



The Hong Kong Polytechnic University Department of Applied Mathematics

Colloquium

Communities within Networks

by

Professor Michael Small
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Abstract

Many complex systems are naturally represented as networks which lack an underlying geodesic space. That is, elements of the network are naturally represented by their interconnection and not by their position in any real space. A favourite problem in complex systems is then how best to infer sensible communities from the network adjacency matrix. To be able to better frame this question, we first need to more precisely say something about what we mean by "sensible" communities. The usual way to do this is to define a statistical measure that quantifies the relative number of inter- to intra- community links - which we call "modularity". With this in mind, there are several methods one can apply to choose suitable sets of communities which achieve local optimality of this measure. I will describe some standard methods and some of our own approaches to this problem. Most recently we have developed methods that embed the network in a suitable geodesic space and then borrow ideas from computational clustering algorithms to detect communities (joint work with Arif Mahmood, formerly of UWA now with Qatar University). If I get time, I hope to finish by spending a few minutes talking about generative algorithms for networks with communities - the problem here is that while we have algorithms to generate networks with specific "nice" properties (preferential attachment, for example), and we have algorithms to generate communities, the algorithms to generate "nice" networks with communities are rather clunky.

Biography

Michael is the CSIRO-UWA Chair of Complex Engineering Systems and based in the School of Mathematics and Statistics at the University of Western Australia (UWA), and the Mineral Resources flagship of CSIRO (CSIRO is the Australian government research agency - the Commonwealth Scientific and Industrial Research Organisation). His work is broadly in the area of Dynamical Systems and Complex Systems, and in particular nonlinear time series analysis, complex networks and collective behaviour. Prior to his current appointment, Michael held an ARC Future Fellowship at UWA, where he is also Winthrop Professor of Applied Mathematics. Before that he had various faculty teaching and research and post-doc positions in the Department of Electronic Engineering at Hong Kong Polytechnic University (2000-2011) and a post-doc appointment in Physics at Heriot-Watt University, Edinburgh (1998-2000). Last millennium he graduated from UWA with an honours degree in Pure Mathematics (dissertation in History of Mathematics) and a PhD in Applied Mathematics. He is editor of Chaos, associated editor of International Journal of Bifurcation and Chaos and IEEE Transactions on Circuits and Systems II, and also on the editorial board of several specialist Journals.

Date : 17 January, 2018 (Wednesday)

Time : 3:00p.m. – 4:00p.m.

Venue : TU801, The Hong Kong Polytechnic University

***** ALL ARE WELCOME ****