

A Review on Privacy Preservation Method by Applying Discrimination Rules in Data Mining

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Abstract: In data mining, when considering the legal and ethical aspects of privacy preservation so discrimination is a very important issue. It is clear that most of the people do not have a wish to discriminate based on their race, nationality, religion, age and so on. This problem mainly arises when these kind of attributes are used for decision making purpose such as giving them a job, loan, Insurance etc. Discrimination is two types direct and indirect discrimination. Direct discrimination is based on sensitive information. Indirect discrimination is based on non-sensitive informative on. In this paper, we mainly review on anti-discrimination a method which also helps to discover and prevent discrimination.

Keywords—: discrimination, direct and indirect discrimination.

I. INTRODUCTION

As a social point of view, Discrimination is very sensitive and essential subject. Unfair or unequal treatment of people based on membership to a category or a minority, without regard to individual merit is known as Discrimination. It can divide the people on bases of their race (color), gender, age, nationality etc. Decisions are made by the attributes like giving them a

job, loan, insurance, finance, etc. Discrimination can be classified as Direct or Indirect.

A. DIRECT DISCRIMINATION

Direct discrimination occurs when persons are treated unequally on bases of their gender, age, disability, nationality, religion, race (color) etc. e.g.: Employee is not selected for a promotion at work. The supervisor says that while he thinks the employee could do the job, but he will be retiring soon, so they are looking for someone else who'll be there for a long time with the firm.

B. INDIRECT DISCRIMINATION:

Discrimination is which often less obvious indirect discrimination is. Sometimes, a policy applying equally seems fair, but unfair treatment to some people is observed when looked closely. Due to this some people or groups of people are disadvantage or less able to comply with the rule. This may be indirect discrimination, if these policy or practice is not reasonable. e.g.: People whose first language isn't English are at a risk as all the information about health & safety is printed in English.

C. DIRECT AND INDIRECT DISCRIMINATORY RULES

There are two types of classification rules:

A. potentially discriminatory rule (PD Rule)

A classification rule $X \rightarrow C$ is potentially discriminatory (PD) when $X = A, B$ with A is a discriminatory item set and B a non discriminatory item set. For example, (Foreign worker = Yes, City = NYC \rightarrow Hire = No). The word ‘potentially means that a PD Rule could probably lead to discriminatory decisions. It is used for direct discrimination.

B. Potentially non-discriminatory rule (PND Rule)

A classification rule $X \rightarrow C$ is potentially Non-discriminatory (PND) when $X = D, B$ is a Non-discriminatory item set. It is used for indirect discrimination. For example, **{Zip =10181, Religion = XYZ, City = NYC \rightarrow Hire = No} or {Experience = Low, City = NYC \rightarrow Hire = No}** PND rule could lead to discriminatory decisions in Combination with some background knowledge. e.g., if the premise of the PND rule contains the zip Code as an attribute and one knows that zip code 10181 are mostly inhabited by foreign people.

This paper mainly focuses on survey of different papers with the different section or parts where part 1 describes the introduction of direct and indirect discrimination. Part 2 describes discrimination prevention method which have two parts discrimination discovery & discrimination prevention. Part 3 describes existing work where three methods are used. Part 4 describes related work where different methods

or techniques are used. In the part 5 proposal for direct and indirect discrimination prevention describes the different components of architecture. Part 6 shows table which shortly describes related work.

II. DISCRIMINATION PREVENTION

METHOD

In this section, we are describing the discrimination discovery and discrimination prevention methods.

A. Discrimination discovery

Discrimination discovery is based on discrimination items. Discrimination is identifying by classification rule. And classification rule is based on PD and PND rule for direct and indirect discrimination.

B. Discrimination prevention

Discrimination prevention method is used to remove discrimination. Discrimination preventing knowledge-based decision support system from making discriminatory decision (discrimination prevention). Discrimination prevention method is divided into three main groups.

- (i) Data transformation and hierarchy-based generalization process (pre-processing).
- (ii) Changing the data mining algorithms (in-processing).
- (iii) Changing the data mining model to reduce the possibility of discriminatory decisions. (Post-processing).

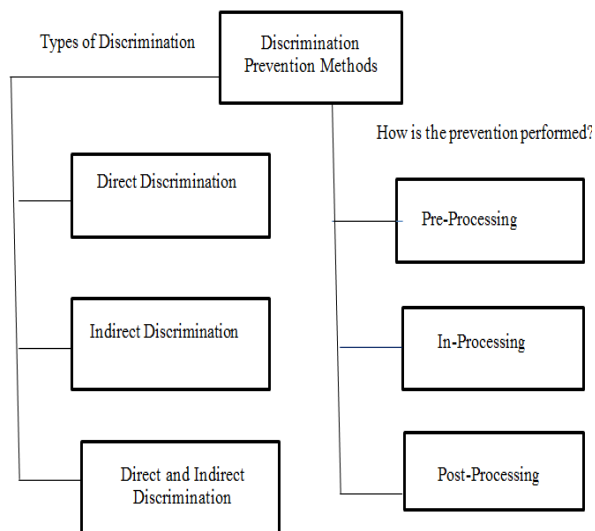


Fig 1: Discrimination prevention methods

With the help of this method discrimination prevention would consist of removing discriminatory attributes from the dataset. However, often attributes which are highly correlated with the sensitive one as given above.

III. EXISTING WORK

From the literature survey has discrimination prevention has different rules. Three approaches are as follows.

A. Pre-processing

In the pre-processing method, data transformation can be gathered from privacy preservation methods in related work. Whenever data can be transferred the original data are removed, after that applies data mining algorithms are applied so that no unequal or unfair or inappropriate decision rules can be mined. In short we can say that data can be changed in this method.

B. In-processing

Different cleaning discrimination methods for different data and non-discriminatory are inbuilt into a decision tree learner with changing its splitting data and pruning strategy through leaf relabeling method. In short data mining algorithms can be changed in such a way that resulting models do not obtain appropriate decision rules in In-process method.

C. Post-processing

In this method the architecture model can be changed or data mining algorithm may also change. Assume that according to CPAR algorithm, a confidence-altering method is extended for classification rules.

IV. RELATED WORK

In this paper different methods are discussed. Those methods have some advantages and disadvantages.

A. Fast algorithm for mining association rules

In data mining, Fast Algorithm is an effective algorithm used to ignore or remove discrimination. In this paper, Apriori algorithm, apriori tid algorithm is used. R.Agrawal and R.Srikant [2] gives brief about association rule method for collecting or storing large database. And they also discovered association for items in the transactions database. And they have described Apriori; AprioriTid Algorithm which is discovers all related association rules in transaction databases. To get the new candidate item extended by the Apriori algorithm is the large item sets. Pruning was done using the fact that any subsection of repeated item set should be frequent. Aprioritid and Apriori algorithm

is related to each other which use Apriori function to determine the candidate sets. In the AIS algorithm involves two concepts are extension of an item set, determining what should be in the candidate item set. It is very costly during shifting Apriori to AprioriTid.

B. Naive bayes approaches for discrimination free classification

Navies Bayes Method used for discrimination free classification and this method is modifying for discrimination.

Using decision rules that base their decision on these attributes in classifier. The Navies bayes model is bayes classifier is trained very efficiently in supervised learning. T.Calders and S.Verwer [3] focuses on sensitive attribute. Artificial and real datasets can be applied.

C. Classification without discrimination

F.Kamiran and T.Calders [4] also describes Classification without discrimination Method. The algorithms is used in this paper is classification algorithm. All discrimination is removed completely. The minimum discrimination and high accuracy is applied on CND.

D. Classification with no discrimination by preferential sampling

Faisal Kamiran, Toon Calders [5] describing a pre-processing and Preferential sampling. It reduces noise and improves resolution. Stable and unstable classifier gives desired result. Ethical and legal region can remove discrimination. We can remove the

sensitive data instead of relabeling it. The algorithm used in this paper is classification algorithm. The goal of classification is to accurately predict the target class for each care in the data. Predicts categorical labels and classify the data based on the training set and the values in a classifying attribute and uses it in classifying new data. Data preparation and filtering steps can considerable amount of processing period. Data pre-processing includes cleaning, normalization, transformation, characteristic extraction selection. In preferential sampling arises when the process that determines the data location and the process being modeled are dependent.

E. Discrimination prevention in data mining

Antidiscrimination law states that all people have right to equality. In the political participation people must be treated unequally on the bases of gender, age, race, nationality. Post-processing and pre-processing are methods are used. In data mining, important process is pre-processing method. S. Hajian, J. Domingo-Ferrer, and A. Martinez-Balleste [6] describing Anti-discrimination techniques and discrimination prevention. It is mainly used for Intrusion and crime detection. And if discrimination is found at the time of discrimination discovery then discrimination is eliminated. In there is much irrelevant and redundant information present or noisy and unreliable data, and then knowledge discovery during the training phase is more difficult. Large amount of relevant information is stored and picked is the process of data mining. Transaction data is the statically and logical analysis of huge sets of data in relation to enterprise resource planning in data mining. The

algorithm used in this paper is not efficient this is main drawback of this paper.

V. THE PROPOSAL PREVENTION FOR DIRECT AND INDIRECT DISCRIMINATION

In this section, we are describing different components of work performances through the architecture.

A. System Model

We are creating the database for large datasets where the large amount of data can store in it with direct discrimination and indirect discrimination items. And also the all discrimination removal methods are maintained in the server.

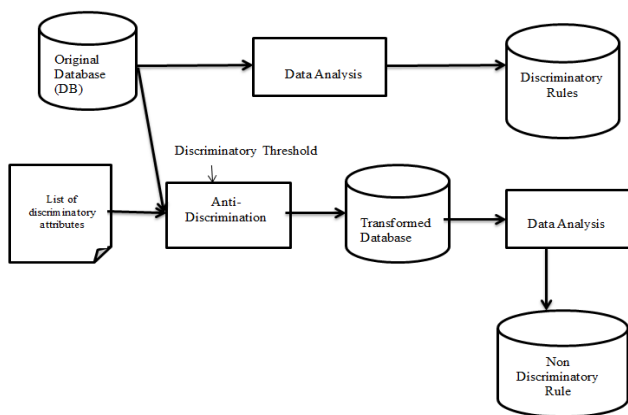


Fig 2 : Architecture Diagram

B. Data Analysis

Data can be analyzed by discrimination rules are used to find Direct and Indirect discrimination. And system classify into two parts: PD (Potential Discriminatory) and PND (Potential Non-discriminatory) rules. And rules are applied on predetermined discriminatory items in original database. For Potential discriminatory rule identify

direct discrimination. For Potential Non Discriminatory rule identify indirect discrimination. The system model maintained data for direct and indirect discrimination.

C. Data Transformation for Direct Discrimination

There are two rules which are described as follows:

1. Direct Rule Protection

In these components we take data from database of direct discrimination. Discrimination rule is converting it into protective rule. Direct discrimination cause which extracted by system the main discriminatory item sets. Then make negation of decision making attributes. Then finally it remove all discrimination is generated in the database.

2. Rule Generalization

The system performs the negation decision making attributes by integrated set of general rule.

D. Data Transformation for Indirect Transformation

1. Indirect Rule Protection - The system extracts all items from the database using the above specified process. And item set are still gets discriminated which are not directly resulted in discrimination.

VI. OUR ANALYSIS

Sr. No	Studies	Used Methods	Advantages	Disadvantages
1	R.Agrawal and R.Srikant (1994)	Apriori, Apriori-Tid Algorithm	It is discovering all significant association rules	It is very costly when shifting from Apriori, Apriori-Tid Algorithm

2	T.Calders and S.Verwer (2010)	Naive Bayes Methods	This method is applied on real and artificial database	This method does not consider numerical attributes
3	F.Kamiran and T.Calders (2009)	Classification without discrimination Method	All Discrimination removed	The incorporation of numerical attributes and groups of attributes as sensitive attributes
4	Faisal Kamiran, Toon Calders (2010)	pre-processing and Preferential sampling	It reduces noise and improves resolution	Ethical and legal region can remove discrimination
5	S.Hajian, J.Ferrer (2011)	Anti-discrimination techniques	It is mainly used for Intrusion and crime detection	Not efficient

VII. CONCLUSION

The main purpose of this paper is to discuss the challenges of previous methods. With the help of these methods, we study the discrimination prevention method with several data transformation methods. At the same time direct discrimination and Indirect discrimination can be performed and prevented. Improve the quality of the resulting data sets & data mining models.

REFERENCES

[1] Sara Hajian and Josep Domingo “*A methodology for Direct and Indirect Discrimination Prevention*”

in Data Mining”, IEEE Transaction on Knowledge and Data Engineering Vol.25. No.7. July 2013.

[2] R. Agrawal and R. Srikant, “*Fast Algorithms for Mining Association Rules in Large Databases*”, Proc. 20th Int’l Conf. Very Large Data Bases, pp. 487-499, 1994.

[3] T. Calders and S. Verwer, “*Three Naive Bayes Approaches for Discrimination-Free Classification*”, Data Mining and Knowledge Discovery, vol. 21, no. 2, pp. 277-292, 2010.

[4] F. Kamiran and T. Calders, “*Classification without Discrimination*”, Proc. IEEE Second Int’l Conf. Computer, Control and Comm. (IC4 ’09), 2009.

[5] F. Kamiran and T. Calders, “*Classification with no Discrimination by Preferential Sampling*”, Proc. 19th Machine Learning Conf. Belgium and The Netherlands, 2010.

[6] S. Hajian, J. Domingo-Ferrer, and A. Martinez-Balleste, “*Rule Protection for Indirect Discrimination Prevention in Data Mining*”, Proc. Eighth Int’l Conf. Modeling Decisions for Artificial Intelligence (MDAI ’11), pp. 211-222, and 2011.

[7] S. Ruggieri, D. Pedreschi, and F. Turini, “*Data Mining for Discrimination Discovery*”, ACM Trans. Knowledge Discovery from Data, vol. 4, no. 2, article 9, 2010.

[8] D. Pedreschi, S. Ruggieri, and F. Turini, “*Discrimination-Aware Data Mining*”, Proc. 14th ACM Int’l Conf. Knowledge Discovery and Data Mining (KDD ’08), pp. 560-568, 2008.

- [9] V.S. Verykios, A.K. Elmagarmid, E. Bertino, Y. Saygin, E. Dasseni, “*Association Rule Hiding*”, IEEE Transactions on Knowledge and Data Engineering, vol. 16, pp. 434-447, Apr. 2004.
- [10] D.Pedreschi, S. Ruggeri, and F. Turini, “*Measuring Discrimination in Socially-Sensitive Decision Records*”, Proc. Ninth SIAM Data Mining Conf. (SDM '09), pp. 581-592, 2009.
- [11] S. Hajian, J. Domingo-Ferrer, and A. Martinez-Balleste, “*Discrimination Prevention in Data Mining for Intrusion and Crime Detection*”, Proc. IEEE Symp. Computational Intelligence in Cyber Security (CICS '11), pp. 47-54, 2011.
- [12] M. Bendick, “*Situation testing for employment discrimination in the United States of America*”, Horizons Strategiques, vol. 3, no. 5, pp. 17-39, 2007.
- [13] S. Hajian, J. Domingo-Ferrer, and A. Martinez-Balleste, “*Discrimination Prevention in Data Mining for Intrusion and Crime Detection*”, Proc. IEEE Symp. Computational Intelligence in Cyber Security (CICS '11), pp. 47-54, 2011.
- [14] S. Hajian, J. Domingo-Ferrer, and A. Martinez-Balleste, “*Rule Protection for Indirect Discrimination Prevention in Data Mining*,” Proc. Eighth Int'l Conf. Modeling Decisions for Artificial Intelligence (MDAI '11), pp. 211-222, 2011.

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