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Causal Discovery in the Presence of Missing Values for Neuropathic Pain Diagnosis

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<https://github.com/TURuibo/MVPC>



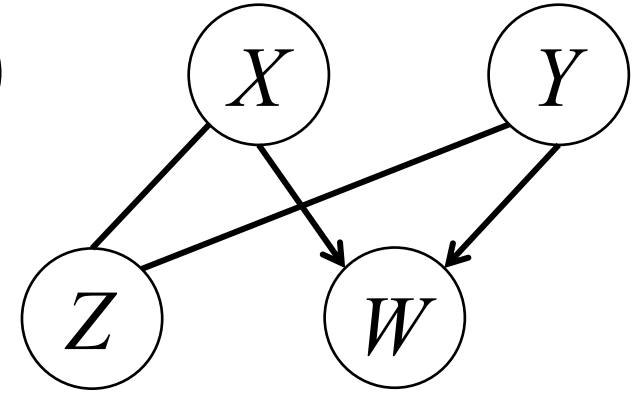
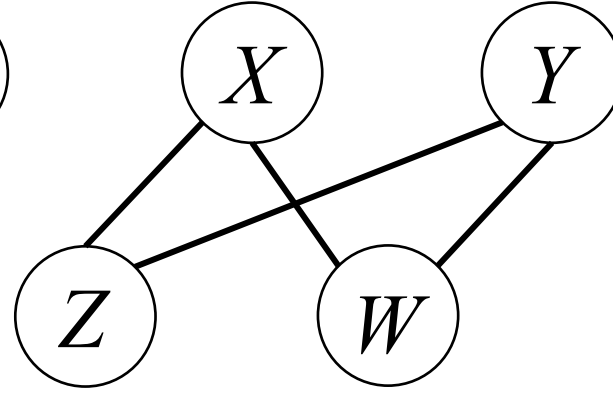
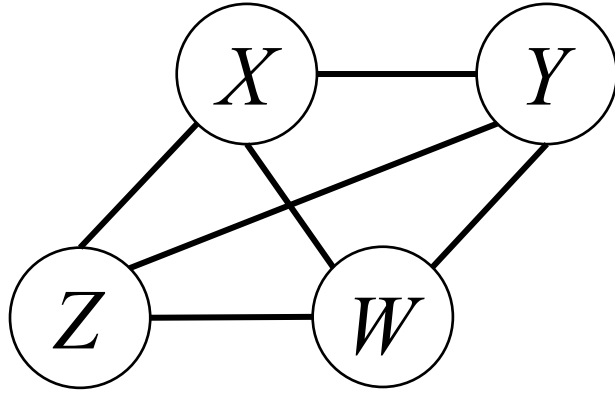
<https://github.com/TURuibo/Neuropathic-Pain-Diagnosis-Simulator>



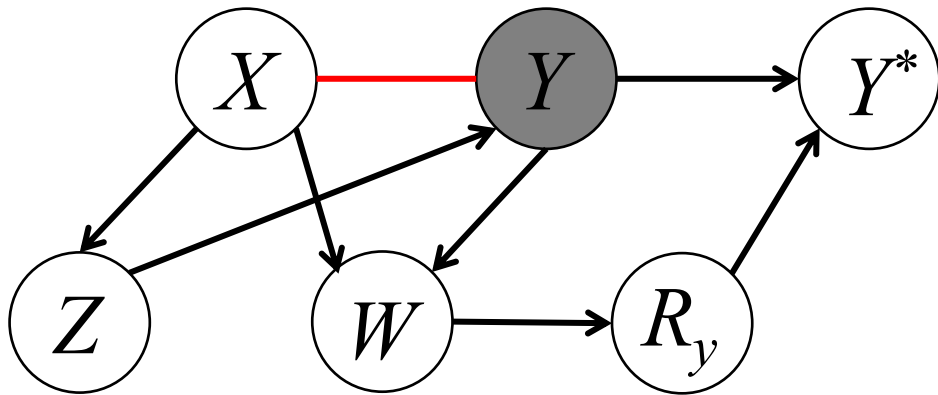
<https://arxiv.org/pdf/1807.04010.pdf>

DELETION-BASED PC

- PC recap



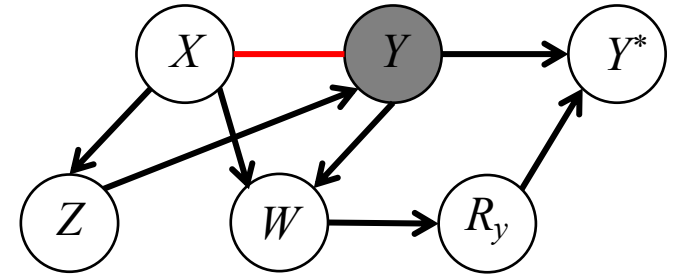
- Missingness graph, Deletion-based PC



X	Y^*	Z	W	R_y
1	2.2	2.1	3.1	0
3	6.1	6.3	9.3	0
2	4.1	4.2	6.1	0
7	M	14.1	21.4	1
4	M	8.1	12.3	1

MVPC

1. Skeleton Search (PC)
2. Detecting direct causes of *missingness indicators*
3. Detecting potential extraneous edges
4. Recovering the true causal graph skeleton
5. Determining the orientation (PC)



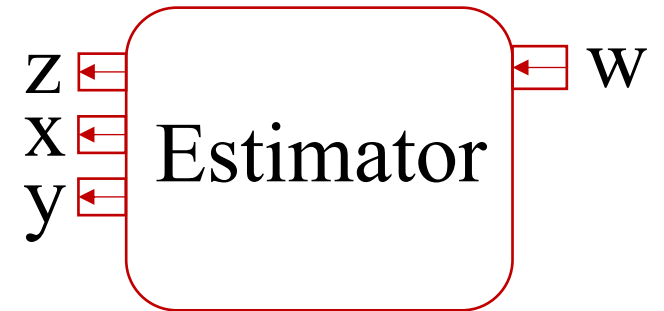
Recovering the true causal graph skeleton

(A) Permutation-based correction:

$$\begin{aligned} P(X, Y, Z) &= \int_W P(X, Y, Z | W) P(W) dW \\ &= \int_W P(X, Y^*, Z | W, R_y = 0) P(W) dW \end{aligned}$$

(B) Density ratio weighted correction

$$\begin{aligned} P(X, Y, Z) &= \frac{P(X, Y, Z^* | R_z = 0) P(R_z = 0)}{P(R_z = 0 | X, Y)} \\ &= P(X, Y, Z^* | R_z = 0) \frac{P(X, Y)}{P(X, Y | R_z = 0)} \end{aligned}$$



Neuropathic Pain Diagnosis Simulator

- A simulator that generates possible neuropathic pain diagnoses.
- Involving selection bias, unknown confounding, and missing data.
- Ground-true causal relations
 - More than **200** variables, **700** cause-effect pairs, **All** d-separations.
- Systematic evaluation of PC, FCI, and GES.

ID	Discoligment injury C1-C2	...	Left C2 Radiculopathy	Right C2 Radiculopathy	...	Left neck pain	Right neck pain	...
1	1	...	0	1	...	1	0	...
2	0	...	0	0	...	1	0	...
3	0	...	1	0	...	0	0	...
...
n	1	...	1	0	...	0	1	...