Frequent Pattern Generation in Association Rule Mining Using Apriori and FP Tree Algorithm

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Abstract— Web mining can be comprehensively characterized as disclosure and investigation of valuable data from the World Wide Web. Web Usage Mining can be depicted as the revelation and investigation of client availability design, amid the mining of log documents and related information from a specific Web webpage, with a specific end goal to acknowledge and better serve the requirements of Web-based applications. Web utilization mining itself can be arranged further contingent upon the sort of use information considered they are web server, application server and application level information. This Research work concentrates on web utilize mining and particularly monitors running over the web usage cases of locales from the server log records. The holding of memory and time use is thought about by methods for Apriori calculation and enhanced Frequent Pattern Tree calculation.

Keyword- Web usage mining, Apriori algorithm, improved Frequent Pattern Tree algorithm, Web log mining

I. INTRODUCTION

Web Mining
The number of Internet applications has grown and continue to grow significantly, affecting the lives of people in various aspects of their life including education, health, business and etc. The convenience and flexibility of services offered by web applications are the contributing factors why web applications are fast gaining popularity. In the process, web applications almost invariably churn out huge data containing user transactions and activity logs of user operations. Web usage mining is the process of finding out what users are looking for on the internet. Few users might be looking at only documented data, whereas some others might be interested in multimedia data.

➢ Web Server Data: The client logs are assembled by the Web server. Usually facts and figures include Internet Protocol address, sheet quotation and get access to time.
➢ Application Server Data: financial submission servers have significant characteristics to endow e-commerce submissions to be built on peak of them with tiny effort. A key feature is the proficiency to pathway diverse kinds of enterprise events and logs them in application server logs.

FP TREE
FP tree is a solid data architecture that retained important, absolutely vital and quantitative information considering common patterns [2]. It comprises of one root marked as "root", a set of piece prefix sub-trees as the child of the root, and a frequent-item header chart. The size of the FP-trees bounded by the overall occurrences of the frequent items in the database. The height of the tree is bound by the maximal number of frequent items in a transaction.

Advantages:
● It uses Compact data structure.
● It eliminates repeated database scan.
● It is faster than Apriori algorithm.
● It reduces the total number of candidate item sets by producing a compressed version of the database in terms of an FP tree.

Disadvantages:
● It takes more time for recursive calls.
● It is good only when user access paths are common.
● It utilizes more memory.

Apriori:
The Apriori Algorithm is an influential algorithm for mining frequent item sets for Boolean association rules [3]. Find the frequent item sets: the sets of items that have minimum support A subset of a frequent item set must also be a frequent item set i.e., if \{AB\} is a frequent item set, both \{A\} and \{B\} should be frequent item set. Iteratively find frequent item sets with cardinality from 1 to K (k-item set). Use the frequent item sets to generate association rules.
Advantages:
- It is very easy and simple algorithm.
- Its implementation is easy.

Disadvantages:
- It does multiple scan over the database to generate candidate set
- The number of database passes are equal to the max length of frequent item set.

Proposed System:

1. Start
2. Reading a log-file.
3. Pre-processing and URL Access.
4. URL Upload.
5. Single upload or Bulk (File) Upload.
6. Upload and Auto Mapping to SQL server.
7. URL Selection.
8. Transaction Selection.
9. Algorithm apply.
10. Result set with Associations and Pattern.
11. Time and Execution analysis.
12. End

Figure 1: Proposed Model
Proposed Flowchart:

![Flowchart Image]

Figure 2: Proposed flow

Proposed Algorithm:

Proposed Algorithm combines the Apriori algorithm and FP-tree structure. The advantage of proposed algorithm is that it doesn’t need to generate conditional pattern bases and sub-conditional pattern tree recursively. And the proposed results of the experiments.

<table>
<thead>
<tr>
<th>TID</th>
<th>Transaction</th>
<th>Frequent Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>f,a,c,d,g,i,m,p</td>
<td>f,c,a,m,p</td>
</tr>
<tr>
<td>002</td>
<td>a,b,c,f,l,m,o</td>
<td>f,c,a,b,m</td>
</tr>
<tr>
<td>003</td>
<td>b,h,i,o</td>
<td>f,b</td>
</tr>
<tr>
<td>004</td>
<td>b,c,k,s,p</td>
<td>c,b,p</td>
</tr>
<tr>
<td>005</td>
<td>a,f,c,e,l,p,m,n</td>
<td>f,c,a,m,p</td>
</tr>
</tbody>
</table>

(Transaction Table to understand proposed algorithm)

We consider using the Apriori method to mining the frequent item sets basing on the FP-tree, the divide-and-conquer strategy is still adopted by mining process. That is to say, the Compressed FP-tree is partitioned off a set of conditional sub tree, each of the
conditional sub tree associated with a frequent item. If there are n 1-frequent items $I_i (i=1,2,\ldots,n)$, then the FP-tree can be divided into n conditional sub tree $FPT_i (i=1,2,\ldots,n)$ , and $FPT_i$ is the conditional sub tree associated with frequent item $I_i$. Then use the apriori algorithm to mine each conditional sub tree, and gain all the frequent itemsets with the first prefix item $I_i$. The proposed algorithm includes two steps, the first step is to construct the FPtree as FP-growth does, the second step is to use of the apriori algorithm to mine the FP-tree. On the second step, it is needed to add an additional node Table, named NTable, each entry in the NTable has two fields: Item-name, and Item-support. Item-name: the name of the node appears in the FPTi. Item-support: the number of the node appear with $I_i$. The pseudo code of the proposed algorithm is described below.

```
Input: FP-tree, minimum support threshold $\xi$
Output: all frequent itemset L
1. $L = L_1$;
2. for each item $I_i$ in header table, in top down order
3. $L_{ii} = \text{Apriori-mining}(I_i)$;
4. return $L = \{L \cup L_{i1} \cup L_{i2} \cup \ldots \cup L_{in}\}$;
 pseudocode: Apriori-mining($I_i$)
1. Find item p in the header table which has the same name with $I_i$;
2. $q = p$.tablelink;
3. while q is not null
4. for each node $q_i$ = root on the prefix path of q
5. if NTable has an entry N such that N.Item-name = q_i.Item-name
6. N.Item-support = N.Item-support + q.count;
7. else
8. add an entry N to the NTable;
9. N.Item-name = q_i.Item-name;
10. N.Item-support = q.count;
11. $q = q$.tablelink;
12. $k = 1$;
13. $F_k = \{j | j \in \text{NTable} \land j$.Item-support $\geq \text{minsup}\}$
14. repeat
15. $k = k + 1$;
16. $C_k = \text{apriori-gen}(F_{k-1})$;
17. $q = p$.tablelink;
18. while q is not null
19. find prefix path t of q
20. $C_t = \text{subset}(C_k,t)$;
21. for each $c \in C_t$
22. $c$.support = $c$.support + q.count;
23. $q = q$.tablelink;
24. $F_k = \{c | c \in C_k \land c$.support $\geq \text{minsup}\}$
25. until $F_k = \emptyset$
26. return $L_1 = L \cup F_1 \cup F_2 \cup \ldots \cup F_k$ // Generate all frequent itemsets which with $I_i$ as the prefix item.
```

To explain the algorithm, we use an example with the transaction database showed in Table 1. The FP tree of this database is showed in Figure 1. The mining process begins from the top of the header table, and moves toward the bottom. For the f-node, it has only one prefix path and the prefix path has no other node except root-node, so there is no frequent item set has the first prefix item with f. For the next c-node in the header table, it has two prefix paths {f}, and {root}. f.support = c.count = 3 = minsup, there is no other request item in c’s prefix, so we gain the frequent itemset {cf} with support 3, the process of mining the Frequent itemsets with the first prefix item c terminates. Next for the a-node, it has one prefix path: cf, and c.support = f.support = a.count = 3, so item c and item f are 1-frequent item, generate 2-candidate cf by joining c and f, then generate two-subset of a’s prefix path, here just is cf, and (cf).support=a.count=3=minsup, so itemset cf is frequent, finally ,we get the frequent itemsets {ac:3,af:3,acf:3}. The remaining mining processes are similar.
Screenshot:
Execution time by Apriori algorithm

![Figure 3 Apply Apriori algorithm](image)

Execution time with FP-Tree algorithm

![Figure 4 Apply FP Tree algorithm](image)

Execution of Proposed Algorithm

![Figure 5 Apply Proposed algorithm](image)
Results and experiments

Comparison Matrix and Performance Evaluation

Results of Proposed System

<table>
<thead>
<tr>
<th>Data</th>
<th>No. Of URL/Transactions</th>
<th>Algorithm</th>
<th>Execution Time Taken (In Milli Seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data.Gov (Dataset)</td>
<td>100</td>
<td>FPTREE</td>
<td>9461</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td></td>
<td>46205</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td></td>
<td>846123</td>
</tr>
<tr>
<td></td>
<td>1500</td>
<td></td>
<td>12691500</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td></td>
<td>159220000</td>
</tr>
<tr>
<td>Go Search Directory (Dataset)</td>
<td>100</td>
<td>FPTREE</td>
<td>7461</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td></td>
<td>43201</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td></td>
<td>9452111</td>
</tr>
<tr>
<td></td>
<td>1500</td>
<td></td>
<td>12871000</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td></td>
<td>145220000</td>
</tr>
<tr>
<td>Data.Gov (Dataset)</td>
<td>100</td>
<td>Proposed</td>
<td>11324</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td></td>
<td>43302</td>
</tr>
<tr>
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<td>94854</td>
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<tr>
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<tr>
<td></td>
<td>2000</td>
<td></td>
<td>178212113</td>
</tr>
<tr>
<td>Go Search Directory (Dataset)</td>
<td>100</td>
<td>Proposed</td>
<td>11270</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td></td>
<td>53448</td>
</tr>
<tr>
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<td>84800</td>
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<tr>
<td></td>
<td>1500</td>
<td></td>
<td>1145600</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td></td>
<td>165212059</td>
</tr>
</tbody>
</table>
Conclusion:

The principle downside of Apriori calculation is that the hopeful set creation is expensive, particularly if an expansive number of examples or potentially long examples exist. The Fundamental downside of FP-development calculation is the unstable amount of does not have a decent applicant era technique. Future research can consolidate FP-Tree with Apriori competitor era strategy to tackle the weaknesses of both Apriori and FP-development. In future the calculation can be reached out to web content mining, web structure mining, and so forth. The work can likewise be reached out to concentrate data from picture records.

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