In observational studies, generalized propensity score (GPS)-based statistical methods, such as inverse probability weighting (IPW) and doubly robust (DR) method, have been proposed to estimate the average treatment effect (ATE) among multiple treatment groups.

Yan et al. investigated the GPS-based statistical methods to estimate treatment effects from two aspects. The first aspect of the investigation is to obtain an optimal GPS estimation method among four competing GPS estimation methods by using a rank aggregation approach. We further examine whether the optimal GPS-based IPW and DR methods would improve the performance for estimating ATE. It is well known that the DR method is consistent if either the GPS or the outcome models are correctly specified. The second aspect of our investigation is to examine whether the DR method could be improved if we ensemble outcome models. To that end, the bootstrap method and rank aggregation method is used to obtain the ensemble optimal outcome model from several competing outcome models, and the resulting outcome model is incorporated into the DR method, resulting in an ensemble DR (enDR) method. Extensive simulation results indicate that the enDR method provides the best performance in estimating the ATE regardless of the method used for estimating GPS. We illustrate our methods using the MarketScan healthcare insurance claims database to examine the treatment effects among three different bones and substitutes used for spinal fusion surgeries. We draw conclusions based on the estimates from the enDR method coupled with the optimal GPS estimation method [1)].

1)
Yan X, Abdia Y, Datta S, Kulasekera KB, Ugiliweneza B, Boakye M, Kong M. Estimation of average treatment effects among multiple treatment groups by using an ensemble approach. Stat Med. 2019 Jul 10;38(15):2828-2846. doi: 10.1002/sim.8146. Epub 2019 Apr 2. PubMed PMID: 30941812.

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