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Implementation of Efficient Algorithms for Mining Top-K High Utility Item Sets

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ABSTRACT

Popular problem in data mining, which is called "high-utility itemset mining" or more generally utility mining. High Utility Itemsets which are itemsets having a utility meeting a user-specified minimum utility threshold value i.e min_util. The main objective of utility mining is to find item sets with highest utilities, by considering profit, quantity, cost or any other user preferences. Research has been carried out in area of mining HUI's. Various techniques have been applied. The main problem with setting threshold value which is mostly user specific, is it needs to be appropriate. In Order to set most appropriate or right Threshold value for mining HUI's,user needs to do trial & error which in turn is time consuming & tedious process, because if min_util is set too low, system will result in getting large data of HUI, which in turn makes system ineffective for the purpose of HUI. If we set min_util too high, this will result in getting small amount or no HUI's. Thus setting minimum threshold value is difficult. The proposed system is following Top-k framework for mining top-k HUI's, which is using two algorithms TKU (mining top-k utility itemsets) & TKO (mining top-k in one phase),without setting min_util threshold.

Keywords: Utility mining, Mining Top-k HUI,High Utility Itemset, Top-k framework, TKU,TKO.

I. INTRODUCTION

High utility itemsets (HUIs) mining is an emerging topic in data mining, which is the process to find all itemsets having a utility meeting a user-specified minimum utility threshold min-util However, setting min-util appropriately is a difficult problem for users. Generally speaking, finding an appropriate minimum utility threshold by trial and error is a tedious process for users. If min-util is set too low, too many HUIs will be generated, which may cause the mining process to be very inefficient. On the other hand, if min-util util is set too high, it is likely that no HUIs will be found. In this paper, we address the above issues by proposing a new framework for top-k high utility item set mining, where k is the desired number of HUIs to be mined. Two types of efficient algorithms named TKU (mining Top-K Utility itemsets) and TKO (mining Top-K utility itemsets in one phase) are proposed for mining such itemsets without the need to set min-util We provide a structural comparison of the two algorithms with discussions on their advantages and limitations. Evaluations on both real and synthetic datasets show that the performance of the proposed algorithms is close to that of the optimal case of state-of-the-art utility mining algorithms.

II. LITERATURE REVIEW

1) An Algorithm for Mining Association Rules Using Perfect Hashing and Database Pruning. [1]: In this method, propose an algorithm for finding frequent item sets in transaction databases. The basic idea of our algorithm is inspired from the Direct Hashing and Pruning (DHP) algorithm, which is in fact a variation of the well-known Apriori algorithm. In the DHP algorithm, a hash table is used in order to reduce the size of the candidate K + 1 item sets generated at each step. The difference of our algorithm is that, it uses perfect hashing in order to create a hash table for the candidate k + 1 item sets. As perfect hashing is used, the hash table contains the actual counts of the candidate k + 1 item sets. Hence we do not need to make extra processing to count the occurrences of candidate k + 1 item sets as in the DHP algorithm. The algorithm also prunes the database at each step in order to reduce the search space. We also tested our algorithm with real datasets obtained from a large retailing company and observed that our algorithm performs better than the Apriority algorithm. In this work, we studied the problem of finding frequent item sets for association rule mining. An algorithm called Direct Hashing and Pruning (DHP) is discussed in

detail, and by using the ideas in the DHP algorithm, we propose a new algorithm PHP that employs the hashing facility of P erl5 in order to keep the actual count of occurrences of each candidate item set of the transaction database. The proposed algorithm also prunes the transactions, which do not contain any frequent items, and trims the non-frequent items from the transactions at each step. Since our algorithm has less number of steps than the DHP algorithm, we did not compare the performance of these two algorithms. In order to test the performance of our algorithm, we compared it against an implementation of Apriority algorithm over the real dataset that was obtained from the Begendik Corporation. As the experimentation has showed, our algorithm performs better than the Apriority algorithm since at each step it reduces the database size to be scanned, and it generates much smaller sized C2 at the initial step.

2) Efficient Algorithm for Finding High Utility Item sets from Large Transactional Databases Using R-Hashing Technique [2]: In this technique, proposed an efficient algorithm R-Hashing technique for mining high utility item sets from transaction databases. A data structure named UP-Tree is used for maintaining the information of high utility item sets. Though, the potential high utility item sets can be efficiently generated from the UP-Tree with only two scans of the database, proposed method decreases the scanning process. In the experiments, both of synthetic and real datasets are used to evaluate the performance of our algorithm. The mining performance is improved significantly since both the search space and the number of candidates are effectively reduced by the proposed strategies.

3) Mining Top-k Frequent Patterns in the Presence of the Memory Constraint [3]: In this method, we have studied a practically important mining problem, namely mining top-k frequent/closed item sets in the presence of the memory constraint. To achieve this, we proposed the MTK/MTK-Close algorithms, which are devised as levelwise search algorithms based on an 35 effective approach to constrain the number of candidates that will be generated-and-tested in each database scan. Since the minimum support to retrieve top-k frequent item sets cannot be known in advance, a novel search approach, called the -stair search, is devised in MTK and MTK-Close to efficiently retrieve top-k frequent/closed item sets. As demonstrated in the empirical study on real data and synthetic data, instead of only providing the flexibility of striking a compromise between the execution efficiency and the memory consumption, MTK can both achieve high efficiency and have a constrained memory bound, showing its prominent advantage to be a practicable algorithm of mining frequent patterns.

4) UP-Growth: an Efficient Algorithm for High Utility Item set Mining [4]: In this system, proposed an efficient algorithm named UP-Growth for mining high utility item sets from transaction databases. A data structure named UP-Tree is proposed for maintaining the information of high utility item sets. Hence, the potential high utility item sets can be efficiently generated from the UP-Tree with only two scans of the database. Besides, we develop four strategies to decrease the estimated utility value and enhance the mining performance in utility mining. In the experiments, both of synthetic and real datasets are used to evaluate the performance of our algorithm. The mining performance is enhanced significantly since both the search space and the number of candidates are effectively reduced by the proposed strategies. The experimental results show that UP-Growth outperforms the state-of-the-art algorithms substantially, especially when the database contains lots of long transactions.

5) Novel Concise Representations of High Utility Item sets Using Generator Patterns [5]:

This method proposes a new framework for mining concise representations of high utility item sets using generators. We investigate the properties of generators and incorporate the concept of generator into HUI mining. We explore two new concise representations of HUIs, called High Utility Generator (HUG) and Generator of High Utility Item sets (GHUIs). Two efficient algorithms named HUG-Miner and GHUI-Miner are proposed to respectively mine these representations. The algorithms provide different trade-offs between execution time and completeness. GHUI-Miner captures the complete set of GHUIs but spends more time because it needs to consider generators that are not HUIs. On the other hand, HUG-Miner is over 100 times faster than GHUI Miner but misses GHUIs that are LUGs. Experimental results on both real-life and synthetic datasets show that the proposed algorithms are very efficient and achieve a massive reduction in terms of number of patterns found.

6) Fast Algorithms for Mining Interesting Frequent Item sets without Minimum Support [6]: In this method present two novel algorithms for mining interesting frequent item set (N-Most Miner and Top-K-Miner) using bit-vector representation approach, which is very efficient in terms of candidate item set frequency counting. For projection we present a novel bit-vector projection technique PBR (projected-bit-regions), which is very efficient in terms of processing time and memory requirement. Several efficient implementation techniques of N-Most Miner and Top-K-Miner are also presented, which experienced in implementation.

7) Mining Correlated High-Utility Item sets using the Bond Measure[7]: This method proposed an algorithm named FCHM (Fast Correlated high-utility item set Miner) to efficiently measure. An extensive experimental study shows that FCHM is up to two orders of magnitude faster than FHM, and can discover more than five orders of magnitude less patterns by only mining correlated HUIs. The source code of algorithms and datasets can be downloaded as part of the SPMF open source data mining library.

8) Mining high on-shelf utility item sets with negative values from dynamic updated database [8]: In this system proposed an algorithm FUPTHOUIN for finding high on-shelf utility item sets with negative item values from dynamic updated database. In first phase, an algorithm builds utility tree by scanning original database. In second phase, it updates utility tree. It rescans an original database whenever necessary. Database is not rescanned for every modification which reduces the execution time of an algorithm. Whenever transactions are modified, utility tree is updated based on predefined four cases. Utility tree avoids unnecessary candidate item set generations and thus improves execution time.

9) Efficient Mining of High Utility Sequential Patterns Over Data Streams[9]: In this system proposed a novel framework for mining high utility sequential patterns over data a stream. Proposed a novel algorithm named HUSP-Stream to discover high utility sequential patterns in a transaction-sensitive sliding window over an item set-sequence stream. Two data structures named Item Util Lists and HUSP-Tree (High Utility Sequential Pattern Tree) are proposed to maintain the essential information of potential high utility sequences over data streams. When data arrive at or leave from the sliding window, HUSP-Stream incrementally updates HUSP-Tree and Item Util Lists online to find high utility sequential patterns based on previous mining results. We also defined a new over-estimated sequence utility measure named Suffix Utility (SFU), and used it to effectively prune the HUSP-Tree. Both real and synthetic datasets are used to show the performance of HUSP-Stream. In the experiments, we compared HUSP-Stream with U Span, a state-of-the art algorithm for mining high utility sequential patterns in static databases.

10) Isolated items discarding strategy for discovering high utility item sets [10]: Traditional methods of association rule mining consider the appearance of an item in a transaction, whether or not it is purchased, as a binary variable. However,customers may purchase more than one of the same item, and the unit cost may vary among items. Utility mining, a generalized form of the share mining model, attempts to overcome this problem. Since the Apriority pruning strategy cannot identify high utility item sets, developing an efficient algorithm is crucial for utility mining. This study proposes the Isolated Items Discarding Strategy (IIDS), which can be applied to any existing level-wise utility mining method to reduce candidates and to improve performance. The most efficient known models for share mining are SHFSM and DCG, which also work adequately for utility mining as well. By applying IIDS to SHFSM and DCG, the two methods FUM and DCG+ were implemented, respectively. For both synthetic and real datasets, experimental results reveal that the performance of FUM and DCG+ is more efficient than that of SHFSM and DCG, respectively. Therefore,IIDS is an effective strategy for utility mining.

III. EXISTING SYSTEM

11) FREQUENT item set mining is a fundamental research topic in data mining (FIM) mining. However, the FIM may discover a large amount of frequent but low-value item sets and lose the information on valuable item sets having low selling frequencies. Hence, it cannot satisfy the requirement of users who desire to discover item sets with high utilities such as high profits. To address these issues, utility mining emerges as an important topic in data mining and has received extensive attention in recent years. In utility mining, each item is associated with a utility (e.g. unit

profit) and an occurrence count in each transaction (e.g. quantity). The utility of an item set represents its importance, which can be measured in terms of weight, value, quantity or other information depending on the user specification. An item set is called high utility item set (HUI) if its utility is no less than a user-specified minimum utility threshold min_util. HUI mining is essential to many applications such as streaming analysis, market analysis, mobile computing and biomedicine.

A. Disadvantages of Existing System:

1. Efficiently mining HUIs in databases is not an easy task because the downward closure property used in FIM does not hold for the utility of item sets.

2. In other words, pruning search space for HUI mining is difficult because a superset of a low utility item set can be high utility.

IV. PROPOSED SYSTEM

The concept of transaction weighted utilization (TWU) model was introduced to facilitate the performance of the mining task. In this model, an item set is called high transaction-weighted utilization item set (HTWUI) if its TWU is no less than min_util, where the TWU of an item set represents an upper bound on its utility. Therefore, a HUI must be a HTWUI and all the HUIs must be included in the complete set of HTWUIs. A classical TWU model-based algorithm consists of two phases. In the first phase, called phase I, the complete set of HTWUIs are found. In the second phase, called phase II, all HUIs are obtained by calculating the exact utilities of HTWUIs with one database scan.

A. Advantages of Proposed System:

1.Two efficient algorithms named TKU (mining Top-K Utility items ets) and TKO (mining Top-K utility item sets in one phase) are proposed for mining the complete set of top-k HUIs in databases without the need to specify the min_util threshold.

2.The construction of the UP-Tree and prune more unpromising items in transactions, the number of nodes maintained in memory could be reduced and the mining algorithm could achieve better performance.

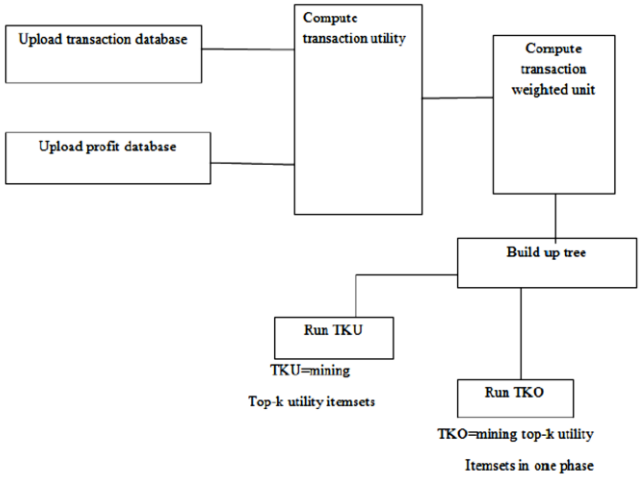
V. IMPLEMENTATION

In order to perform mining in one phase we are using TKO algorithm. The TKO algorithm uses the utility list structure.This algorithm scans the database only once and hence requires less memory compared to the present algorithms. It usesHUI-Miner and its utility-list structure, which is a basic search procedure. When TKO generates the item set, without scanning the database the utility-list calculates the utility. Initially the threshold is set to zero.

Utility Mining

In this, we will discuss about utility-list structure and its properties. In TKO algorithm, each itemset is linked with a utility list. This utility lists of items are constructed by searching the database twice. This is called is initial utility-lists. In its first search, utility values of items and Transaction Weighted utilities(TWU) are computed. In its second search, according to TWU values items are sorted in each transaction and each items utility-list is built.

System Architecture



The System Architecture depicts the overall flow of proposed system to find out HUI using top-k ramework mechanism. Basically proposed system is using two algorithms TKU & TKO for mining HUI.

A. Read Transaction Database

Using this module we are uploading entire transaction file to the application, each transaction is in separate line and each item is separated with comma.

B. Read Profit Database

Using this module we are uploading profit table where each line represent Item name and its profit, separated with comma.

C. Compute TU (Transaction Unit)

Using this module we are calculating total profit for each transaction.

D. Compute TWU

Using this module application will calculate entire profit for each item exists in all transaction.

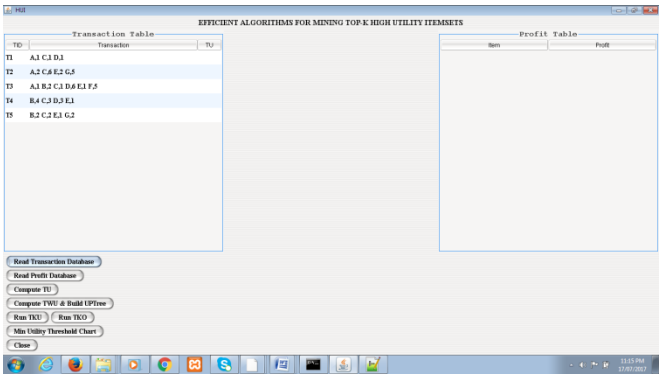
E. Build UP tree

Application will generate up tree from generated TWU itemsets.

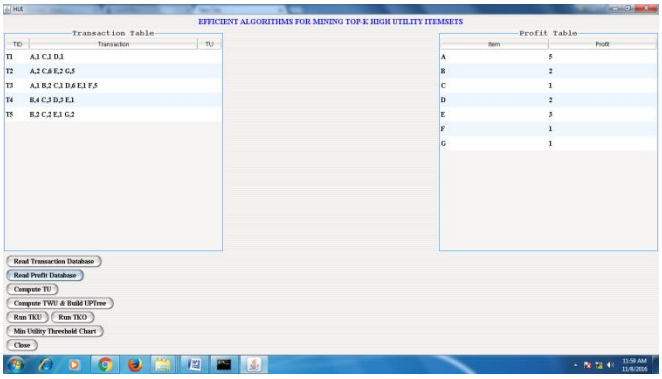
F. TKU and TKO

Run code to generate TKU (mining top-k utility items sets) and TKO (generate top k utility item sets in one phase).

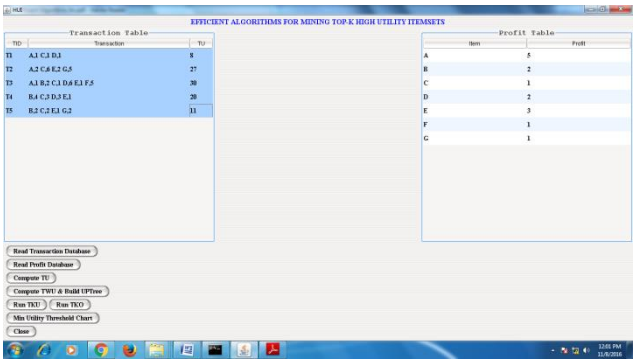
1. Reading Transaction database



2. Calculating profit table

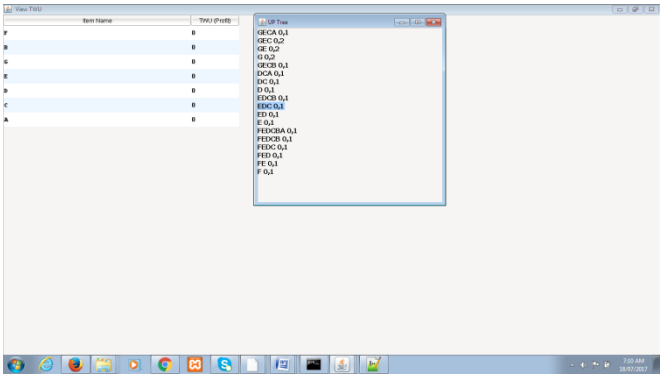


3. Computing transaction utility e.g (for transaction T1, the items are A1, C1, D1—the TU is 5+1+2)

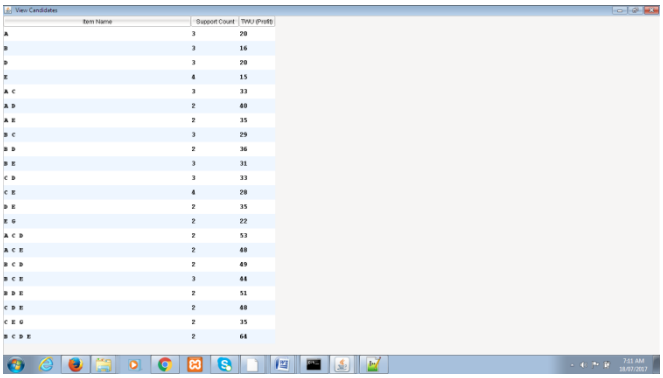


4. Compute TWU & Build UP Tree:

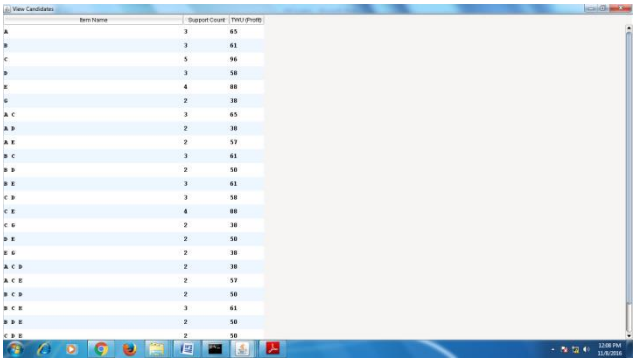
4.1 TWU: (sum of all the TU values of the current item in all the transactions)



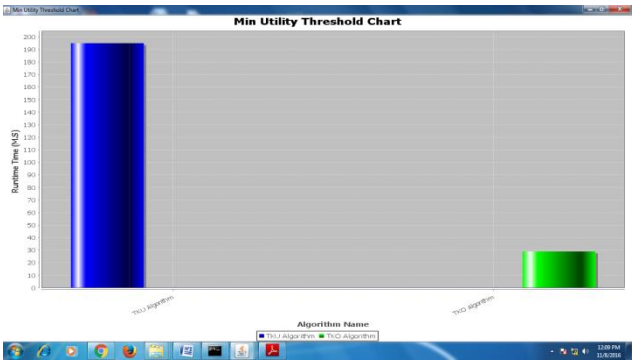
5. Run TKU



6. Run TKO



7. Minimum utility threshold comparison chart between TKU and TKO algorithms:



VI.CONCLUSION

In this paper, we have studied the problem of top-k high utility itemsets mining, where k is the desired number of high utility itemsets to be mined. Two efficient algorithms TKU (mining Top-K Utility itemsets) and TKO (mining Top-K utility itemsets in One phase) are proposed for mining such itemsets without setting minimum utility thresholds. TKU is the first two-phase algorithm for mining top-k high utility itemsets,. On the other hand, TKO is the first one phase algorithm developed for top-k HUI mining. Empirical evaluations on different types of real and synthetic datasets show that the proposed algorithms have good scalability on large datasets and the performance of the proposed algorithms is close to the optimal case of the state-of-theart two-phase and one-phase utility mining algorithms.

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