

An Algorithm to Conserve Confidentiality using Anti-Discrimination Method in Data Mining

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Abstract— Data mining is increasing important technology. In Data mining, collection of large amount data is hidden. This technology is used for extracting useful knowledge hidden from large collection of data. The main two issues in data mining are privacy violation and discrimination. This technique is used in data mining for decision making in various classification. In real life observation, the majority people do not want to be discriminated base on their gender, nationality, religion, age and so on. This types of attributes is used for decision making purpose such as giving job, loan, insurance etc. so that discrimination issue is arise. For that reason to find such attributes and deleting them from training data without affecting their decision making utility important. Discrimination is two types' direct discrimination and indirect discrimination. Direct discrimination occur when decision making utility is based on some sensitive attributes like race, religion, gender etc. Indirect discrimination occurs when decision making utility is based on non-sensitive attributes which are related to sensitive attributes. There are many new method propose for solving discrimination prevention problem by applying direct or indirect prevention one by one or both at same time. We discuss about how to clean training data sets and out sourced data sets in such way that direct and/or indirect discriminatory rules are converted to non-discriminatory rule. The propose system prevent the discrimination without affecting the data quality. In this paper, we mainly focus on anti-discrimination or hybrid approach (preferential sampling and direct and indirect discrimination) which helps to detect and prevent discrimination

Key words: Anti-Discrimination, Data Mining, Direct and Indirect Discrimination Prevention, Rule Protection, Rule Generalization, Privacy, Discrimination Measures

I. INTRODUCTION

Data mining is technology for uncover hidden large collection of data. Discrimination is a very important issue, when some decision making utility occur in data mining. It is difficult, when people do not to be classifying base on their gender, nationality, religion, so on. When these types of attributes are used for decision making purpose such as giving job, loan, insurance etc. At that time discrimination issue arise. Discrimination is two types, direct and indirect. Direct discrimination occur when decision are made based on sensitive attributes. Indirect discrimination occur when decision are made based on non-sensitive attributes which are exactly related with sensitive attributes [1]. There are various approach are available for discrimination prevention in data mining. There are two dimension approaches available in data mining [4]. In first dimension, consider only direct discrimination and indirect discrimination or both at the same time. Based on this dimension the discrimination prevention approaches are divided into three

groups: direct discrimination prevention approaches or indirect discrimination prevention approaches and direct/indirect discrimination prevention approaches. In second dimension, the classification related to the phase of the data mining where discrimination prevention occur accordingly, discrimination prevention separated into three types as shown in fig 1.

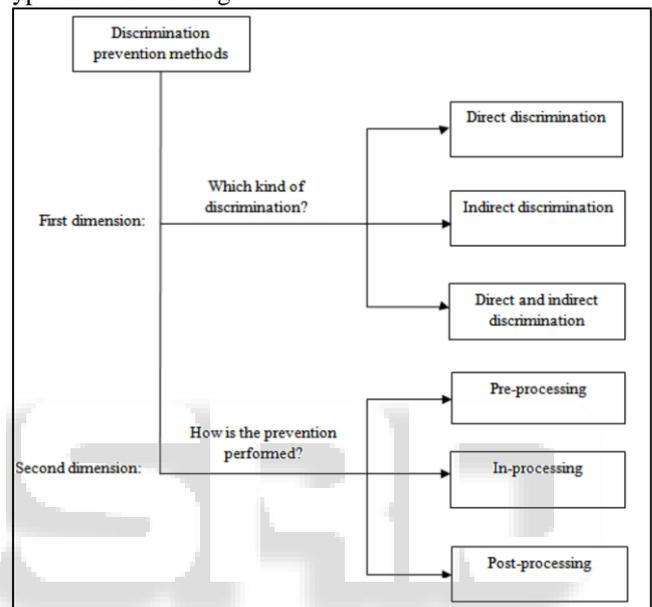


Fig. 1: The taxonomy of discrimination prevention method [1]

A. Pre-processing

In this method source data is transform in discrimination, original data are removed after source data generated. So that decision rule is mined in transformed data. Any standard algorithm is only applied in this method of data mining. It converts the original data before used in task of data mining. The goal of this is transformation data to protect sensitive information like pattern hidden in original data [2].

B. In-Processing

In this method data mining algorithm are change in process so that resulting model dose not unfair decision rules. Special purpose algorithm is used for because it cannot prevent discrimination. It modified the data mining algorithm by interacting them with privacy protection model. The goal of this is protect the mined model [2].

C. Post-Processing

In this method, data mining algorithm and architecture both change. It is change original database. It used the privacy model after the data mining is complete the convert data mining result. The goal is mined model for in protecting individual privacy different between post and in-processing

is that the does not require any changing of the mining process and that, it can be used any data mining tool [2].

There are some approaches for each of the above mention techniques; discrimination prevention is a topic of research. This paper also gives an overview of the available

literature on discrimination prevention approaches in data mining.

II. LITERATURE SURVEY

Paper Title	Approach	Advantage	limitation
A methodology for direct and indirect discrimination in data mining[1]	Data transformation methods	Work with direct and indirect discrimination	It cannot handle attributes with ambiguity in contravene
Direct and indirect discrimination prevention methods[8]	Pre-processing method	Discovery and prevention discrimination	Data quality no measure
Discrimination prevention for crime and intrusion detection[9]	Data transformation methods	Preserves data quality	It not handle indirect discrimination
Classification with no Discrimination by Preferential Sampling[10]	Preferential Sampling method	High accuracy level	Work with only on the borderline data
Three Naive Bayes Approaches for Discrimination Free Classification[11]	Naive Bayes approach	Modified Naive Bayes classifier for armed discrimination	It not work on numerical attributes
Discrimination aware decision tree learning[6]	Decision tree classifier	Lower discrimination	Creation of decision tree is complex.
Rule protection for indirect discrimination[12]	Indirect rule protection	Considers all discriminatory attributes	Not consider background knowledge
Discrimination aware data mining [7]	α protection measure	Removing the discriminatory attributes with all possible changes.	Intrusive method

Table 1: Comparative Analysis

III. BACKGROUND

We first collect some basic definition related to data mining [6]

A. Basic Definition

- A group of data object (record) and their attributes its called data sets. Consider the original data set as DB.
- An item is contain attributes with its value, for example City- Surat
- An item set is collection of one or more items, for example {Cast- Open, City- Surat}
- Classification rule is containing an expression $A \rightarrow B$, where B is class item and A is an item set.
- Record division contains the item set it's called support of an item set, $\text{supp}(A)$. A and B are present in the record, so we can say that rule $A \rightarrow B$ is fully sustains by the record.
- Frequently how class item is appears in record which contain A its determined its called $\text{conf}(A \rightarrow B)$. Therefore if $\text{supp}(A) > 0$ then $\text{Conf}(A \rightarrow B) = \text{supp}(A, B) / \text{supp}(A)$
- Confidence greater then respective specified lower bound with support classification rule its called FR. FR is one type of data base of frequent classification rule, which are extracted from DB.

B. PD and PND Classification Rule

- 1) Potentially Discrimination Rule: In this classification rule $X \rightarrow C$ is potentially discrimination. When $X = A, B$ with A is discriminatory item set and B is a discriminatory item set. It is used for direct discrimination. For example, {Foreign worker = Yes, City = NYC} \rightarrow Hire = No.

- 2) Potentially Non Discriminatory Rule: A classification rule $X \rightarrow C$ is possible non-discriminatory item set. It is used for indirect discrimination. For example, {Zip = 10451, City = NYC} \rightarrow Hire = No, or {Experience = Low, City = NYC} \rightarrow Hire = No

IV. RELATED WORK

A. Problem Statement

The existing system used of pre-processing and post-processing approach, it remove the discriminatory attributes from the data set. This solves the direct discrimination problem, it causes much information loss & it would not solve indirect discrimination. They are generally based on the classification rules. It takes a more time to handle the decision tree. It will not handle more data & cannot predict attributes.

B. Existing System

In existing system, for direct discrimination prevention we used idea of rule generalization and rule protection. But this is no give batter result. We introduced the used of rule protection and rule generalization both in generalize way for direct and indirect discrimination prevention. So, this gives batter result. In this paper, we present new approach to direct and indirect discrimination prevention with hybrid algorithm (preferential sampling and direct discrimination prevention) and used. All possible method based of rule protection and/or rule generalization that can apply for both direct and indirect discrimination prevention. In this paper, we described new method.

C. Goals

Goal of the proposed system is to introduce a new hybrid (preferential sampling and direct discrimination prevention) algorithm for discrimination prevention in pre-processing

approach using hybrid algorithm. Objective is to reduce the information loss and maintain data quality.

D. Motivation

Discrimination & privacy violation is very difficult issue in data mining. It is more difficult that when people do not to be discriminated base on their gender, nationality, religion, age and so on. When these type of attributes are used for decision making purpose such as giving them a job, loan, Insurance etc. For Direct & indirect discrimination prevention, existing system use post-processing approach is more flexible & not require to changing the standard data mining algorithm. But this approach is not guarantee to the transformed datasets is discrimination free. The main Motivation of this topic is to make datasets discrimination free to use.

E. Proposed System

In this section we discussed about data transformation method which used for direct and indirect discrimination prevention.

1) Proposed Approach

- Measurement of Discrimination: Direct and indirect discrimination is obtaining from the alpha discriminatory rules and read lining rules [7]. PD and PND rules are generated base on the discriminatory items in database DB and FP the frequent classification rule. Direct discriminatory is measure by obtain PD rule using a discrimination measure and a discrimination threshold. After indirect discrimination measure by obtain the read lining rule with PND rules.
- Transformation of Discrimination: Transform the original database DB in such way that to remove direct or indirect discriminatory. Data transformation describe for both direct and indirect discrimination.

a) Data Transformation for Direct Discrimination

There are two rules are described in this two data transformation as follow:

- Direct Rule Protection: In this, data take from database of direct discrimination. Discrimination rule is transfer into protective rule. Direct discrimination occurs which take out by system the main discriminatory item sets. Then build contravene of decision making attributes. Then finally it generated in the database.
- Rule Generalization: The system perform the contravene decision making attributes by unity set of general rule.

b) Data Transformation for Indirect Transformation

There are two rules are described in this two data transformation as follow:

- Indirect Rule Protection: The system take out all items from the database using above specified process. Item set are continue gets discriminated which are not directly resulted in discrimination.

2) System Architecture

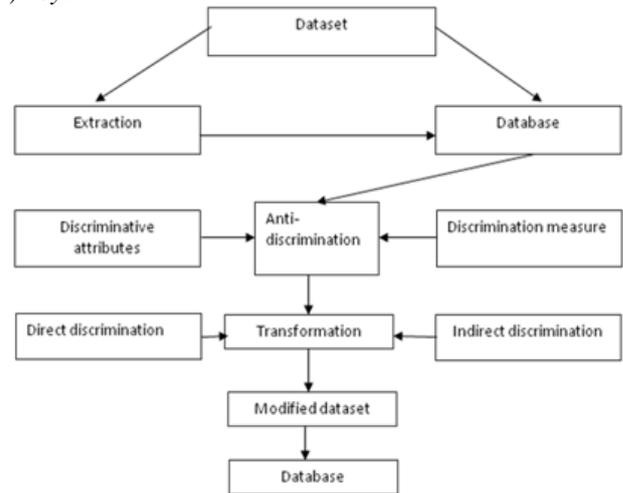


Fig. 2: Proposed Block Diagram [3]

3) Proposed Algorithm

This Proposes algorithm is modification of direct discrimination prevention & preferential sampling. Used both algorithm & create hybrid algorithm to batter performance. This algorithm is in generalized way for batter discrimination.

a) Hybrid algorithm

Input: DB, FR, MR, alpha, DIs

Output: DB'

- 1) For each r': A,B C in MR do
- 2) FR FR-{r'}
- 3) CND = Pref_Sample()
- 4) For each dbc in CND do
- 5) Compute impact (dbc)={ra in FR|dbc
- 6) Support the premise of ra}
- 7) End for
- 8) Sort DBc By ascending impact
- 9) while conf(r') >= alpha * conf(B->C) do
- 10) Select first record in DBc
- 11) Modify discriminatory item set based on CND based on Pref_Sample()
- 12) End while
- 13) End for

4) Software and Hardware Requirement

Operating System : Independence OS
Tools : Weka
Front-end : Java
Programming language : Java
Back-end : MY SQL
Processor : Pentium IV.
Memory : 256 MB RAM

5) Performance Evolution

The proposed system is more effective than the existing. It removes the direct and indirect discrimination from original database. Anti-discrimination or hybrid algorithm was introduced in the proposed method for effective discrimination method. Proposed system provides no information loss and high data quality after mined database.

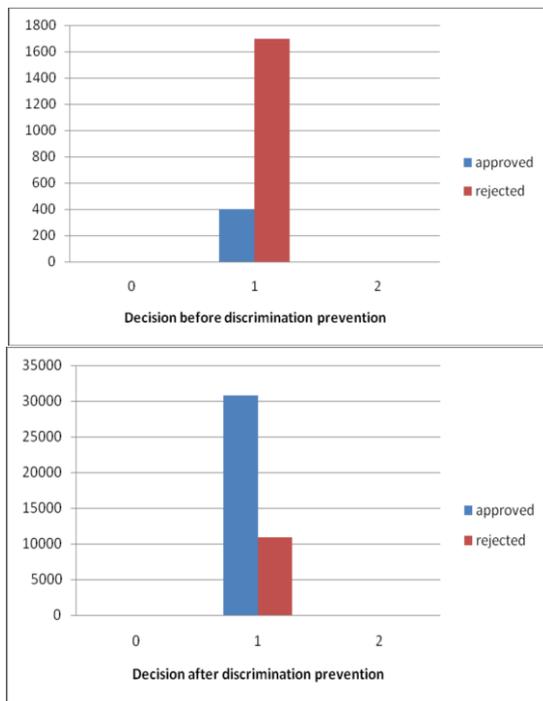


Fig. 3: Performance evolution of proposed and existing system

Above fig show the performance of proposed and existing system. The existing system used of the discrimination approach more number of data is rejected in given data set. In proposed, hybrid algorithm of discrimination used for the original dataset to remove all discriminatory item set in the database. Less number of dataset is rejected in the proposed method.

V. CONCLUSION

For discrimination, we use new preferential sampling & direct discrimination prevention method both hybrid algorithm including different data transformation method that can prove direct discrimination, indirect discrimination, or both of them at the same time. Hybrid algorithm is use for batter performance. Different transformation is used for finding of discrimination. The process is mapping the discrimination & identifies the class by decision- making processes. After discrimination free database is generated from the transformed data set without damaging the data quality.

A. Future Work

My future work is that based on direct discrimination prevention & preferential sampling algorithm. Improving this 2 algorithm to create hybrid algorithm for achieve batter performance for discrimination. This algorithm & its analysis is used to variety of input data.

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