

## An Efficient Propensity Score Method for Causal Analysis With Application to Case-Control Study in Breast Cancer Research

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**Abstract :** Propensity score (PS) methods have recently become the standard analysis as a tool for the causal inference in the observational studies where exposure is not randomly assigned, thus, confounding can impact the estimation of treatment effect on the outcome. For the binary outcome, the effect of treatment on the outcome can be estimated by odds ratios, relative risks, and risk differences. However, using the different PS methods may give you a different estimation of the treatment effect on the outcome. Several methods of PS analyses have been used mainly, include matching, inverse probability of weighting, stratification, and covariate adjusted on PS. Due to the dangers of discretizing continuous variables (exposure, covariates), the focus of this paper will be on how the variation in cut-points or boundaries will affect the average treatment effect (ATE) utilizing the stratification of PS method. Therefore, we are trying to avoid choosing arbitrary cut-points, instead, we continuously discretize the PS and accumulate information across all cut-points for inferences. We will use Monte Carlo simulation to evaluate ATE, focusing on two PS methods, stratification and covariate adjusted on PS. We will then show how this can be observed based on the analyses of the data from a case-control study of breast cancer, the Polish Women's Health Study.

**Keywords :** average treatment effect, propensity score, stratification, covariate adjusted, monte Carlo estimation, breast cancer, case\_control study

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