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PRECISE INFORMATION HIDING TECHNIQUES

B.Kowsalya[1], N.Kokila[2],
M.Phil Full time Research Scholar, PG and Research Department of Computer Science[1]
Asst. Professor, Department of Computer Science & Applications[2]
Vivekanandha College of Arts & Sciences for Women (Autonomous),
Tiruchengode, Namakkal-637 205,
Tamil Nadu, India
kwcbalu27@gmail.com
padmeeshraj@gmail.com

ABSTRACT- This research paper contains an overview of the new and rapidly emerging research area of privacy preserving data mining. Privacy preserving in data mining has been a heart favorite topic of researchers from many years. Every organization contains sensitive data & such data is needed to be protected from the unauthorized access. This paper contains the comprehensive survey of traditional and modern privacy preserving data mining methods. Advantages and disadvantages of the existing algorithms are discussed a classification hierarchy that sets the basis for analyzing the work which has been performed in this context.

Keywords— PPDM, Support, Confidence, Information security.

I. INTRODUCTION

Data mining is the non-trivial process of identifying valid and probably useful patterns in data. Many governmental organization, businesses etc are finding a way to collect, analyze and report data about individuals ,households or businesses, in order to support (short and long term) planning activities. Information system contains private or confidential information like their social security number, income of employees, purchasing of customer etc, that should be properly secured.

Privacy preserving data mining is a new case in data mining and statistical databases. In PPDM data mining algorithms are analyzed for side effects obtain in data privacy. There is a twofold consideration in privacy preserving data mining. The first is precise raw data that are kept secure from unauthorized access like identifiers, names; addresses should be modified from original database in order for inheritor of data not to be able to compromise another person's privacy. The second one is sensitive knowledge is excluded that can be mined from a database by using data mining algorithms as such type of knowledge compromises data privacy.

Association rules are frequently used by retail stores to support in marketing, advertisement and inventory control. Let us suppose a grocery store chain keeping record of weekly transaction where each transaction represents the item bought during one cash register transaction.

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The executives of this chain recipient summarized report of transaction that indicated want type of item? Sold at what quantity? They periodically take information about which items are commonly purchased together. Then they find that 100% of time that peanut butter is purchased bread is also purchased.33.3% of time peanut butter is purchased ,jelly is also purchased .Peanut butter is exist in only 50% of overall transaction

II. BACKGROUND

Association rules provide information in the form of if-then statements. The association rules are computed from the data and unlike the if-then rules of logic the association rules are feasibility in nature. If 90% of transactions that purchase bread and butter then also purchase milk.

Antecedent: butter and bread
Consequent: milk
Confidence factor: 90%

In addition to the antecedent (the ―if‖ part) and the consequent (the ―then‖ part) an association rule has two numbers that express the degree of ambiguity about the rule. In association rule analysis the antecedent and consequent are sets of items (called item sets) that are disjoint (do not have any items in common).

Support for an association rule X->Y is the percentage of transaction in database that contains X U Y .The other number is known as the **Confidence** of the rule.

Confidence of an association rule X U Y is the ratio of number of transactions that contains X U Y to number of transaction that contains X.

III. REVIEW OF PRIVACY PRESERVING TECHNIQUES

Data distortion is done by the alteration of an attribute value by a new value. It changes 1's to 0's or vice versa in selected transactions. There are two basic approaches for rule hiding in data distortion based technique: Reduce the confidence of rules and reduce the support of rules. Consider sample database given in Table I.

Selecting minimum support = 20% and minimum confidence = 80% and applying association rule mining algorithm, two association rules AB -> C (confidence = 100%) and BC-> A (confidence= 100%) are mined. Now suppose rule AB-> C is sensitive and needs to be hidden. Decreasing the confidence of a rule AB-> C can be done by either increasing the support of AB in transactions not supporting C (as shown in Table II) or by decreasing the support of C in transactions supporting both AB and C (as shown in Table III). Decreasing support of rule AB-> C can be done by decreasing the support of the corresponding large item set ABC (as shown in Table IV). The problem for finding an optimal sanitization to a database against association rule analysis has been proven to be NP-Hard. In, authors presented three algorithms 1.a, 1.b and 2.a for hiding sensitive association rules.

Algorithm 1.a hides association rules by increasing the support of the rule's antecedent until the rule confidence decreases below the minimum confidence threshold. Algorithm 1.b hides sensitive

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rules by decreasing the frequency of the consequent until either the confidence or the support of the rule is below the threshold. Algorithm 2.a decreases the support of the sensitive rules until either their confidence is below the minimum confidence threshold or their support is below the minimum support threshold. In 1.a algorithm large number of new frequent item sets is introduced and, therefore, an increasing number of new rules are generated. Algorithm 1.b and 2.a affects number of non sensitive rules in database due to removal of items from transaction.

In two algorithms are proposed ISL Increase Support of LHS and DSR Decrease Support of RHS. In two algorithms DCIS Decrease Confidence by **I**ncrease **S**upport and DCDS Decrease Confidence by Decrease **S**upport are proposed to automatically hide mingled recommendation association rules without pre-mining and selection of hidden rules. The ISL and DCIS algorithms try to increase the support of left hand side of the rule and algorithms DSR and DCDS try to decrease the support of the right hand side of the rule. It is observed that ISL requires more running time than DSR. Also both algorithm exhibit contrasting side effects. DSR algorithm shows no hiding failure (0%), few new rules (5%) and some lost rules (11%). ISL algorithm shows some hiding failure (12.9%), many new rules (33%) and no lost rule (0%). Algorithm DCIS requires more running time than DCDS.

Similar to ISL and DSR algorithms DCIS and DCDS also exhibit contrasting side effects. DCDS algorithm shows no hiding failure (0%) few new rules (1%) and some lost rules (4%). DCIS algorithm shows no hiding failure (0%), many new rules (75%) and no lost rule (0%). In an algorithm DSC (Decrease Support and Confidence) is proposed in which pattern-inversion tree is used to store related information so that only one scan of database is required. There are about 4% of new rules generated and about 9% of rules are lost on the average for DSC algorithm and it also shows hiding failure for two predicting items.

TABLE I.
DATABASE SAMPLE

TID	**Items**		
1	A,B,C		
2	A,B,C		
3	A,C	**Rule**	**Proof**
4	A,E	**AB->C**	**100%**
5	C,D	**BC->A**	**100%**

TABLE-II.
HIDING AB-> C BY INCREASING SUPPORT OF AB

TID	**Items**		
1	A,B,C		
2	A,B,C		
3	A,C	**Rule**	**Proof**
4	A,E	AB->C	66%

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5	C,D	BC->A	100%

TABLE-III.

HIDING AB->C BY DECREASING SUPPORT OF C.

TID	**Items**		
1	**A,B**		
2	A,B,C		
3	A,C	**Rule**	**Confidence**
4	A,E	AB->C	50%
5	C,D	BC->A	100%

TABLE-IV.

HIDING AB-> C BY DECREASING SUPPORT OF ABC

TID	**Items**		
1	**A,C**		
2	**A,B**		
3	A,C	**Rule**	**Confidence**
4	A,E	AB->C	0%
5	C,D	BC->A	0%

In authors proposed an efficient algorithm, FHSAR (Fast Hiding Sensitive Association Rules) for fast hiding sensitive association rules. The algorithm can completely hide any given sensitive association rule by scanning database only once which significantly reduces the execution time. In this algorithm correlations between the sensitive association rules and each transaction in the original database are analyzed, which can effectively select the proper item to modify. In four heuristic algorithms are proposed: Algorithm Naïve MinFIA (Minimum Frequency Item Algorithm) MaxFIA (Maximum Frequency Item Algorithm) and IGA (Item Grouping algorithm). Each algorithm selects the sensitive transactions to sanitize based on degree of conflict. Naive Algorithm removes all items of selected transaction except for the item with the highest frequency in the database. The MinFIA algorithm selects item with the smallest support in the pattern as a victim item and it removes the victim item from the sensitive transactions. Unlike the MinFIA & algorithm MaxFIA selects the item with the maximum support in the restrictive pattern as a victim item. Algorithm IGA groups restricted patterns in groups of patterns sharing the same item sets so that all sensitive patterns in the group will be hidden in one step.

In a heuristic algorithm named DSRRC, Decrease Support of R.H.S. item of Rule Clusters, is given. which provides privacy for sensitive rules at certain level while ensuring data quality. Proposed DSRRC algorithm clusters the sensitive association rules based on R.H.S. of rules and hides as many as possible rules at a time by modifying

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fewer transactions. Because of less modification in database it helps maintaining data quality. Algorithm DSRRC cannot hide rules having multiple RHS items. **Blocking** is the replacement of an existing value with a —?‖.

This technique inserts unknown values in the data to fuzzify the rules. In some applications where publishing wrong data is not acceptable, then in such cases the unknown values may be inserted to blur the rules. When unknown values are inserted support and confidence values would fall into a range instead of a fixed value. Consider the database shown in Table V. For rule A-> C, Support (A-> C) = 80% and Confidence (A-> C) = 100%.After fuzzifying the values, support and confidence becomes -> C) ≤ 100% and 60% ≤ Support (A-> C) ≤ 80%.

In blocking technique the maximum confidence of a sensitive rule cannot be reduced. If the blocking algorithm does not add much uncertainty in the database, adversary can infer the hidden values if he applies a smart inference technique. In database both 0's and 1's must be hidden during blocking because if only 1's were hidden the adversary would simply replace all the ?'s with 1's and would restore easily the initial database and many ?'s must be inserted if we don't want an adversary to infer hidden data. This approach hides sensitive association rule by modifying the borders in the lattice of the frequent and the infrequent item sets of the original database. The item sets which are at the position of the borderline separating the frequent and infrequent item sets forms the borders.

Border based approach uses the theory of borders presented in. The first frequent item set hiding methodology that is based on the notion of the border is proposed in .It maintains the quality of database by greedily selecting the modifications with minimal side effect. Then in more efficient algorithms based on border theory are presented.

This approach contains non heuristic algorithms which formulates the hiding process as a constraints satisfaction problem or an optimization problem which is solved by integer programming. These algorithms can provide optimal hiding solution with ideally no side effects. In an exact algorithm for association rule hiding is proposed which tries to minimize the distance between the original database and its sanitized version.

TABLE V.
HIDING A-> C BY BLOCKING

A	B	C	D
1	1	1	0
1	0	1	0
0	1	0	1
1	1	1	0
1	0	1	1

→

A	B	C	D
1	1	1	0
1	0	?	0
?	1	0	1
1	1	1	0
1	0	1	1

In 2012, shikha sharma. Presented an algorithm. To hide any specified association rule X → Y our algorithm works on the basis of confidence (X → Y) and support (X → Y).To hide the rule X → Y (containing sensitive element X on LHS),this algorithm increases the value of the special variable of the rule X → Y until confidence

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(X → Y) goes below a minimum specified threshold confidence (MCT).As the confidence (X → Y) goes below MCT(minimum specified confidence threshold),rule X → Y is hidden i.e. it will not be discovered through data mining algorithm.

IV. CONCLUSION

This paper has presented an overview and an extended characterization and clustering of various privacy preserving data mining algorithms. The work presented in this paper indicates the ever increasing interest of researchers in the area of securing sensitive data and knowledge from malicious users. The worthiness and bad mark of the PPDM methods have analyzed in brief. While all the purposed methods are only approximate to our goal of privacy preservation, we need to further perfect those approaches or develop some efficient methods.

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