Detection of Mesoscopic Role-Structure in Complex Networks — Joerg Reichardt1, Roberto Alamino2, and David Saad2 — 1UC Davis, CA — 2Aston University, Birmingham

Not all nodes are created equal in complex networks. Rather, they play diverse roles in the functioning of a network and their role is reflected in the network’s link structure. Hence, structural analysis can be used to infer the latent roles and functions of nodes purely based on connectivity data. Currently, network structure is studied at three different levels: the micro level, where the degree distribution, path-lengths, diameters or clustering coefficients are investigated. At the micro level, properties of individual nodes and edges such as centrality indices or rank functions such as pagerank are studied. The study of the meso-scale, which aims at studying joint properties of groups of nodes, so far has mainly been focused on the detection of cohesive subgroups of nodes, so-called communities.

The talk will show that, though important, communities are only one special case of a much wider class of mesoscopic structures called “stochastic block structures”. This name comes from the fact that latent classes of roles and their resultant patterns of connectivity in a network account for salient block structure in the adjacency matrix of a network when the rows and columns are ordered according to these latent roles.

We present an effective and accurate algorithm that performs this task employing a purely Bayesian approach, show that it outperforms competing approaches and present applications to real world data sets that open new frontiers of research in the study of both structure, functionality and evolution of complex networks from a mesoscopic perspective.

Structured k-partite networks by decomposition into overlapping communities — Florian Blochl1,2, Mara L. Hartsgersper12, Volker Stumpfle1, and Fabian J. Theis134 — 1Institute for Bioinformatics and Systems Biology, Helmholtz Zentrum München — 2Department of Mathematics, TU München — 3Equal contributors

With increasing availability of large-scale networks we face the challenge to interpret these data in a comprehensive fashion. A common solution is a decomposition into modular building blocks, so-called communities. Prominent examples are functional modules in protein interactions. However, the integration of heterogeneous resources such as degree distributions, path-lengths, diameters or clustering coefficients are investigated. At the micro level, properties of individual nodes and edges such as centrality indices or rank functions such as pagerank are studied. The study of the meso-scale, which aims at studying joint properties of groups of nodes, so far has mainly been focused on the detection of cohesive subgroups of nodes, so-called communities.

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The tomography of human mobility – what do shortest-path trees reveal?

Dirk Brockmann
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The tomography of human mobility. What do shortest-path trees reveal? Different length scales interact in the embedding multiscale network of network characteristics as a function of scale and analyze how the properties change steadily under the iterated fusion steps. Moreover we investigate the relation of a series of network characteristics as a function of scale and analyze how the different length scales interact in the embedding multiscale network.

We finally discuss possible connections to real world networks.