



Execution of APRIORI Algorithm of Data Mining Directed Towards Tumultuous Crimes Concerning Women

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Abstract- Apriori Algorithm is the most popular and useful algorithm of Association Rule Mining of Data Mining. As Association rule of data mining is used in all real life applications of business and industry. Objective of taking Apriori is to find frequent itemsets and to uncover the hidden information. This paper elaborates upon the use of association rule mining in extracting patterns that occur frequently within a dataset and showcases the implementation of the Apriori algorithm in mining association rules from a dataset containing crimes data concerning women. As for this WEKA tool is used for extracting results. For this one dataset is taken from UCI repository And other data is collected manually from the session court of sirsa to collect data on heart melting crimes against women. The main motive to use UCI is to first check the proper working of dataset and then apply Apriori on real dataset against crimes on women which extracts hidden information that what age group is responsible for this and to find where the real culprit is hiding. In last the comparison is done between Apriori & PredictiveApriori Algorithm in which Apriori is better and faster than PredictiveApriori Algorithm.

Keywords- Data Mining, Association Rule, Apriori Algorithm, Command line interface.

I. Introduction

Data Mining is a detailed process of analyzing large amounts of data and picking out the relevant information. It refers to extracting or mining knowledge from large amounts of data. The data sources can include databases, data warehouses, the Web, other information repositories, or data that are streamed into the system dynamically. [4,13]. Association Rule in Data Mining plays a important role in the process of mining data for frequent itemsets. Finding frequent patterns called associations. Frequent patterns are the patterns that occur frequently in the data. Patterns can include itemsets, sequences and subsequences. A frequent itemset refers to a set of items that often appear together in a transactional data set. example : bread and milk. It involves the following steps: cleaning and integrating data from data sources like databases, flatfiles, pre-treatment of selecting and transformation target data, mining the required knowledge and finally evaluation and presentation of knowledge. A data mining algorithm is complete if it mines all interesting patterns. It is often unrealistic and inefficient for data mining systems to generate all possible patterns. Instead, user-provided constraints and interestingness measures should be used to focus the search. In data mining, association rule learning is a most popular methodology to identify the interesting relations between the data stored in large database.

II. Related Definition

Association Rule: Association rule of data mining involves picking out the unknown inter-dependence of the data and finding out the rules between those items [3]. Agrawal introduced association rules for point of sale (POS) systems in supermarkets. A rule is defined as an implication of the form $A \Rightarrow B$, where $A \cap B \neq \emptyset$. The left-hand side of the rule is called as antecedent. The right-hand side of the rule is called as consequent.

Support: $I = \{i_1, i_2, i_3, \dots, i_m\}$ is a collection of items. T be a collection of transactions associated with the items. Every transaction has an identifier TID [6]. Association rule $A \Rightarrow B$ is such that $A \in I, B \in I$. A is called as Premise and B is called as Conclusion. The support S , is defined as the proportion of transactions in the data set which contains the itemset. $\text{Support}(X \Rightarrow Y) = \text{Support}(XUY) = P(XUY)$.

Confidence: The confidence is defined as a conditional probability $\text{Confidence}(X \Rightarrow Y) = \text{Support}(XUY) / \text{Support}(X) = P(Y|X)$.

Lift: is the ratio of the probability that L and R occur together to the multiple of the two individual probabilities for L and R , i.e. $\text{lift} = \text{Pr}(L,R) / \text{Pr}(L) \cdot \text{Pr}(R)$.

Conviction: is similar to lift, but it measures the effect of the right-hand-side not being true. It also inverts the ratio. So, a conviction is measured as:

$$\text{conviction} = \frac{\Pr(L) \cdot \Pr(\text{not } R)}{\Pr(L, R)}$$

III. APRIORI Algorithm

A realization of frequent pattern matching based on support and confidence measures produced excellent results in various fields. As Table 1 gives the Pseudocode of apriori algorithm.

TABLE 1 APRIORI ALGORITHM

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Join Step: Ck is generated by joining Lk-1 with itself

Prune Step: Any (k-1)-itemset that is not frequent cannot be a subset of a frequent k-itemset

Ck: Candidate itemset of size k
Lk: frequent itemset of size k
L1 = {frequent items};
for(k= 1; Lk != ∅; k++) do begin
Ck+1 = candidates generated from Lk;
for each transaction tin database do
increment the count of all candidates in Ck+1 that are contained in t
Lk+1 = candidates in Ck+1 with min. support
end
return U1 Lk;
    
```

A. Working of Apriori Algorithm:

In general, Apriori Algorithm can be viewed as a two-step process:

- (i) Generating all item sets having support factor greater than or equal to, the user specified minimum support.
- (ii) Generating all rules having the confidence factor greater than or equal to the user specified minimum confidence [8].

Example:

A database has five transactions. Let the min sup = 50% and min con f = 80%. As it shows the transaction in Figure 1

Step 1: Find all Frequent Itemsets, as shown in Figure 2

Frequent Itemsets:

{A}, {B}, {C}, {E}, {A,C}, {B,C}, {B,E}, {C,E}, {B,C,E}

Step 2: Generate strong association rules from the frequent itemsets. Results are shown in Table 2

TID	ITEMS
100	ACD
200	BCE
300	ABCE
400	BE

Fig 1 Database

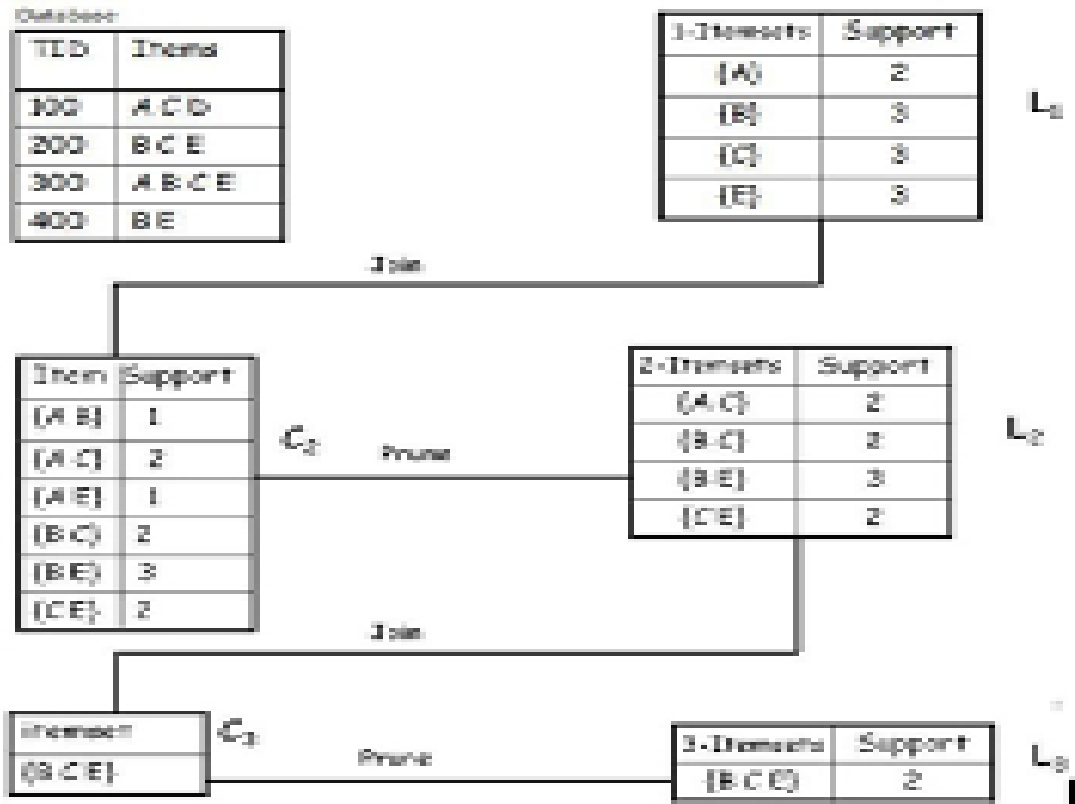


Fig 2 frequent itemsets

TABLE II SUPPORT & CONFIDENCE

Rules	Support(XY)	Support(X)	Confidence
{A}→{C}	2	2	100
{B}→{C}	2	3	66.66
{B}→{E}	3	3	100
{C}→{E}	2	3	66.66
{B}→{C, E}	2	3	66.66
{C}→{B, E}	2	3	66.66
{E}→{B, C}	2	3	66.66
{C}→{A}	2	3	66.66
{C}→{B}	2	3	66.66
{E}→{B}	3	3	100
{E}→{C}	2	3	66.66
{C, E}→{B}	2	2	100
{B, E}→{C}	2	3	66.66
{B, C}→{E}	2	2	100

As it includes all the frequent itemsets.

IV. Implementation of APRIORI Algorithm

In the implementation of the Apriori algorithm in mining association rules from a dataset containing cases of different crimes against women as dataset available in Session court. Extraction of frequent item sets is essential towards mining useful and relevant patterns from datasets. As it includes data under section 376,363,366. As it includes data of various section which comes under the Pathetic crimes against Women, as data is collected from Session court Sirsa, and Rewari .

- A. **WORKING OF WEKA:** As it includes attributes such as Age of boy, Age of Girl, Relation ,Section. As Relation Attribute tells us about the what a relation a victim has with a accused. WEKA is used to figure out all this. Figure 3 shows importing of database to WEKA.[19]

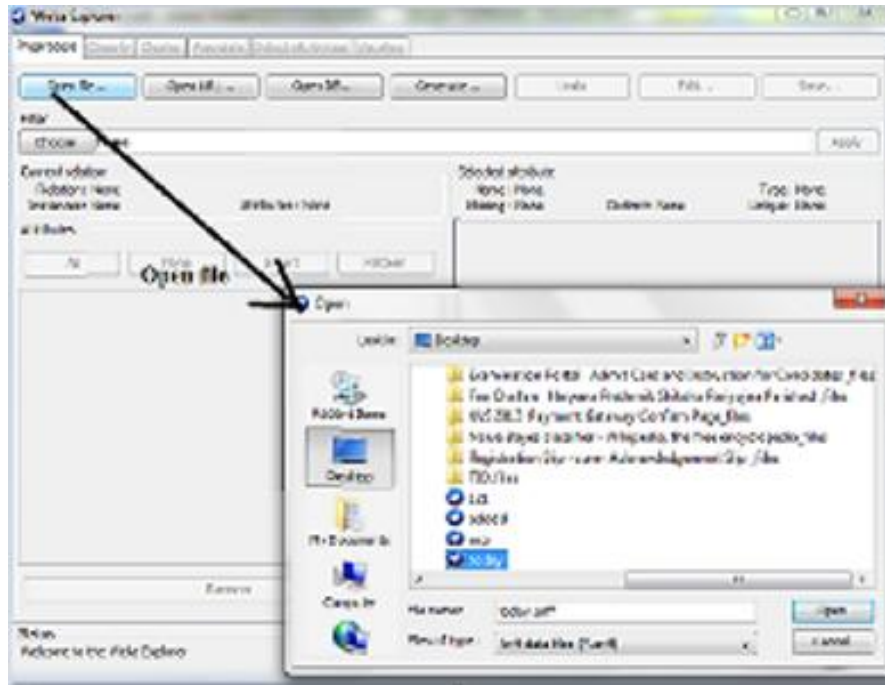


Fig 3 to Import database

- 1) **Preprocess Panel:** The preprocess panel is the start point for knowledge exploration. From this panel you can load datasets, browse the characteristics of attributes. Figure 4 shows the preprocess panel of womencrime dataset.

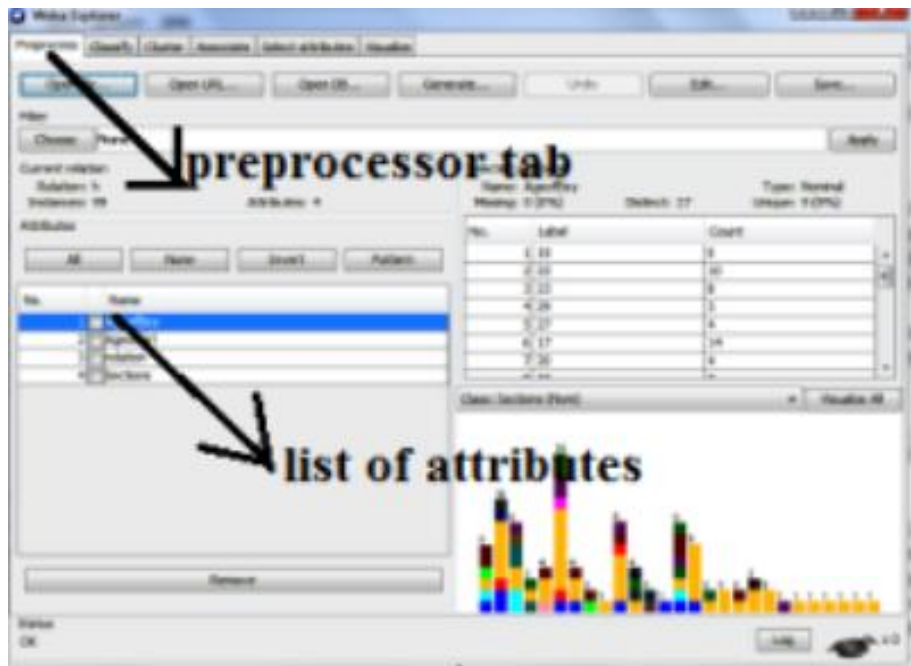


Fig 4 Preprocessor

2) Associate Panel: From the associate panel you can mine the current dataset for association rules using the weka associators. Different options available for Apriori are class index, lower bound, min support, metric type, minimum metric, number of rules etc shown in Figure 5, Figure 6 shows the ten best association rules using Apriori.

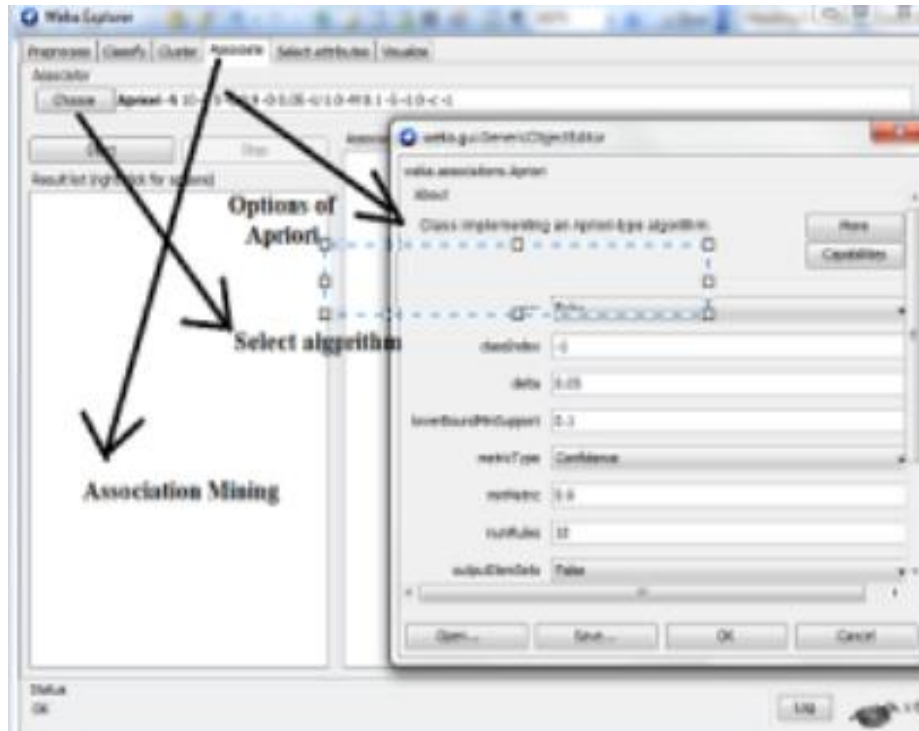


Fig 5 Selecting parameters

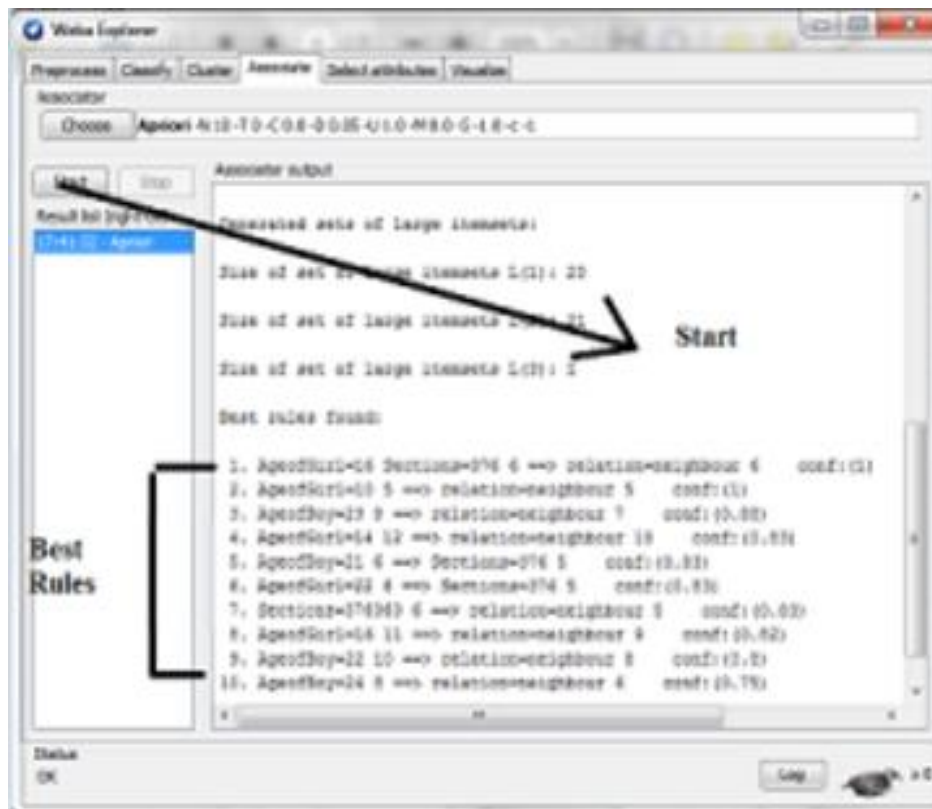


Fig 6 Best Rules

3) *Command Line Interface*: (CLI) is used shown in Figure 7. type command in space given below. Figure 8 shows the association rules and frequent itemsets for Apriori using CLI.

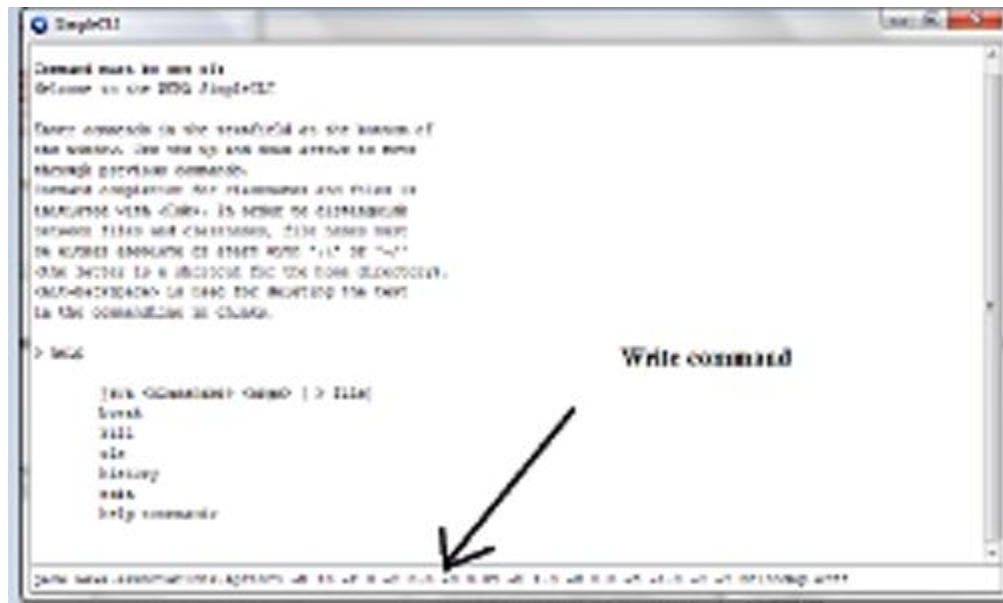


Fig 7 CLI

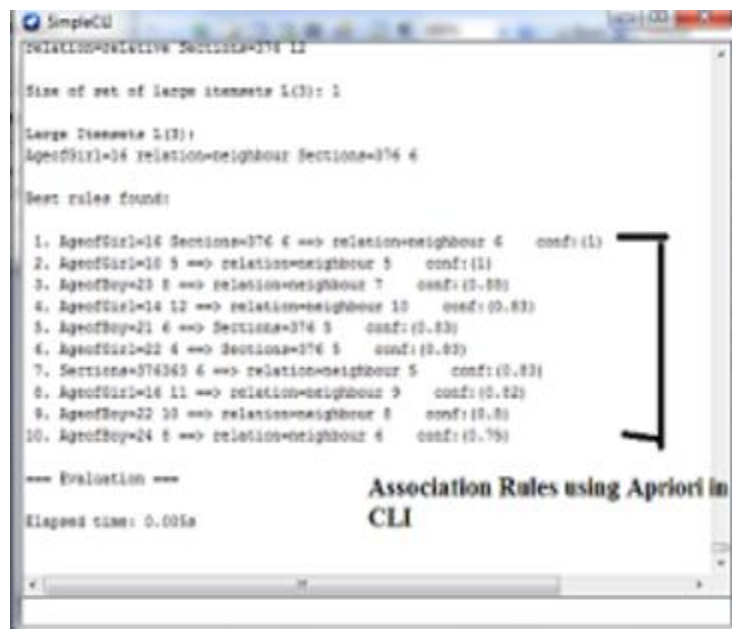


Fig 8 Association rules in CLI

V. Experimental Results

Here the experimental results of both algorithms of Association Rule Mining are given. In this paper comparison has done on both Apriori algorithm and PredictiveApriori algorithm. As Apriori is explained in previous section, now the brief discussion on other algorithm. As elapsed time is calculated for both the algorithms of association with the help of Command line interface (CLI) of WEKA.

A. PredictiveApriori Association Rule Mining:

In predictive Apriori association rule algorithm, support & confidence is combined into a single measure called "Accuracy". {Support, Confidence}=> Accuracy. In this predictiveApriori association rule algorithm, this predictive accuracy is used to generate the Apriori association rule. In Weka, this algorithm generates "n" best association rule based on "n" is number of rules specified by the user.

B. Comparative Results:

This paper finds the result using Association rule algorithms by mining tool WEKA. In this car dataset and women Dataset is used for comparison with 7 attributes and 1728 instances of car and 4 attributes and 99instances of women crimes are used. Table 3 is used to show the result of both algorithms of car dataset such as Apriori and PredictiveApriori. Table 4 is used to show the result of both algorithms of women dataset. Figure 9 shows the comparison of both the datasets which clearly tell Apriori Algorithm is better and Faster than PredictiveApriori Algorithm.

TABLE 3 RESULT OF CAR DATASET

Association Rule Algorithm	
Apriori Rules	PredictiveApriori Rules
1. persons=2 576 ==> class=unacc 576 conf:(1)	1. persons=2 lug_boot=small 192 ==> class=unacc 192 acc:(0.995)
2. safety=low 576 ==> class=unacc 576 conf:(1)	2. persons=2 lug_boot=med 192 ==> class=unacc 192 acc:(0.995)
3. buying=vhigh 432 ==> class=unacc 360 conf:(0.83)	3. persons=2 lug_boot=big 192 ==> class=unacc 192 acc:(0.995)
4. maint=vhigh 432 ==> class=unacc 360 conf:(0.83)	4. buying=vhigh persons=2 144 ==> class=unacc 144 acc:(0.99499)
5. lug_boot=small 576 ==> class=unacc 450 conf:(0.78)	5. buying=vhigh safety=low 144 ==> class=unacc 144 acc:(0.99499)
6. lug_boot=med 576 ==> class=unacc 392 conf:(0.68)	6. buying=high persons=2 144 ==> class=unacc 144 acc:(0.99499)
7. lug_boot=big 576 ==> class=unacc 368 conf:(0.64)	7. buying=high safety=low 144 ==> class=unacc 144 acc:(0.99499)
8. safety=med 576 ==> class=unacc 357 conf:(0.62)	8. buying=med persons=2 144 ==> class=unacc 144 acc:(0.99499)
9. class=unacc 1210 ==> persons=2 576 conf:(0.48)	9. buying=med safety=low 144 ==> class=unacc 144 acc:(0.99499)
10. class=unacc 1210 ==> safety=low 576 conf:(0.48)	10. buying=low persons=2 144 ==> class=unacc 144 acc:(0.99499)
Elapsed Time of Apriori Association rule Algorithm- 0.062s	Elapsed Time of PredictiveApriori Association rule Algorithm- 9.656s

TABLE 4 RESULT OF WOMENCRIME DATASET

Association Rule Algorithm	
Apriori Rules	PredictiveApriori Rules
1. AgeofGirl=16 Sections=376 6 ==> relation=neighbour 6 conf:(1)	1. AgeofGirl=16 Sections=376 6 ==> relation=neighbour 6 acc:(0.98057)
2. AgeofGirl=10 5 ==> relation=neighbour 5 conf:(1)	2. AgeofGirl=10 5 ==> relation=neighbour 5 acc:(0.97436)
3. AgeofBoy=23 8 ==> relation=neighbour 7 conf:(0.88)	3. AgeofGirl=18 3 ==> relation=neighbour 3 acc:(0.94532)
4. AgeofGirl=14 12 ==> relation=neighbour 10 conf:(0.83)	4. AgeofGirl=21 3 ==> relation=relative 3 acc:(0.94532)
5. AgeofBoy=21 6 ==> Sections=376 5 conf:(0.83)	5. AgeofBoy=40 2 ==> relation=neighbour 2 acc:(0.90973)
6. AgeofGirl=22 6 ==> Sections=376 5 conf:(0.83)	6. AgeofBoy=45 2 ==> Sections=376 2 acc:(0.90973)
7. Sections=376363 6 ==> relation=neighbour 5 conf:(0.83)	7. AgeofGirl=26 2 ==> Sections=376 2 acc:(0.90973)
8. AgeofGirl=16 11 ==> relation=neighbour 9 conf:(0.82)	8. AgeofGirl=4 2 ==> relation=neighbour 2 acc:(0.90973)
9. AgeofBoy=22 10 ==> relation=neighbour 8 conf:(0.8)	9. AgeofGirl=24 2 ==> relation=relative 2 acc:(0.90973)
10. AgeofBoy=24 8 ==> relation=neighbour 6 conf:(0.75)	10. AgeofBoy=23 8 ==> relation=neighbour 7 acc:(0.82238)
Elapsed Time of Apriori Association rule Algorithm- 0.087s	Elapsed Time of PredictiveApriori Association rule Algorithm- 0.701s

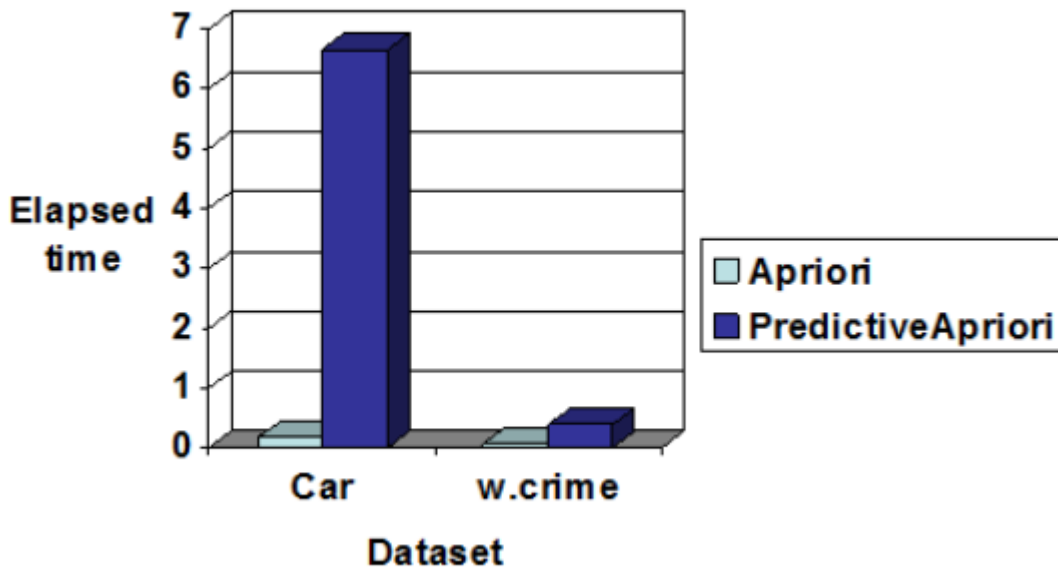


Fig 9 comparison of both datasets

VI. Conclusions and Future Work

The main aim of research is to find out the truth which is hidden and which has not been discovered yet. Through each research study has its own specific purposes. The purpose of research is to discover answer to questions through the application of scientific procedures. Apriori Algorithm is used to discover and understand the underlying patterns involved in the court's records from their data contains in various sections. Pathetic crimes against women are an alarming public issue not only in one or the other area but of world wide issue. Hence, there is a need present for accurate, timely information to react to changing pathetic condition of women, identifying who are mostly involved i.e. age group of accused, stranger or known to the victim, and basically which age groups girls are the main target of victims are analyzed to improve the deteriorating condition of women. As this research works answers all the questions as agr group of men is 20- 24 ,age group of girls who are on their target is 16-22 and mostly accused are well known by the victim. This is helpful for the government, society and police that they will take certain actions towards the male society. It basically tells what steps a society should take so that this appalling situation of women will improved and women can go freely anywhere.

Future work: To identify the states where crime rate is very much and what type of crime is faced by respective states such as murder, stealing, etc. It can be applied to real life application such as in hospitals to collect data on what type of diseases the mostly people are suffering i.e. region wise which disease is mostly found in people i.e. common ailment in people. It can also include comparing with other algorithm of Association Rule Mining which can also be applied in real life applications.

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