Network-decentralised approaches to dynamical networks

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Polo scientifico-tecnologico Fabio Ferrari – via Sommarive 9 - Trento

Abstract:
Dynamical networks are interconnected systems whose overall dynamic behaviour results from the interaction of several dynamic subsystems (units, or agents). They constitute a broad class of models that includes both natural systems, for instance biochemical systems, food webs and social networks, and artificial systems, such as production and distribution systems, telecommunication systems, computer networks, vehicle platoons and multi-robot systems. Local interactions occur according to a possibly time-varying topology, which can be visually represented as a graph, or hyper-graph, and their interplay determines the global behaviour of the dynamical network. In engineered systems, the local interactions in a dynamical network can typically be designed to obtain the desired global behaviour. In this talk, network-decentralised control strategies will be considered, in which several control agents act locally and make their decisions based on local information only. Precisely, each control agent is associated with an arc in the interconnection graph and has knowledge exclusively about variables related to the nodes that the arc directly affects. Some theoretical results on network-decentralised stabilisability for linear systems and for nonlinear compartmental systems will be presented, showing that network-decentralised stabilisability is equivalent to stabilisability under suitable conditions. The asymptotic optimality properties of network-decentralised controllers will also be presented. Finally, the dual concept of network-decentralised estimation will be discussed, along with network-decentralised strategies for collision avoidance in multi-agent systems and for the solution of optimisation problems defined on a network.

Biosketch:
Giulia Giordano received her B.Sc. and M.Sc. degrees summa cum laude in Electrical Engineering and her Ph.D. degree with a focus on Systems and Control Theory from the University of Udine, in 2010, 2012 and 2016, respectively. She visited the Control and Dynamical Systems group, California Institute of Technology, in 2012 and the Institute of Systems Theory and Automatic Control at the University of Stuttgart in 2015. Between 2016 and 2017 she was in the Department of Automatic Control and LCCCN Linnaeus Center, Lund University. Since September 2017, she has been an Assistant Professor at the Delft Center for Systems and Control, Delft University of Technology.

Her main research interests include the study of dynamical networks, the analysis of biological systems and the control of networked systems.

She received the Outstanding TAC Reviewer award letter from the IEEE Transactions on Automatic Control in 2016, the EECI PhD Award 2016 from the European Embedded Control Institute for her PhD thesis "Structural Analysis and Control of Dynamical Networks" and the IFAC NAHS Paper Prize 2017 as a co-author of the paper "A Switched System Approach To Dynamic Race Modelling", Nonlinear Analysis: Hybrid Systems, 2016. She was awarded the Delft Technology Fellowship in 2018.

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