# SUMMARY

In the data mining field, association rules have been researched for quite a many number of years however the degree to which the support threshold effectively discovers interesting association rules has received little attention. There is no universal standard on what constitutes the ideal minimum support threshold. The use of a minimum support threshold results in the loss of interesting association rules if this threshold is set inaccurately. Moreover, the association rules discovered typically do not include item sets that are infrequently observed nor item sets that are absent in a set of transaction records. Consequently, the loss of interesting association rules is almost inevitable.

In this project, we use mapping to logical equivalences according to propositional logic to discover all interesting association rules, without loss. These association rules include item sets that are frequently and infrequently observed in a set of transaction records in addition to item sets that are absent in each transaction record. In addition to a complete set of rules being considered, these association rules can also be reasoned as logical implications because they inherit propositional logic properties. Having considered both infrequent and absent items, as well as being implicational, these newly-discovered association rules are distinguished from typical association rules. These new association rules reduce the risks associated with using an incomplete set of association rules for decision making, as follows:

1. (i) Our new set of association rules considers all possible combinations of item sets that are both present and absent in each transaction record. It is misleading to report an incomplete set of rules and at the same time create a sense that all available rules have been found. The latter misleads a decision maker into thinking that only these rules are available which in turn will lead a decision maker to reason with incomplete information. In contrast, our algorithm results in a full set of rules, giving the user confidence that the information resulting from data mining activities is complete.
2. (ii) Our new set of association rules can identify the strongest rules. Prior algorithms could not guarantee that the strongest association rules found were indeed the strongest as it was possible that the strongest rule could have been among hidden rules. Because all possible combinations of item sets are considered, users can be confident that the strongest rules have been found, and consequently, the information resulting from data mining activities is correct.
3. (iii) Our new set of association rules avoids reporting that item 𝐴 is associated with item 𝐵 if there is a stronger association between item 𝐴 and the *absence* of item 𝐵. Using prior association rules that do not consider this situation could lead a user to erroneous conclusions about the relationships among items in a dataset. Again, identifying the strongest rule will promote information correctness and appropriate decision making.
4. The risks associated with incomplete rules are reduced fundamentally because our association rules are created without the user having to identify a minimum support threshold, and because absent items have been considered. Among the large number of association rules, only those that can be mapped to logical equivalences according to propositional logic are considered interesting and reported.