An introduction to graph analysis and modeling

Introduction

MSc in Statistics for Smart Data – ENSAI

Automn semester, 2017

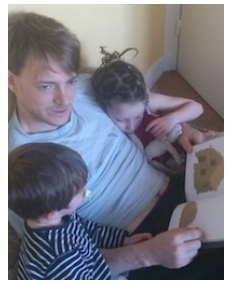
`http://julien.cremeriefamily.info`

Teacher

UMR 518 ArgroParisTech/Inra

https://www6.inra.fr/mia-paris

Julien Chiquet



Researcher at Inra

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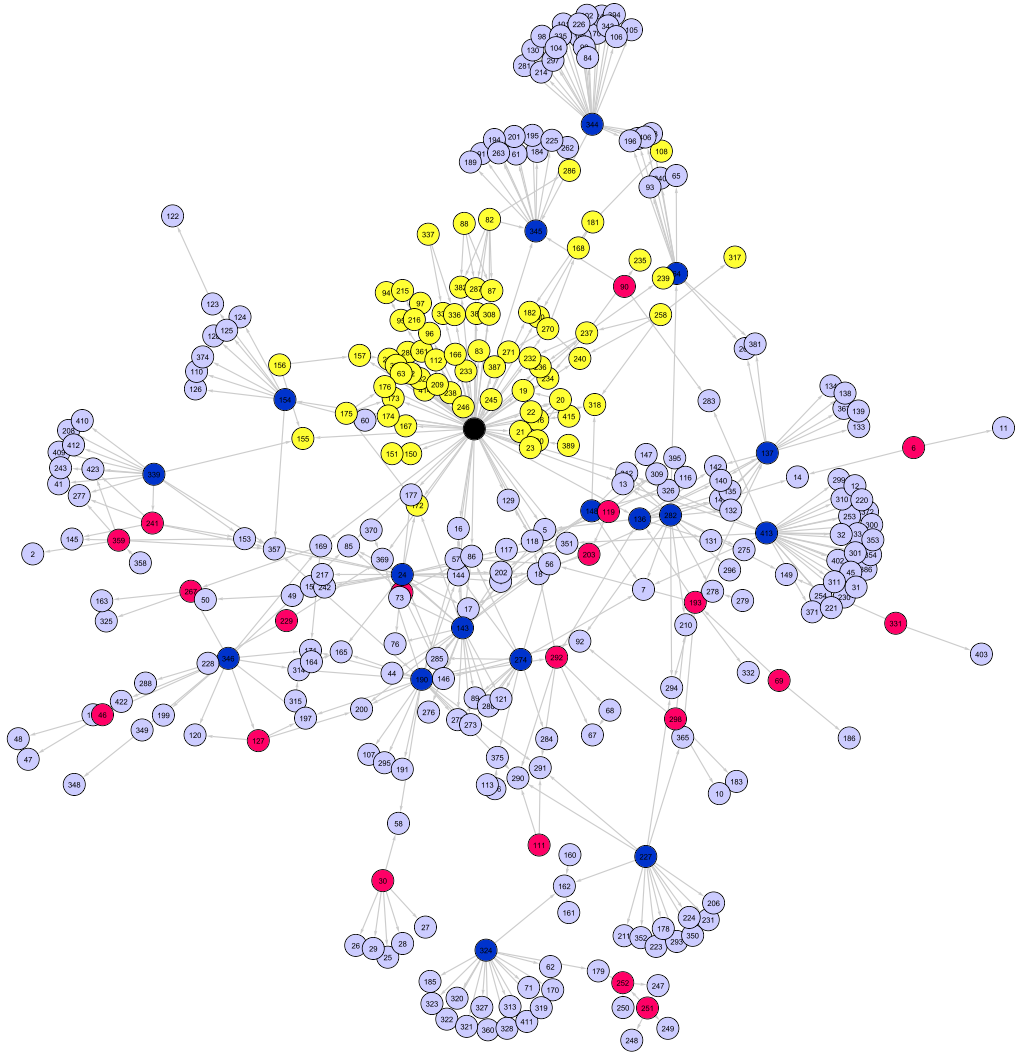
Motivation 1

Unravel the latent organization of an observed network

E. coli regulatory network

- relationships between gene and their products
- inhibition/activation



Motivation 1

Unravel the latent organization of an observed network

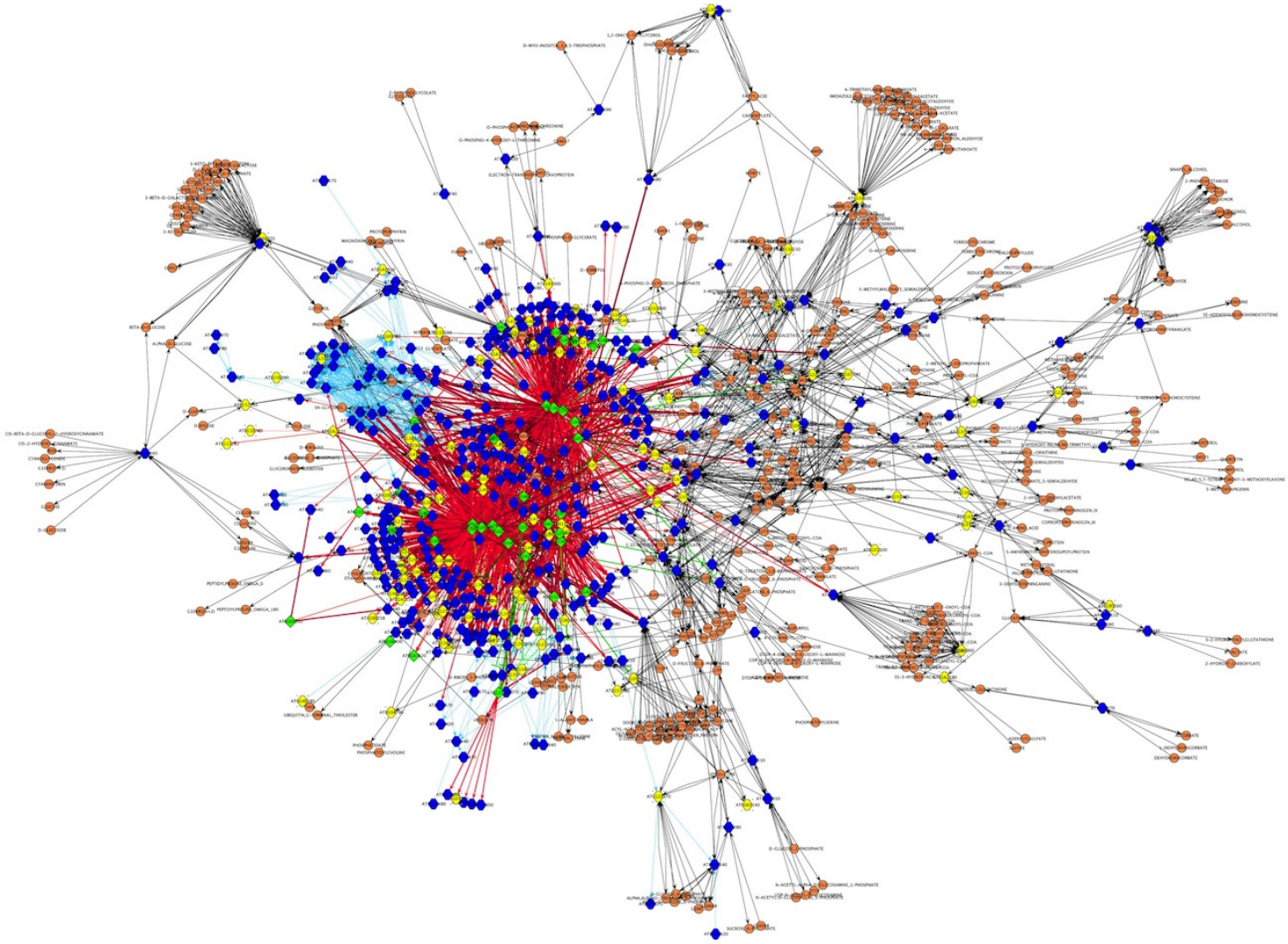
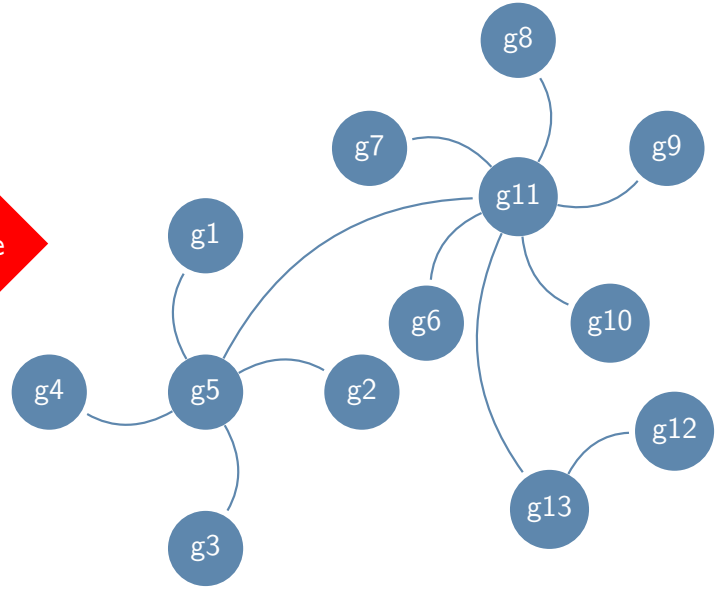


Figure: Regulatory network identified in mammalian cells: highly organized

Motivation 2

Reconstruct an network to capture important features of a system

Inference



$\approx$ 10s/1000s assays

$\approx$ 1000/100,000s features

Agenda (expected...)

first day Descriptive Analysis of Network Data (19/10)

1. Basic on Graphs
2. Descriptive Statistics
3. Graph Partionning

second day Statistical Models for Networks Data (07/11)

1. Exponential Random Graph Models
2. Stochastic Block Model

third day Inference of Network Topology (28/11)

1. Association Networks
2. Gaussian graphical models

Module Assessment

1. Practicals
   - each session comes with Practical on R
   - send me a small R-markdown report at the end of the session

2. Projects (more on this later)
   - article review
   - application project
   - implementation of an algorithm

General books in Statistical Learning and networks

`http://julien.cremeriefamily.info/teachings_ensai_networks.html`

- Graphical Models in Applied Multivariate Statistics, Joe Whittaker
- Graphical Models, S. Lauritzen
- Statistical Analysis of Network Data with R, Eric Kolazcyk
- Pattern recognition and Machine Learning, C. Bishop
- The Element of Statistical Learning Hastie, Tibshirani, Friedman