

Bi-weekly Seminar

12pm - 1pm, Friday, April 5, 2019
UWM EMS 715

Hiding Sensitive Information When Sharing Distributed Transactional Data

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Abstract:

Retailers have been sharing transactional data with supply chain partners for a long time, to the benefit of all involved. However, many are still reluctant to share, and there is evidence that the extent of sharing would be greater if information sensitive to retailers is concealed before data is shared. While there has been considerable research into methods to hide sensitive information from transactional data, extant research has focused only on sensitive information at the organizational level. This is rarely the case in reality – the retail industry has recognized and adapted their offerings to region-wide differences in customer tastes for decades, and when stores offer a mix of standardized and customized products, the differences in customer characteristics across regions lead to sensitive information that is region-specific, in addition to sensitive information at the organizational level. To date, this version of the problem has been overlooked, and no effective methods exist to solve it; this paper fills that gap. While some existing approaches can be adapted to this more realistic context, the existence of region-level requirements substantially increases the size of an already difficult (NP-hard) problem to be solved, making such adaptations impractical. Traditional decomposition-based approaches like Lagrangean relaxation are not viable either, as they require the repeated solution of NP-hard problems involving millions of variables multiple times. In this paper, we present an ensemble approach that draws intuition from Lagrangean relaxation to maximize the accuracy of a shared transactional dataset. Extensive computational experiments show that this approach not only identifies near-optimal solutions, it can do so even when other approaches fail. We also show that the precision of recommendations made using datasets that have been modified using the ensemble approach is not statistically different from that of recommendations made using the original datasets; this demonstrates that using the ensemble approach to hide sensitive information before sharing transactional data has negligible negative impact.