CABDyN / INET Oxford SEMINAR SERIES

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'Communities and role structure in directed complex networks'

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ABSTRACT:

In this presentation I will talk about the use of flow-based methods to as a natural way to explore the multiscale community and role structure of directed networks.

I will discuss the Markov Stability community detection method which defines communities as sets of nodes that retain flows for longer than one would expect at random. By analysing flows of different duration we can examine communities at multiple resolutions. Although directionality can be fundamental, when the network is large it introduces serious computational challenges; this means that it is sometimes ignored. The effect of ignoring directionality is not uniformly distributed across the communities: some communities disappear in the undirected network whereas others remain.
We obtain the roles of the nodes using the Role-Based Similarity (RBS) framework. RBS uses the transients of dynamical systems to compute the pairwise similarity of the nodes' incoming and outgoing flow-profiles. By incorporating communities and roles in the same analysis we can construct 'informational organigrams' which give global views of the network and classify communities in terms of their role-mix and flow dynamics. I will showcase these methods using a network of influential Twitter users during the UK riots of 2011, the c. elegans connectome, and metabolic networks.

Finally, I will frame the discussion of these techniques in a broader metadata/data (or structure/content) context for information systems and will show some examples of ongoing projects that attempt to incorporate content into the analysis.