# IPWE comparison

## 2020-07-01

Setting: nonstandarized, the predictors have non zero mean values

## Simulation

The data sets are generated following the below parameter setting:

$$\mathbf{y_{ki}} = \mathbf{X_i}(\beta_\mathbf{k} + \mathbf{b_{ki}} + \mathbf{\Gamma_k}(\alpha'\mathbf{x})) + \epsilon_{\mathbf{ki}} \tag{1}$$
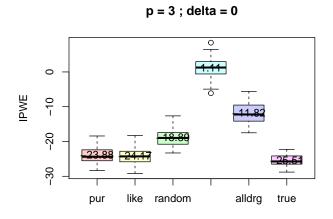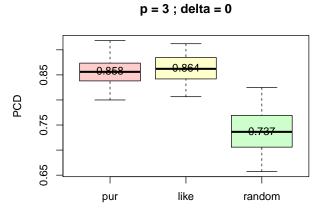
where

- $\alpha = \alpha_\mathbf{1} + \delta\alpha_\mathbf{2}$

  - $\alpha_1 = (1, 2, ..., p)'$;
  - $\alpha_2 = (\alpha_{21}, ..., \alpha_{2p})' \sim Exp(10)$
  - $||\alpha||_2^2 = 1$
  - when $\delta = 0$, equation (1) is a GEM model while $\delta \neq 0$, equation (1) is a non GEM model

- Suppose we have $k = \{1, 2\}$ treatments. $k = 1$ represents the placebo group while $k = 2$ represents the drug group.

- $\mathbf{X_i} = [1, t, t^2]$, and $t = [0, 1, 2, 3, 4, 6, 8]$, which is the design matrix for fixed effect and random effect

- $\beta_\mathbf{1} = \beta_\mathbf{2} = [0, -0.1, -0.05]$

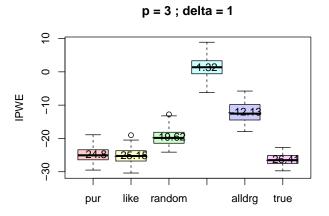- $\mathbf{\Gamma_1} = [0, \cos(\pi/3)/10, -\sin(\pi/3)/10]$, $\mathbf{\Gamma_2} = [0, \sin(\pi/3)/10, \cos(\pi/3)/10]$,

- $\mathbf{b_{1i}} \sim N(0, \mathbf{D_1}), \mathbf{b_{2i}} \sim N(0, \mathbf{D_2}), \mathbf{D_1} = \mathbf{D_2} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0.1 & 0 \\ 0 & 0 & 0.05 \end{pmatrix}$

- $\mathbf{x_i} \sim MVN(\mu_x, \Sigma_x)$, $\mu_x = (1, 2, .., p)$, $\Sigma_x$ has diagonal equals to 1 and 0.5 everywhere else.

- $\epsilon_\mathbf{1}, \epsilon_\mathbf{2} \sim N(0, 1^2)$

- $p = \{3, 10\}$, which is the dimension of the predictors $x_i$.

The IPWE are calculated with the estimated treatment assignment by using the purity criterion and by using the log-likelihood criterion. The proportions of correct assignment are also calculated. The whole procedures are repeated for 100 times.

## p = 3 ; delta = 0

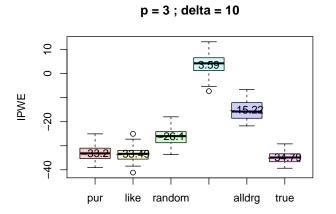IPWE

- pur: -23.88
- like: -24.17
- random: -18.80
- alldrg: 1.11
- true: -25.54 / -11.82

## p = 3 ; delta = 0

PCD

- pur: 0.858
- like: 0.864
- random: 0.737

## p = 3 ; delta = 1

IPWE

- pur: -24.8
- like: -25.16
- random: -19.62
- alldrg: 1.32 / -12.13
- true: -26.44

## p = 3 ; delta = 1

PCD

- pur: 0.864
- like: 0.869
- random: 0.74

## p = 3 ; delta = 10

IPWE

- pur: -33.2
- like: -33.49
- random: -26.4
- alldrg: 3.59 / -15.22
- true: -34.70

## p = 3 ; delta = 10

PCD

- pur: 0.889
- like: 0.896
- random: 0.758

2

**p = 3 ; delta = 100**

IPWE

-98.43
-118.30
-89.06
26.39
-46.68
-123.6

pur   like   random   alldrg   true

**p = 3 ; delta = 100**

PCD

0.806
0.907
0.764

pur   like   random

**p = 10 ; delta = 0**

IPWE

-226.83
-239.05
-244.46
151.02
-200.4
-239.48

pur   like   random   alldrg   true

**p = 10 ; delta = 0**

PCD

0.966
0.987
0.848

pur   like   random

**p = 10 ; delta = 10**

IPWE

-269.17
-275.2
-244.43
173.31
-238.46
-276.4

pur   like   random   alldrg   true

**p = 10 ; delta = 10**

PCD

0.95
0.986
0.842

pur   like   random