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DISCRIMINATION PREVENTION USING RULE PROTECTION AND RULE GENERALIZATION

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Abstract

Discrimination is the process of unequally treating people on the basis of their belonging to a specific group. If the decisions are based on sensitive attributes (gender, race, religion, etc.,) then the results may ensue. For this reason antidiscrimination technique such as rule protection and rule generalization is used. Rule protection and Rule generalization is a two step process. The first step is to measure discrimination and identify categories and groups of individuals that have been directly discriminated in the decision-making processes. The second step is to transform data in the proper way to remove all those discriminatory biases. Finally, discrimination- free data models can be produced from the transformed data set without seriously damaging data quality.

Keywords: Data mining, discrimination, classification rule, rule generalization, rule protection.

INTRODUCTION

The word discrimination originates from the Latin discriminare, which means to “distinguish between”. In general, discrimination is the unjust or prejudicial treatment of different categories of people, especially on the grounds of race, age, or sex. Different antidiscrimination acts are provided to avoid discrimination. For example, the European Union applies the principle of same treatment between men and women [9]. But almost all the laws provided are reactive. They should be proactive. Hence applying pro active laws to avoid discrimination

Classification rules are actually learned by the system (e.g., loan granting) from the training data. If the training data are biased then the learned model may show a discriminatory behavior. Hence to identify such biases and remove them to make data set discrimination free. Discrimination can be either direct or indirect (also called systematic). When decisions are made based on sensitive attributes, Direct Discrimination occurs. While decisions based on nonsensitive attributes, Indirect Discrimination occurs.

In this paper, Section II discusses related work; Section III introduces background and motivation; Section IV describe the modules required to remove the discrimination and section V describes the system architecture, section VI includes algorithms and section VII contains conclusions made based on literature survey.

The discovery of discriminatory decisions was first proposed by Pedreschi et al. [5]. The approach is based on mining classification rules (the inductive part) and reasoning on them (the deductive part) on the basis of quantitative measures of discrimination that formalize legal definitions of discrimination. Current discrimination discovery methods consider each rule individually for measuring discrimination without considering other rules or the relation between them [3]. Here we consider existence and non-existence of discriminatory attribute. After discrimination discovery they focus on Discrimination prevention methods like:

Pre-processing – First we transform the data so that discriminatory biases are removed. Then the pre-processing approaches of data transformation and hierarchy-based generalization can be adapted from the privacy preservation literature. The pre-processing approach is useful for applications in which a data set should be published and/or in which data mining needs to be performed also by external parties (and not just by the data holder).

In processing change the data mining algorithms in such a way that the resulting models do not contain unfair decision rules. For example, an alternative

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approach to cleaning the discrimination from the original data set is proposed in [2] whereby the nondiscriminatory constraint is embedded into a decision tree learner by changing its splitting criterion and pruning strategy through a novel leaf relabeling approach. However, it is obvious that in processing discrimination prevention methods must rely on new special-purpose data mining algorithms; standard data mining algorithms cannot be used.

Post processing. Modify the resulting data mining models, instead of cleaning the original data set or changing the data mining algorithms. For example, a confidence-altering approach is proposed for classification rules inferred by the CPAR algorithm. The post processing approach does not allow the data set to be published: only the modified data mining models can be published (knowledge publishing), hence data mining can be performed by the data holder only [3].

Also Pedreschi explained a proposal for direct and indirect discrimination prevention. In this section, we present our approach, including the data transformation methods that can be used for direct and/or indirect discrimination prevention. Our approach for direct and indirect discrimination prevention can be described in terms of two phases:

- Discrimination measurement. Direct and indirect discrimination discovery includes identifying discriminatory rules and redlining rules. To this end, first, based on predetermined discriminatory items in DB, frequent classification rules in FR are divided in two groups: PD and PND rules.
- Data transformation. Transform the original data DB in such a way to remove direct and/or indirect discriminatory biases, with minimum impact on the data and on legitimate decision rules, so that no unfair decision rule can be mined from the transformed data. In the following sections, we present the data transformation methods that can be used for this purpose.

III.PROPOSED SYSTEM

Discrimination avoidance is a two step process. The first step involves the amount of discrimination involved in the data base, and the second step involves avoidance of discrimination by applying the data transformation method known as rule protection and rule generalization.

IV.MODULES

Rule protection: This module takes the database of direct discrimination. It converts each discriminatory rule into a protective rule. The system extracts the main discriminatory item sets causing the direct discrimination, then takes each indirect rule from this item sets. Then negation of decision making attribute is done. At last a database is generated by removing all discrimination causing item sets.

Rule Generalization: The system considers relation between rules instead of discrimination measure. To formalize the dependency among rules, the system takes combined set of general rule and redlining rule and performs the negation process on the decision making attribute.

V. System Architecture

Consider user request to administrator the database. Administrator extracts the database from large collection of database using data mining techniques. Database passes to discrimination prevention module to get discrimination free database. In this module database passes to many sub phases like calculation of support and confidence, calculation of elift, data transformation and all. After passing database from this component. Administrator gets discrimination free database and passes to it.

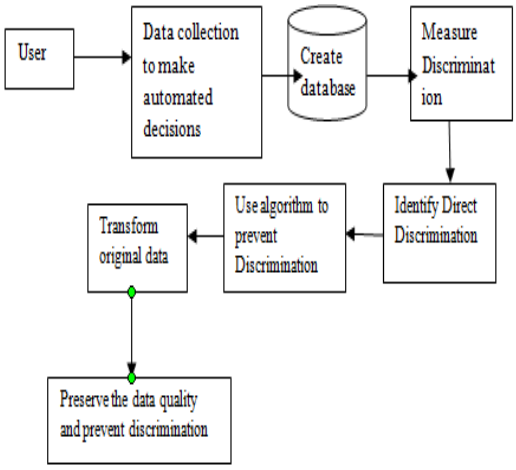

Fig 1: System Architecture

VI. ALGORITHMS

Algorithm for direct Rule Protection for changing the data item

Inputs: DB // The given data set

FR // classification rules with negative decisions MR //database of direct α-discriminatory rules
DI_s// predetermined discriminatory items in DB
$_\alpha$// threshold value
Output: DB' **//** Transformed data set
Step1: for each r': A, B->c ∈ MR do
Step 2: FR<- FR- {r'}
Step 3: DB_c <- all records completely supporting ¬A,B->¬C
Step 4: for each $db_c \in DB_c$ do
Step 5: compute impact $(db_{c)}$ =| {r_a ∈ FR/ db_c supports the premise of r_a}|
Step 6: end for
Step 7: sort DB_c by ascending impact
Step 8: while conf (r')>= α.conf (B->C) do
Step 9: select first record in DB_c
Step 10: modify discriminatory item set of db_c from ¬A to A in DB
Step 11: recompute conf (r')
Step 12: end while
Step 13: end for
Step 14: output: DB'= DB

Algorithm for direct Rule Protection for changing the class item

Inputs: DB // The given data set
FR //classification rules with negative decisions
MR //database of direct α-discriminatory rules
DI_s // predetermined discriminatory items in DB
$_\alpha$ // threshold value
Output: DB' **//** Transformed data set
Step1: for each r': A, B->c ∈ MR do
Step 2: FR<- FR- {r'}
Step 3: DB_c <- all records completely supporting ¬A,B->¬C
Step 4: for each $db_c \in DB_c$ do
Step 5: compute impact $(db_{c)}$ =| {r_a ∈ FR/ db_c supports the premise of r_a}|
Step 6: end for
Step 7: sort DB_c by ascending impact
Step 8: while conf (B->C) <= conf (r')/ α do
Step 9: select first record in DB_c
Step 10: modify discriminatory item set of db_c from ¬C to C in DB
Step 11: recompute conf (conf (B->C))
Step 12: end while
Step 13: end for
Step 14: output: DB'= DB

Algorithm for Rule Protection and Rule Generalization:

Inputs: DB // The given data set
FR // classification rules with negative decisions
TR //database of direct α-discriminatory rules and redlining rules
DI_s // predetermined discriminatory items in DB
$_\alpha$ // threshold value
Output: DB' **//** Transformed data set
Step1: for each r': A, B->c ∈ TR do
Step 2: FR<- FR- {r'}
Step 3: if $TR_{r'}$=RG then
// Rule Generalization
Step 4: DB_c <- all records completely supporting A,B,¬D->C
Step 5: for each $db_c \in DB_c$ do
Step 6: compute impact $(db_{c)}$ =| {r_a ∈ FR/ db_c supports the premise of r_a}|
Step 7: end for
Step 8: sort DB_c by ascending impact
Step 9: while conf (r') > conf (r_b:D,B->C)/ p do
Step 10: select first record in DB_c
Step 11: modify class item set of db_c from C to ¬C in DB
Step 12: recompute conf (r')
Step 13: end while
Step 14: end if
Step 15: if $TR_{r'}$=DRP then
//direct rule protection
Step 16: FR<- FR- {r'}
Step 17: DB_c <- all records completely supporting ¬A,B->¬C
Step 18: for each $db_c \in DB_c$ do
Step 19: compute impact $(db_{c)}$ =| {r_a ∈ FR/ db_c supports the premise of r_a}|
Step 20: end for
Step 21: sort DB_c by ascending impact
Step 22: while conf (B->C) <= conf (r')/ α do
Step 23: select first record in DB_c
Step 24: modify discriminatory item set of db_c from ¬C to C in DB
Step 25: recompute conf (conf (B->C))
Step 26: end while
Step 27: end for
Step 28: Output: DB= DB'

VII. CONCLUSION

- The proposed algorithm is to develop discrimination prevention methodology including different data transformation methods that can prevent direct discrimination. For this , first step is to measure discrimination and identify categories and

groups of individuals that have been directly and/or indirectly discriminated in the decision-making processes, the second step is to transform data in the proper way to remove all those discriminatory biases. Finally, discrimination- free data models can be produced from the transformed data set.

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