Application BASTRI

Fiches Equipes

DANCE (SR0904ZR)

Dynamique et contrôle des réseaux
NECS (SR0863XR) DANCE

Statut: Décision signée

Responsable : Paolo Frasca

Mots-clés de "A - Thèmes de recherche en Sciences du numérique - 2023" : A1.2.6. Réseaux de capteurs , A1.2.7. Systèmes cyber-physiques , A1.2.9. Réseaux sociaux , A1.5. Systèmes complexes, systèmes de systèmes , A6.1.1. Modélisation continue (EDP, EDO) , A6.1.3. Modélisation discrete (multi-agent, individus centrés) , A6.4. Automatique , A8.8. Théorie des réseaux

Mots-clés de "B - Autres sciences et domaines d'application - 2023" : B2.3. Epidémiologie , B6.3.4. Réseaux sociaux , B7. Transport et logistique , B8.2. Ville connectée

Domaine : Mathématiques appliquées, calcul et simulation
Thème : Optimisation et contrôle de systèmes dynamiques

Période : 01/02/2021 -> 31/12/2026
Dates d'évaluation : 12/01/2022

Etablissement(s) de rattachement : UGA, CNRS
Laboratoire(s) partenaire(s) : GIPSA-LAB (UMR5216)

CRI : Centre Inria de l'Université Grenoble Alpes
Localisation : Centre de recherche Inria de l'Université Grenoble Alpes
Code structure Inria : 071139-0

Numéro RNSR : 202123950W
N° de structure Inria: SR0904ZR

Présentation

Our mission is to advance the field of Automatic Control to meet the challenges of today's hyper-connected society. We perform both fundamental research about control systems theory and about network science, as well as applied research in relevant domains such as mobility, transportation, social networks, and epidemics.

Axes de recherche

The research of DANCE (formerly known as NeCS) combines Automatic Control and Network Science to address the challenges of today's hyper-connected world. We perform fundamental research in the theory of control systems and networks, as well as research in relevant domains of application, such as mobility and transportation, social networks, and epidemics. The research of DANCE team is structured into five Research Axes.

Axis 1: Automatic Control Methods for Networks

Classical methods from Automatic Control do not apply well to networks, simply because they were designed for systems that do not have a network structure. Once the presence of network structure is composed of multiple parts that interact with each other and whose interactions are described by a network. Firstly, a network structure implies obstructions to the flow of information between different parts of the system. A key instrument to take them into account is the deployment of graph-theoretical methods. Secondly but not less importantly, a network structure implies the opportunity (or sometimes the need) to scale the network up in size, growing larger and larger networks by the addition of nodes and edges. Sometimes, classical control methods scale poorly in terms of complexity or performance, and therefore need overhaul. This research axis therefore pertains to the development of system-theoretic methods that are based on graph theoretical representations of the system and whose complexity and performance scale well with the size of the network, so that networks with tens or hundreds of nodes can be studied.

Contact

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En savoir plus

- Site de l'équipe
- Site sur inria.fr
- Site du responsable
- Derniers Rapports d'Activité : 2021 , 2022 , 2023

Documents sur la structure

- Intranet
- Privés

Décisions

- 14671 (01/02/2021) : création
- 15853 (14/12/2022) : prolongation
- 16225 (02/06/2023) : prolongation

Localisation

- **Adresse postale :** Centre de recherche Inria de l'Université Grenoble Alpes Inovallée 655 Avenue de l'Europe - CS 90051 38334 Montbonnot CEDEX France
- **Coordonnées GPS :** 45.218, 5.807

Axis 2: Approximate methods for Large-scale Networks

Graph-based methods have intrinsic limitations that make them usuitable to very large networks. Indeed, their topological structure is often not well known, because of the presence of noise, errors in data, links changing in time. Additionally, the applicability of estimation and control methods is constrained by the limitation of computational resources. In order to address these limitation, this research axis develops system-theoretic methods for large-scale networks that abstract from the detailed network state, by performing operations of aggregation or approximation. These tools are meant to be applied to networks with thousands of nodes. This line of work has been boosted by the ERC Advanced Grant Scale-freeBack and currently sees the development of three complementary approaches:

- Node aggregation and scale-free methods, whereby a large graph is summarized into a much smaller equivalent graph;
- The continuation method, whereby a networked system of ODEs is trasformed into a PDE;
- Graphons, whereby the network graph is substituted by a continuum.

Axis 3: Smart Transportation Systems

Smart transportation is the main domain of application for the team. The research topics include cooperative control of Connected and Autonomous Vehicles, pedestrian navigation, vehicular traffic in urban road networks, and multi-modal transportation. The experimental platforms Grenoble Traffic Lab (GTL) and GTL-Ville continuously collect real-time data about traffic in Grenoble. Other data collection campaigns, such as TMD-CAPTIMOVE, have produced datasets about multi-modal transportation.

Axis 4: Cyber-Social Systems

Cyber-social systems are systems where humans interact via a digital platform. Such are social networking services and e-commerce sites. Applying Automatic Control tools to such large and complex systems poses new challenges. This research has been supported by project DOOM and has seen the collaboration of the CNRS Center for Internet and the Society and of the Algorithmic Society Chair of the MIAI Institute of Grenoble.

Axis 5: Epidemics

The current COVID-19 pandemics has proved how important is the understanding of network dynamics to mitigate and contain epidemics. The group has taken up this challenge and produced multiple contributions that leverage our expertise about control of networks, social networks, online media, and human mobility. A network model of epidemics evolution coupled with human mobility in the Grenoble area can be visualized in the inferface GTL-COVID.

Relations industrielles et internationales

The team maintains and developes numerous external collaborations with industrial partners, such as Sysnav, applied research centers, such as IFPEN, and academic partners. Ongoing or recent international collaborations include University of California Berkeley (USA), University of Groningen (Netherlands), University of Twente (Netherlands), Université catholique de Louvain (Belgium), CNR-IEIIT Turin (Italy), Southeast University Nanjing (China), and Tokyo Tech (Japan).