INFERENCE ON/IN/OF NETWORKS

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faculty of mathematics and natural sciences

Introduction

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Box 1

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$$\cos^3\theta = \frac{1}{4}\cos\theta + \frac{3}{4}\cos 3\theta \qquad (1)$$

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Causal effect in network

Motivation: Can we learn causal effects from observational data in high-dimensional systems?

Nonparanormal distribution

- $f = F^{-1} \circ \Phi$ monotone univariate function
- $f(Y) = (f_1(Y_1), ..., f_p(Y_p))^T \sim N(0, \Sigma)$ and $Y = (Y_1, ..., Y_p)^T$ has a nonparanormal distribution

Causal Effect for Nonparanormal Graphical Models

We are interested in the causal effect of Y_i on Y_p for $i \in (1, ..., p-1)$

- Gaussian distribution: $E(Y_p|Y_i = y_i, pa_i) = \beta_0 + \beta_i y_i + \beta_{pa_i}^T pa_i$

$$\frac{\partial}{\partial y_i} E[Y_p|do(Y_i = y_i)] \equiv \beta_i$$

- Non-Gaussian distribution

$$\begin{aligned}\frac{\partial}{\partial y_i} E[Y_p|do(Y_i = y_i)] &\cong f_p^{'}(z_{0j})\delta_i(f_i^{-1})^{'}(y_i) \\ &= f_p^{'}(z_{0i})\beta_i(f_j^{-1})^{'}(y_i)\end{aligned}$$

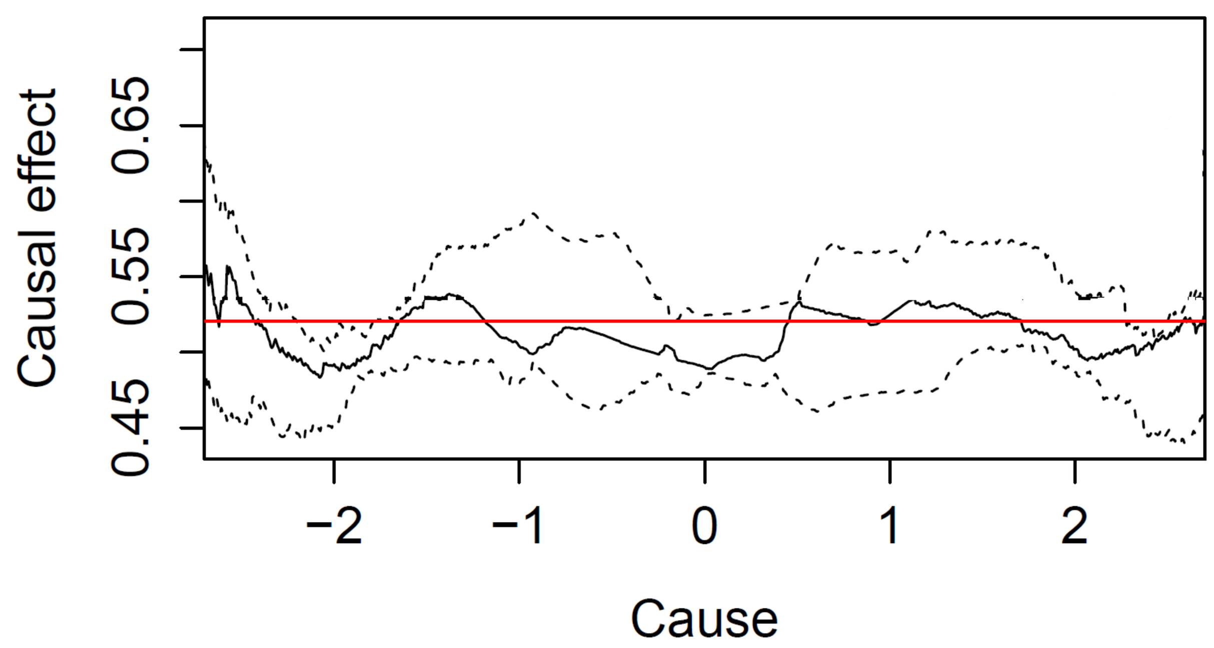

Figure 2: Dashed lines are quantile profile for the functional causal effect(shown here with solid black line) of Y_i on Y_p. Red line show true causal effect.

Conclusion: We have derived an explicit formula for describing a causal effect for Nonparanormal distribution.

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Box2

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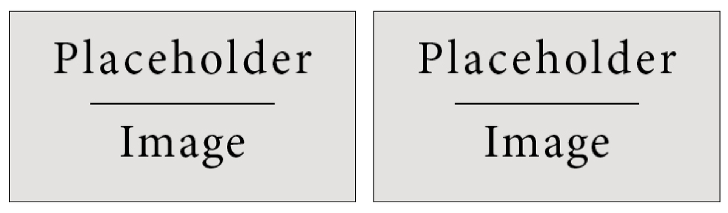

Figure 1: Figure caption 1 (left); Figure caption 2 (right)

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Box 4

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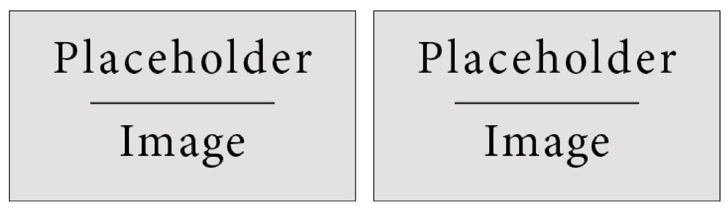

Figure 3: Figure caption 1 (left); Figure caption 2 (right)

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