Introduction to network inference and network learning in R: Markov random Fields and Bayesian Networks (S008)

Friday, January 31 2025

Course location: Utrecht Science Park, Sjoerd Groenman Building room C020

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Time	Type	Description
09:15 – 12:15	- Introductions, - Lecture and - computer lab - Two breaks	- Aim of the course - What is a Probabilistic Graphical Model (PGM) and why do we use that for our real data analysis/problem? - What is a Graph, a node, and an edge? - Data structure as an input for PGM - Directed and Undirected PGM - Undirected PGM (Markov Random Fields) - Data structure - Nodes and edges in Undirected PGM - Continuous Undirected PGM - Discrete Undirected PGM - (Conditional) (in) dependency - Marckov blanket/ Separators, global Markov properties and clique - Estimating **Network structure** using Undirected PGM for data sets including Continuous Variables (Continuous Undirected PGM) - Covariance matrix, precision matrix, partial correlation coefficients, Gaussian graphical model (GGM). - Estimating the network structure using Graphical lasso (step by step algorithm) - Computer lab- real world scenarios

Time	Type	Description
12:15 – 13:15	Lunch break	

13:15 – 16:30	- Lectures and
	- computer labs
	- Two breaks
		- Bayesian Networks (BNs)
		- Data structure
		- Directed Acyclic Graph (DAG)
		- Nodes and edges in BNs
		- (Conditional) (in) dependency
		- Markov assumption
		- V- structure
		- Markov Blanket
		- path, collider, blocked/open path and d-separation
		
		- Types of BNs
		   - Discrete BNs
		   - Continuous BNs
		   - Conditional linear Gaussian BNs (CLGBNs)
		
		-Estimating the DAG structure
		   - *constraint-based*,
		   - *score-based*
		
		- Computer lab- real world scenarios

16:30-17:00	More time for questions and to practice with computer lab exercises	