out[4]: [['"doc_154"'], ['"doc_3d6"'], ['"doc_16f"']]
```

Task 2: Apply the **apriori** algorithm to the data. **(10 points)**

Call **apriori()** on transactions data. As parameters **apriori()** can take the minimum support, minimum confidence, minimum lift and minimum items in a transaction. Only the pairs of items that satisfy these criteria would be returned.

For example:

```
# Prints one rule
print(rules[0])
```

```
RelationRecord(items=frozenset({'"doc_6bf"', '"doc_11d"'}), support=0.001589420815054994, ordered_statistics=[OrderedStatist
ic(items_base=frozenset({'"doc_6bf"'}), items_add=frozenset({'"doc_11d"'}), confidence=0.12195121951219513, lift=5.388120032
885722)])
```

Note that here rules is the **apriori()** object on transactions data.

Task 3: List the rules in a readable table. **(25 points)**

The printed rule above is not very clear. You've to convert it to a more readable format. You'll add a **From** and **To** field to the DataFrame, to indicate a rule's antecedent and consequent respectively. Hence for a rule of the form **A->B**. The **From** will contain **A** and **To** will contain **B**. We'll also add the **Support**, **Confidence,** and **Lift** corresponding to each rule in the DataFrame.

The output should be as follows for the first 5 rows: **(10 points)**

Out[6]:

	From	To	Support	Confidence	Lift
0	"doc_6bf"	"doc_11d"	0.001589	0.121951	5.388120
1	"doc_16e"	"doc_4ac"	0.002797	0.346457	53.425660
2	"doc_19f"	"doc_466"	0.001526	0.173913	25.806399
3	"doc_3ec"	"doc_1a2"	0.001017	0.115942	13.311330
4	"doc_4c7"	"doc_1a2"	0.002098	0.239130	17.996568

Next, List Rules with N's. Here you have to do the following: **(15 points)**

- Pick top rules sorted by Support, then **(3 points)**
- List all items, then **(3 points)**
- Creates a mapping of items to numbers, then **(3 points)**
- Maps the items to numbers and adds the numeric **'FromN'** and **'ToN'** columns, then **(3 points)**
- Displays the top 20 association rules, sorted by Support **(3 points)**

The output should be as follows:

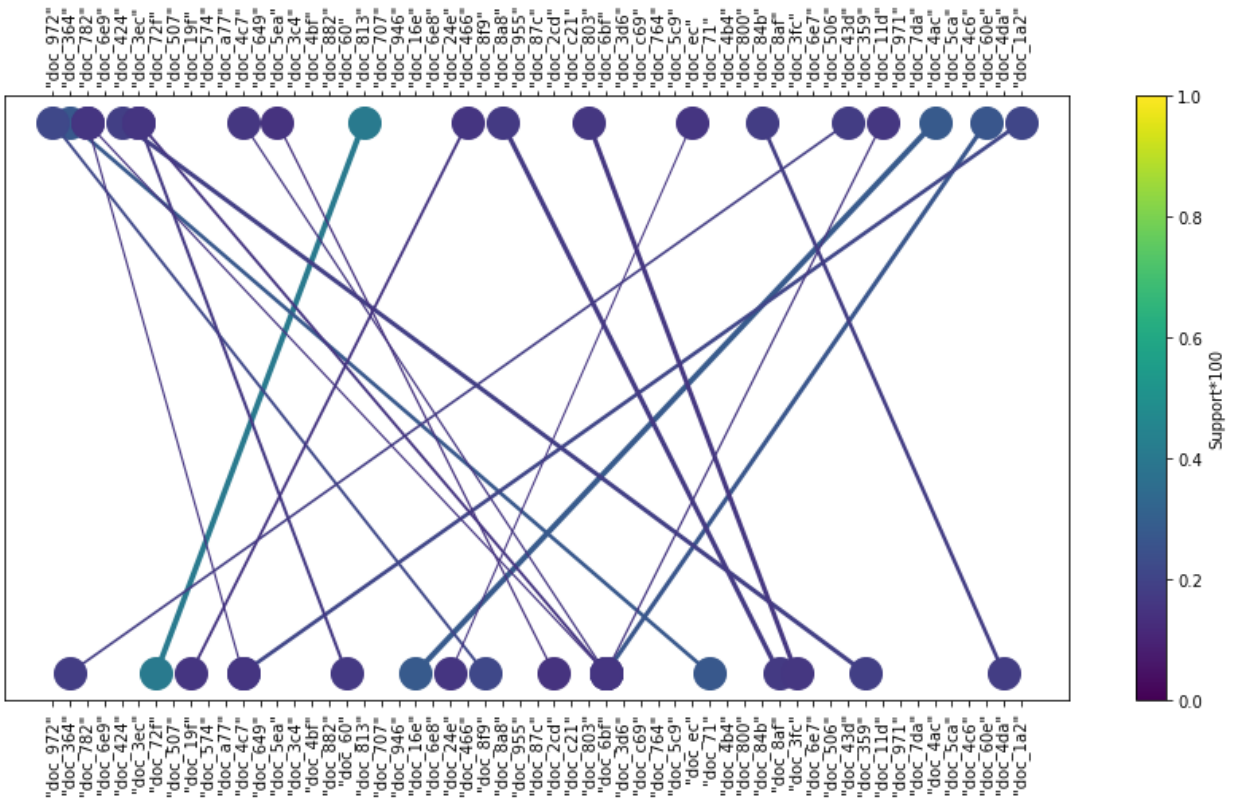
Out[7]:

	From	To	Support	Confidence	Lift	FromN	ToN
53	"doc_72f"	"doc_813"	0.004069	0.351648	16.811784	6	18
1	"doc_16e"	"doc_4ac"	0.002797	0.346457	53.425660	21	51
14	"doc_71"	"doc_364"	0.002734	0.233696	15.912549	38	1
46	"doc_6bf"	"doc_60e"	0.002670	0.274510	21.062267	32	54
60	"doc_8f9"	"doc_972"	0.002162	0.177083	18.693582	25	0
4	"doc_4c7"	"doc_1a2"	0.002098	0.239130	17.996568	11	56
8	"doc_359"	"doc_424"	0.001844	0.271028	44.406250	47	4
37	"doc_4da"	"doc_84b"	0.001780	0.231405	34.016529	55	41
12	"doc_364"	"doc_43d"	0.001780	0.152174	16.064050	1	46
58	"doc_8af"	"doc_8a8"	0.001717	0.290323	47.077153	42	26
20	"doc_60"	"doc_3ec"	0.001653	0.189781	21.021589	17	5
0	"doc_6bf"	"doc_11d"	0.001589	0.121951	5.388120	32	48
35	"doc_6bf"	"doc_4c7"	0.001589	0.119617	9.177850	32	11
23	"doc_3fc"	"doc_803"	0.001589	0.287356	59.471416	43	31
48	"doc_6bf"	"doc_782"	0.001526	0.117073	13.247798	32	2
21	"doc_6bf"	"doc_3ec"	0.001526	0.175182	13.441196	32	5
36	"doc_4c7"	"doc_782"	0.001526	0.114833	12.994251	11	2
6	"doc_24e"	"doc_ec"	0.001526	0.106195	10.374760	23	37
2	"doc_19f"	"doc_466"	0.001526	0.173913	25.806399	8	24
7	"doc_2cd"	"doc_5ea"	0.001462	0.121693	14.611535	29	13

Task 4: Plot the rules. **(25 points)**

Plot each pair of items in the rule. If a rule is A->B, then item A is in the bottom row of the plot (y=0) and B is in the top row (y=1). The color of each line indicates the support of the rule multiplied by 100 (support*100). The width of each line is controlled by the confidence of each rule.

The output should be close to as follows:



The submission grading rubric is as follows (points out of 75 total):

Project element	**Points**
Task 1	15
Task 2	10
Task 3	25
Task 4	25

Submission Instructions: Create a compressed file (.zip or .tar.gz files are accepted) with your all source files such as .ipynb files and data files. Generally speaking, to complete Task 1 through Task 4, you just need one .ipynb file. But it's better to submit everything as a compressed file. Submit the compressed file to Canvas.

Late submission policy: As described in the syllabus, any late submission will the penalized with 10% off after each 24 hours late. For example, an assignment worth 100 points turned in 2 days late will receive a 20-point penalty. Assignments turned in 5 or more days after the due date will receive a grade of 0.