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Notation and Definitions

Here I list often used abbreviations and notations for quick reference. The notation in chapter 3 complies to Steffen Lauritzens book [72], the statistical standard reference on graphical models.

Chapter 1

DNA	Deoxyribonucleic acid
RNA	Ribonucleic acid
mRNA	messenger RNA
RNAi	RNA interference

Chapter 2

V	set of graph vertices representing network components
p	number of pathway components, $p = \|V\|$.
$T = (V, \mathcal{E})$	network topology on vertices V and edge set $\mathcal{E}$
D	special case: T is a directed acyclic graph
X, x	a random variable and its realization
$\mathbf{X}$, $\mathbf{x}$	a set or vector of random variables and its realization
M	data matrix $M = \{\mathbf{x}^1, \dots, \mathbf{x}^N\}$
N	sample size
$P(X = x) \equiv p(x)$	if no confusion can arise
$X \perp Y$	X and Y are independent random variables
$X \perp Y \mid Z$	X and Y are independent given Z
Σ, $\hat{\Sigma}$	covariance matrix and its estimator
K	precision matrix, inverse covariance matrix, $K = \Sigma^{-1}$
$\theta_{v\|pa(v)}$	the parameters of random variable X_v given the values of its parents $\mathbf{X}_{pa(v)}$ in the Bayesian network DAG
$\alpha_{i_\delta\|\mathbf{i}_{pa(\delta)}}$	Dirichlet parameters for a discrete node $\delta \in V$ with parent state $\mathbf{i}_{pa(\delta)}$ in a Bayesian network.
DAG	directed acyclic graph
GGM	Gaussian graphical model
DBN	dynamic Bayesian network
LPD	local probability distribution

Chapter 3

$do(X_v = x'_v)$	do-operator: X_v is fixed to state x'_v
$\mathrm{d}(x)$	Dirac-function, point mass at $x = 0$
Δ	the set of discrete vertices
Γ	the set of Gaussian vertices
$\mathbf{X} = (\mathbf{I}, \mathbf{Y})$	the set of variables splits into discrete ones ($\mathbf{I}$) and continuous ones ($\mathbf{Y}$).
I_δ, i_δ	a discrete random variable ($\delta \in \Delta$) and its realization
Y_γ, y_γ	a Gaussian random variable ($\gamma \in \Gamma$) and its realization
$\mathcal{I}_\delta$, $\mathcal{I}_{pa(\delta)}$	the state space of I_δ and its parents $\mathbf{I}_{pa(\delta)}$
$\mathcal{P}(\theta, w, t)$	pushing operator applied to parameters θ with strength w towards target state t
$\theta_{\delta\vert\mathbf{i}_{pa(\delta)}}$	parameters of discrete variable I_δ
$\theta_{\gamma\vert\mathbf{i}_{pa(\gamma)}}$	parameters of Gaussian variable Y_γ depending on the values $\mathbf{i}_{pa(\gamma)}$ of discrete parents

Chapter 4

$V = \mathbf{E} \cup \mathbf{S}$	vertices correspond to signaling genes (S-genes) and reporter genes (E-genes)
E_i	reporter genes ($i = 1, \ldots, m$)
S_j	signaling genes ($j = 1, \ldots, p$)
E_{ik}, e_{ik}	binomial random variable corresponding to the state of E_i in experiment k and its realization
C_{ik}	continuous expression states
T	pathway topology on S-genes
T'	extended topoloy including S-genes and E-genes
Φ	silencing scheme
α	probability to observe a false positive effect
β	probability to observe a false negative effect
$\theta_i = j$	position parameter: S_j is the parent of E_i in T'
η_i	probability to observe an effect at E_i
η_{is}	probability to observe an effect at E_i given parent state s
M_i^s	data of E_i when parent was in state s
n_{ise}	number of observations $e_{ik} = e$ when parent state is s