

LTCC Proposed Course

Title: Maximum Entropy Models of Complex Networks

Core Audience (first year or second/third year: pure, app. or stats): first year or second: app. or stat

Course Format (extended or intensive): Extended course

Keywords: Maximum Entropy Models of Complex Networks

Syllabus: Complex networks encode for the complexity of the majority of complex systems from the brain to the social networks. Maximum entropy models of complex networks constitute a very powerful tool to construct null models for real datasets and are increasingly used for inference problem in networks and applied in a large variety of context from finance to biology. In this course we will introduce the most relevant properties of complex networks and the fundamental statistical principles at the basis of maximum entropy models of networks. We will define different network ensembles (microcanonical and canonical) and discuss their relation by studying their statistical mechanics properties such as their entropy. The module will also cover modelling of weighted networks and modelling of generalized networks structures such as multilayer networks and simplicial complexes.

Recommended reading: G. Bianconi, Multilayer networks: structure and functions (extracts)

Additional optional reading:

Prerequisites:

No of discussion/problem sheets (typically 4 for extended courses, and 1 for intensive courses, with solutions): Problem sheets 4

Electronic lecture notes (these are strongly encouraged, as they will form the core of the individual study of the students): Electronic lecture notes will be provided every week during the module.

Necessary support facilities: Projector, Board/Visualizer

Necessary software requirements for computing facilities: N/A

Proposed timing: Term 2 1pm

Lecture/computer session/tutorial/discussion split (hours of each): Lectures
(2 hours/week)

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