Propensity Score Weighting

using machine learning

Young Geun Kim
ygeunkim.github.io

2019711358, Department of Statistics

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Introduction

Propensity Score Estimation

Evaluation

Related Contents

Introduction

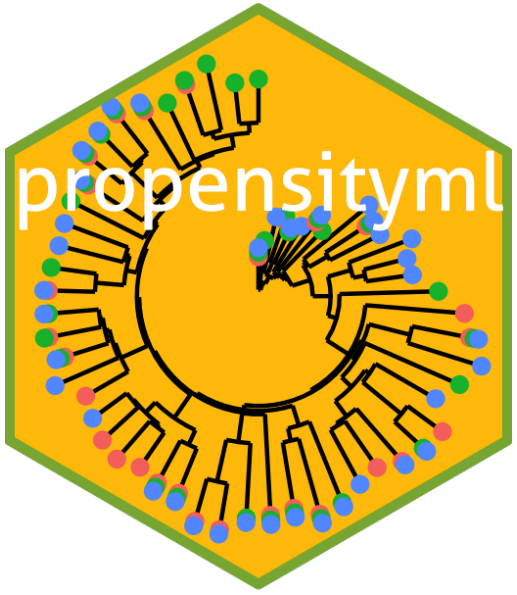
Reviewed Paper

Reviewd and apply Lee et al. (2010): estimate propensity score using

- Logistic regression
- Random forests
- CART
- SVM

Custom Package

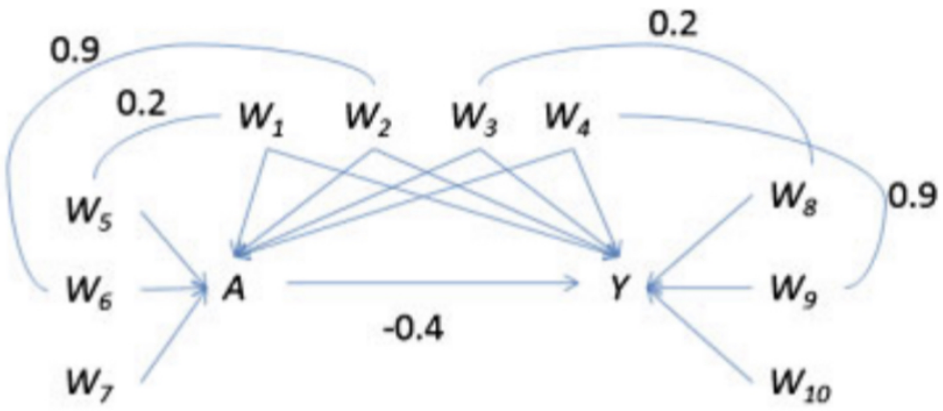
```
# remotes::install_github("ygeunkim/propensityml")
library(propensityml)
```



Simulation study

Simulation setting by Setoguchi et al. (2008):

- 10 covariates: confounders, exposure predictors, outcome predictors
- Treatment
- Outcome probability



A: exposure
Y: outcome
W_1-W_4: confounders
W_5-W_7: exposure predictors
W_8-W_{10}: outcome predictors

Binary variables: A, W_1, W_3, W_6, W_8, W_9
Continuous variables: Y, W_2, W_4, W_7, W_{10}

Scenarios

1. Additivity and linearity
2. Mild non-linearity: *1 quadratic term*
3. Moderate non-linearity: *3 quadratic term*
4. Mild non-additivity: *3 two-way interaction terms*
5. Mild non-additivity and non-linearity: *3 two-way interaction terms and 1 quadratic term*
6. Moderate non-linearity: *10 two-way interaction terms*
7. Moderate non-additivity and non-linearity: *10 two-way interaction terms and 3 quadratic terms*

Function to reproduce Setoguchi et al. (2008)

```
sim_outcome(n = 1000, covmat = build_covariate()) %>% str()
#> Classes 'data.table' and 'data.frame':   1000 obs. of  12 variables:
#>  $ w1           : Factor w/ 2 levels "0","1": 1 2 2 2 1 2 2 2 1 1 ...
#>  $ w2           : num  -0.28 0.306 0.633 -0.307 -0.59 ...
#>  $ w3           : Factor w/ 2 levels "0","1": 1 1 1 2 2 2 2 2 2 2 ...
#>  $ w4           : num  1.657 -1.44 -1.94 0.539 0.412 ...
#>  $ w5           : Factor w/ 2 levels "0","1": 2 2 2 1 1 2 1 1 2 2 ...
#>  $ w6           : Factor w/ 2 levels "0","1": 1 2 2 1 1 2 2 1 2 2 ...
#>  $ w7           : num  0.4874 -0.0162 -0.1558 -0.3943 0.3646 ...
#>  $ w8           : Factor w/ 2 levels "0","1": 2 2 1 1 2 1 2 2 1 1 ...
#>  $ w9           : Factor w/ 2 levels "0","1": 2 1 1 2 2 1 2 1 1 1 ...
#>  $ w10          : num  -0.305 0.594 0.418 0.763 0.881 ...
#>  $ exposure     : Factor w/ 2 levels "0","1": 2 2 2 2 2 1 2 2 2 2 ...
#>  $ outcome_prob: num  5.95e-53 7.20e-01 2.73e-23 1.85e-33 7.78e-03 ...
#>  - attr(*, ".internal.selfref")=<externalptr>
```

Propensity Score Estimation

Sample Size

For simulation, 1000 replicates

Small: 500
with 7 scenarios

Medium: 1000
with 7 scenarios

Large: 2000
with 7 scenarios

Covariate Balance

For example,

```
compute_balance(
  small_list[mcname == 1 & scenario == "A", -c("mcname", "scenario")],
  treatment = "exposure", trt_indicator = 1, outcome = "outcome_prob"
)
#>     variable  balance
#>  1:       w1 -0.05540
#>  2:       w2 -0.03770
#>  3:       w3 -0.09556
#>  4:       w4  0.09143
#>  5:       w5 -0.11176
#>  6:       w6  0.03223
#>  7:       w7 -0.06150
#>  8:       w8 -0.09707
#>  9:       w9  0.01704
#> 10:      w10  0.00309
```

Average(`balance`) = **Average standardized absolute mean distance** (ASAM).

Average standardized absolute mean distance (ASAM)

- Evaluation
- After applying weighting

Logistic Regression

Evaluation

Related Contents

About this project

Project repository

https://github.com/ygeunkim/psweighting-ml

Project package

https://github.com/ygeunkim/propensityml

References I

Lee, B. K., Lessler, J., and Stuart, E. A. (2010). Improving propensity score weighting using machine learning. *Statistics in Medicine*, 29(3):337–346.

Setoguchi, S., Schneeweiss, S., Brookhart, M. A., Glynn, R. J., and Cook, E. F. (2008). Evaluating uses of data mining techniques in propensity score estimation: a simulation study. *Pharmacoepidemiology and Drug Safety*, 17(6):546–555.