

Bayesian Randomized Response Technique

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When sensitive attributes are investigated, Randomized Response Technique (RRT) is a popular approach to reduce the bias arisen from untruthful response. Nonetheless, traditional RRT has weakness that it mainly focuses on estimating the moments of univariate random variables but not dependence among multiple random variables. This paper is to introduce a new method to estimate the covariance matrix of the random vectors under the framework of RRT. Modified Cholesky decomposition is applied to reparameterize the covariance matrix so that the parameters of the covariance matrix can be expressed as regression on a row-by-row basis. This simplifies the structure of the matrix and ensures the positive definiteness of the estimator. To keep the inference nonparametric, moment equations of the randomized realizations are adopted as the quasi-likelihood. Moreover, Bayesian lasso is applied to impose shrinkage effect in the estimation. This helps reduce estimation error when the covariance matrix is sparse. An easy-to-implement Gibbs sampling scheme is proposed for the inference. A simulation study is conducted to evaluate the accuracy of the estimation. An empirical study related to software piracy behavior is conducted to compare the difference of the estimates under randomized and non-randomized settings.

Keywords: Bayesian lasso analysis; modified Cholesky decomposition; sensitive responses; shrinkage.