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## Statistical inference of causal and ordinary differential equation models

Mahmoudi, Seyed Mahdi

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## **Statistical inference of causal and ordinary differential equation models**

Seyed Mahdi Mahmoudi

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1. By describing the causal network as a directed acyclic graph it is possible to estimate a class of Markov equivalence systems that describe the underlying causal interactions consistently (Chapter 2).
2. In non-Gaussian systems, causal effects stop being linear and cannot be described any more by a single coefficient (Chapter 2).
3. Nonparanormal Causal Effect (NCE) is a simple and, under certain conditions, consistent method to estimate causal effects nonparametrically, based on a first order approximation of the general causal effect formula (Chapter 2).
4. Generalized Tikhonov regularization is a general framework for estimation of parameters in differential equations (Chapters 3).
5. Network Reconstruction via Additive Differential Equations (NRADE) proposes a two-step variable selection procedure for the estimation of a dynamic network, described by means of a system of ordinary differential equations (Chapters 4).
6. The generalized MM kinetics model is capable of describing typical properties of positive and negative autoregulated genes (Chapters 5).
7. The dynamic behaviour of autoregulated genes *INO4* in *S. cerevisiae* and *SCO3217* in *S. coelicolor* show are probably of a bistable nature (Chapters 5).