



## **ΠΡΟΣΚΛΗΣΗ**

Το Τμήμα Μαθηματικών και Στατιστικής  
του Πανεπιστημίου Κύπρου  
σας προσκαλεί στην

**Σειρά Διαλέξεων του Πανεπιστημίου της Διασποράς**

**Modeling, computation, inference and applications of graphical  
models**

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**University of Florida**

Οι διαλέξεις οι οποίες θα γίνουν στην Αγγλική  
είναι ανοικτές στο κοινό.

**ΣΘΕΕ-01-Αίθουσα 039**

**16.00-18.00**

**Motivation:** Graphical models represent a canonical statistical model for capturing conditional dependencies between a set of variables of interest. Recent applications to high-dimensional data include reconstruction of gene regulatory networks, analysis of financial data and legislative networks. In this lecture series, we review basic concepts regarding graphical modeling, discuss algorithms for estimating undirected graphical models for graphical models and present the theoretical properties of the estimates under various assumptions (e.g. structured sparsity). We further discuss extensions that account for effects of latent variables, as well as approaches that jointly estimate structurally related graphical models. We will also provide a brief overview of new approaches that address hypotheses testing problems for graphical models. Finally, a brief background on convex optimization algorithms and their properties will be provided, as well as some necessary technical material for theoretical developments.

### **Lecture 1, 24/11/2017**

- Basic concepts on graphical modeling and motivating applications
- Undirected graphical models and the special case of the Gaussian distribution
- Gaussian graphical models for high-dimensional data – structural assumptions
- Neighborhood selection (and the corresponding lasso regression problem) and maximum likelihood estimation of Gaussian graphical models, algorithms and optimization issues

### **Lecture 2, 27/11/2017**

- Some key concepts from convex optimization
- Some key technical tools (e.g. concentration inequalities)
- Consistency of estimates for the Gaussian graphical model
- Extensions of graphical models to other types of data (e.g. binary, count)

### Lecture 3, 28/11/2017

- Hypothesis Testing for the parameters of the Gaussian graphical model
- Applications to problems from molecular biology, finance and political science

### Lecture 4, 4/12/2017

- The problem of joint estimation of multiple graphical models: motivating applications and formulation
- Introduction of modeling assumptions in the form of structured penalties
- Overview of recent developments of optimization algorithms employed for such complex problems
- Overview of estimation issues
- Discussion of applications

Most of the material presented is based on papers published in the statistics and machine learning literature over the last 10+ years. However, some useful book references include

1. Buhlmann and van de Geer (2011), *Statistics for High Dimensional Data: Methods, Theory and Applications*.
2. Hastie, Tibshirani and Wainwright (2016), *Statistical Learning with Sparsity: the Lasso and Generalizations* (freely available on the web)