ID2222 HM2 - Discovery of Frequent Itemsets and Association Rules

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2 Introduction

This document is a report created as an assignment for ID2222 course at KTH. The main goal of the assignment was to implement the apriori algorithm to extract the frequent itemsets of a sale transaction dataset with a predefined support. Additionally, the extraction of association rules with a specific confidence based on these frequent itemsets have been developed. We used the given dataset of sale transactions. This dataset, together with some test datasets can be found in 'test/data' folder in the repository.

3 Solution

We decided to develop a project in Python 3.7 using popular libraries provided in `requirements.txt` file in the repository. The whole repository itself is attached to this report. In order to fulfill the task assigned we implemented the following scripts: 1. Run, main scripts to run the tests and print the results. 2. Apriori, representing an instance of the apriori algorithm and providing methods for extracting candidates, frequent itemsets and association rules.

4 Running

In order for the solution to run, Python 3.7 has to be installed. We recommend creating a virtual environment for the purpose of evaluating the solution. One can either use command line `python run.py` or run the programme in attached jupyter notebook: `ID2222 HM2 - Discovery of Frequent Itemsets and Association Rules.ipynb`. Below is the output of the jupyter notebook presenting the example run of the program. Due to the extend of the output considering the number of association rules and the time of execution, the experiment is run over the first 300 elements of the dataset.

5 Creating Apriori instance and generating baskets

```
In [1]: import os
        from apriori import Apriori

        PATH = os.getcwd() + "/test/data/T10I4D100K.dat"
        SUPPORT = 6
        CONFIDENCE = 0.75
        N = 300

        # create a new instance of Apriori
        apriori = Apriori(PATH, n=N, sep=' ', duplicates=False, verbose=True)

        for basket in apriori.baskets[:10]:
            print(basket)
```

5.1 Candidates and frequent items per iteration

```
In [2]: # get candidates and frequent itemsets
        candidates, frequent_itemsets = apriori.compute(support=SUPPORT, verbose=False)

        print("Frequent items:")
        for i in range(0, len(frequent_itemsets)):
            print("L{}: {}\n".format(i, list(frequent_itemsets[i])))
```

```
Frequent items:
L0: [frozenset({'236'}), frozenset({'793'}), frozenset({'884'}), frozenset({'280'}), frozenset({

L1: [frozenset({'583', '354'}), frozenset({'583', '617'}), frozenset({'172', '538'}), frozenset(

L2: [frozenset({'354', '583', '617'}), frozenset({'172', '538', '464'}), frozenset({'801', '862'
```

5.2 Association rules

```
In [3]: association_rules = apriori.get_association_rules(confidence=CONFIDENCE, verbose=False)

        print("Association rules:")
        for r, (c, s) in association_rules.items():
            print("Rule: {} -> {} - Confidence: {} - Support: {}".format(list(r[0]), list(r[1]),
```

```
Association rules:
Rule: ['801', '862'] -> ['392'] - Confidence: 1.0 - Support: 6
Rule: ['801', '392'] -> ['862'] - Confidence: 1.0 - Support: 6
Rule: ['862', '392'] -> ['801'] - Confidence: 0.86 - Support: 6
Rule: ['801'] -> ['862', '392'] - Confidence: 1.0 - Support: 6
Rule: ['172', '538'] -> ['464'] - Confidence: 1.0 - Support: 6
Rule: ['172', '464'] -> ['538'] - Confidence: 1.0 - Support: 6
```

```
Rule: ['538', '464'] -> ['172'] - Confidence: 1.0 - Support: 6
Rule: ['172'] -> ['538', '464'] - Confidence: 0.75 - Support: 6
Rule: ['464'] -> ['172', '538'] - Confidence: 0.86 - Support: 6
Rule: ['583', '354'] -> ['617'] - Confidence: 1.0 - Support: 6
Rule: ['617', '354'] -> ['583'] - Confidence: 1.0 - Support: 6
Rule: ['583', '617'] -> ['354'] - Confidence: 1.0 - Support: 6
Rule: ['583'] -> ['617', '354'] - Confidence: 1.0 - Support: 6
Rule: ['464'] -> ['538'] - Confidence: 0.86 - Support: 6
Rule: ['58'] -> ['354'] - Confidence: 0.86 - Support: 6
Rule: ['801'] -> ['862'] - Confidence: 1.0 - Support: 6
Rule: ['801'] -> ['392'] - Confidence: 1.0 - Support: 6
Rule: ['172'] -> ['464'] - Confidence: 0.75 - Support: 6
Rule: ['464'] -> ['172'] - Confidence: 0.86 - Support: 6
Rule: ['172'] -> ['538'] - Confidence: 0.75 - Support: 6
Rule: ['583'] -> ['617'] - Confidence: 1.0 - Support: 6
Rule: ['583'] -> ['354'] - Confidence: 1.0 - Support: 6
```

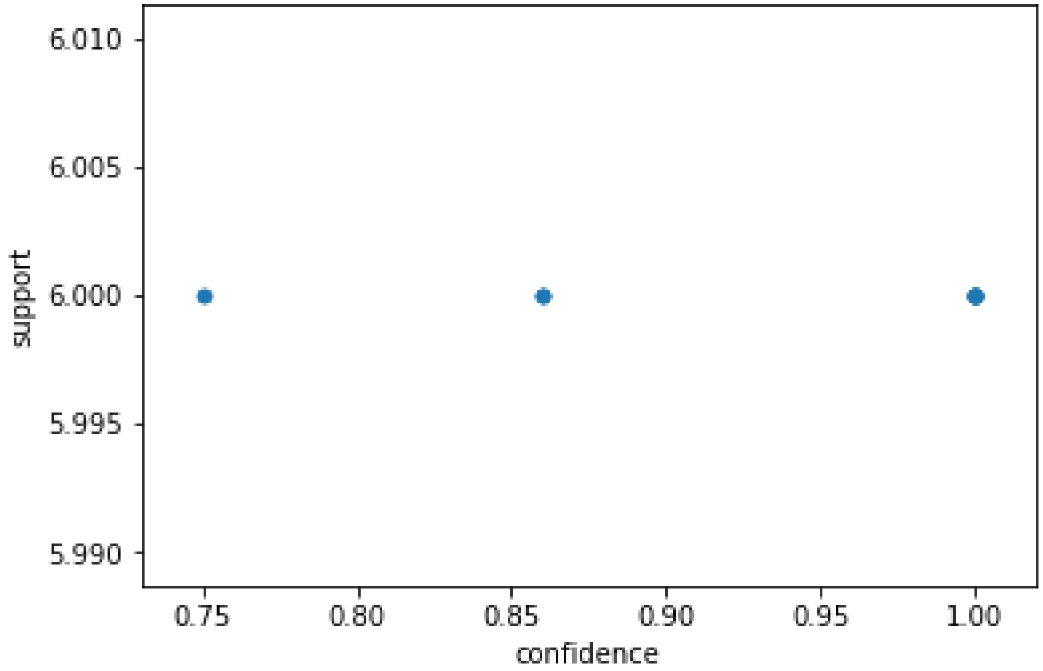
6 Visualization

6.0.1 Scatterplot with confidence and support

```
In [4]: %matplotlib inline
        import pandas as pd

        df = pd.DataFrame(association_rules.values())
        df.columns = ["confidence", "support"]
        df.plot.scatter(x="confidence", y="support")
```

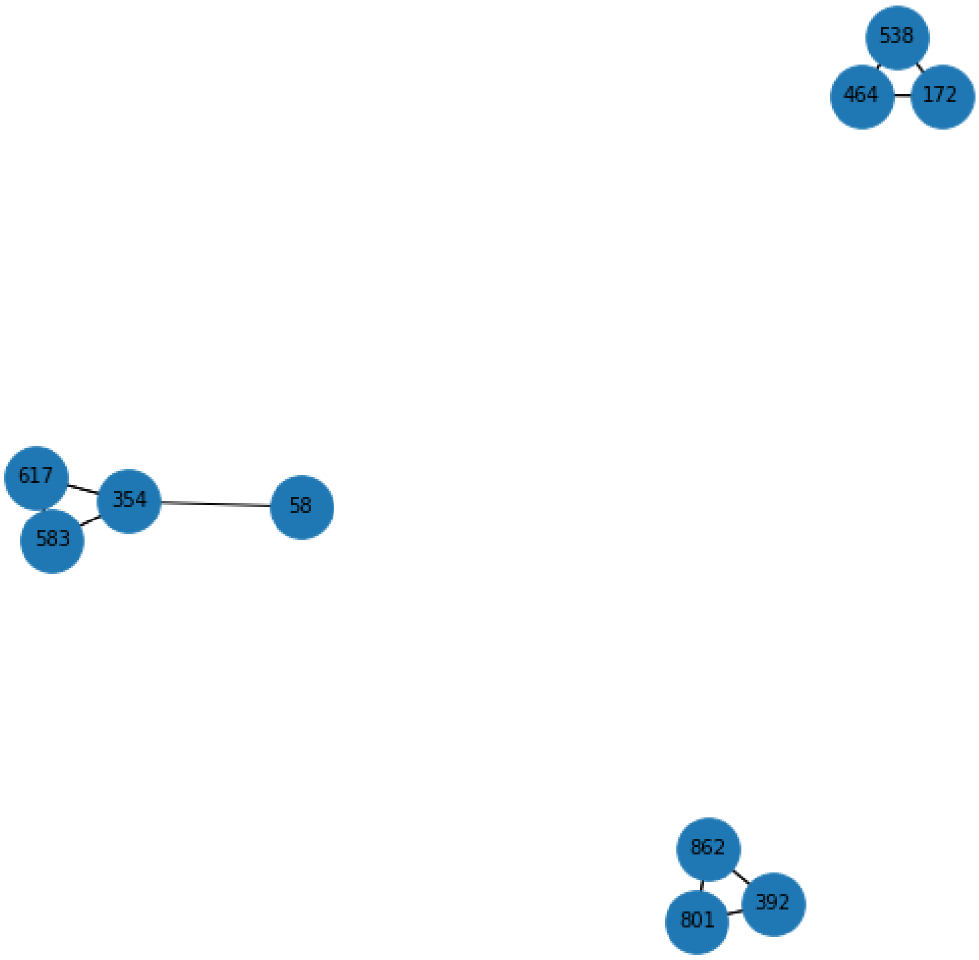
```
Out[4]: <matplotlib.axes._subplots.AxesSubplot at 0x27d569c02b0>
```



7 Connected graph

```
In [5]: import networkx as nx
        import matplotlib.pyplot as plt

        plt.figure(figsize=(10, 10))
        G = nx.DiGraph()
        for r, (c, s) in association_rules.items():
            end = list(r[1])[0]
            for rx in list(r[0]):
                G.add_edge(rx, end, weight=1, arrowsize=100)
        edges = [
            (u, v) for (u, v, d) in G.edges(data=True)
        ]
        pos = nx.spring_layout(G)  # positions for all nodes
        nx.draw_networkx_nodes(G, pos, node_size=1000)
        nx.draw_networkx_edges(G, pos, edgelist=edges, width=1, arrows=True)
        nx.draw_networkx_labels(G, pos, font_size=10, font_family="sans-serif")
        plt.axis("off")
        plt.show()
        print("")
```



8 References

R. Agrawal and R. Srikant. Fast Algorithms for Mining Association Rules, VLDB ’94, URL: http://www.vldb.org/conf/1994/P487.PDF