Titles and abstracts of practical sessions

Patrick Cattiaux, Fanny Delebecque (Institut de mathématiques de Toulouse)
A few models for the emergence of collective behaviour in population motion– Talk and practical session

The talk aims at introducing a few models for the collective behaviour in the motion of a population of many agents. We will focus on the property of flocking in Cucker-Smale like models. We will then implement some of these models.

Prerequisite: The talk and simulations are meant to be understandable by almost all M1 students, but basic notions on ODEs, probabilities and Implementation with Scilab could be helpful.

Sébastien Déjean, Nathalie Villa-Vialaneix (Institut de mathématiques de Toulouse, INRA de Toulouse)
An introduction to network analysis: inference and mining

The aim of the workshop is to introduce statistical methods to infer networks from biological data and then to analyze them. It is organized as 1/ a basic introduction to networks, 2/ graph mining and 3/ network inference with a focus on the Gaussian Graphical Models. The workshop will mainly rely on practical applications using the free statistical software environment R (www.r-project.org).

Prerequisite: No prerequisite is required.

Jérôme Fehrenbach (Institut de mathématiques de Toulouse)
Coupling data and mechanical models

Identifying models parameters from measurements (« data assimilation ») provides quantitative information in numerous domains: geosciences, non destructive testing, medical imaging, biological modeling...
We will present a few applications of data assimilation to medical imaging and biology. Then we will introduce the main issue which is the 'ill-posedness'

of these problems which makes the solution very sensitive to noise. A few techniques that allow to overcome this issue will be presented. These notions will be illustrated by computer experiments with a simplified toy model.

Prerequisite: elementary differential equation and linear algebra notions, elementary optimisation notions (gradient descent).