MINI WORKSHOP ON NETWORK SCIENCE

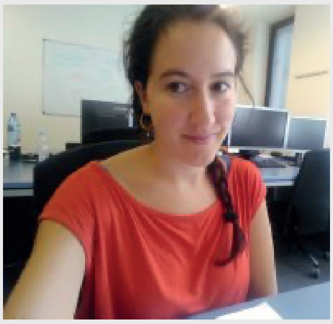
Where Seminar Room 1, Floor 1, Building R2, Suzukakedai Campus, Tokyo Institute of Technology

When Friday January 24, 2020, 10:30–12:00

Organizer Petter Holme, WRHI, Institute of Innovative Research, Tokyo Institute of Technology.
Email: holme@cns.pi.titech.ac.jp

Don't miss! The WRHI symposium in the afternoon the same day. https://www.wrhi.iir.titech.ac.jp/

10:30–11:00 **Irene Malvestio** University of Bristol



k-core requires something more

The organization of a network in tightly knitted groups of nodes with at least *k* connections known as *k*-shell (*k*-cores) structure/decomposition has been used to study several phenomena associated with, e.g., spreading dynamics. It has been proven, in fact, that nodes in the innermost *k*-shells play a crucial role in the diffusion of pathogens, emergence of consensus, and resilience of the system. The *k*-shell decomposition of several empirical networks displays non-trivial features. It is therefore legitimate to ask whether such features are amenable to the degree sequence of the nodes or if, instead, a generative model needs to account also for other 'ingredients'. In this talk, I will present the results of a study aimed at testing such hypothesis. Given some empirical and synthetic networks, I will study their *k*-shell decomposition as well as that of some suitably 'randomized' counterparts, and then show how the *k*-core structure needs something more than the degree in order to be reproduced.

11:00–11:30 **Zi-Ke Zhang** Hangzhou Normal University

Structure difference model for link prediction on complex networks

The classical Link Prediction (LP) methods only can solely be applied to directed or undirected networks. Few research have been devoting to establishing a universal framework to address the LP problem in both networks. In this talk, based on Laplacian transformation, we propose a structure difference model to study the LP problem. Theoretical analysis has proved that the accuracy of LP problem can be mathematically described, and the different distributions (corresponds to different network structure) show different robustness with introduced perturbation. Extensive experiments on tens of real-networks (both directed or undirected) show the proposed method does not only has low computational complexity, but also can generate more accurate prediction.

11:30–12:00 **Paul Expert** Imperial College

Uncovering the structural correlates of brain function using Graph Signal Analysis

Graph Signal Analysis is a Fourier like theory that allows to decompose a function or signal on the nodes of a graph using a basis related to its structure. A basis of choice is the eigenbasis of the graph Laplacian, as the corresponding eigenvalues can be interpreted as spatial frequencies and the corresponding eigenvectors their spatial location. Combining structure and function, Graph Signal Analysis offers a unique window to understand complex systems. In particular, its natural multi scale description of a signal is well suited to characterise brain function. In this talk, we will show how this method differentiates between rest and task by yielding de/activated modes relating to the task considered.