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9th-2023 International Conference on Control, Decision and Information Technologies

CoDIT 2023

July 03-06, 2023 - Rome, Italy

IFAC INTERNATIONAL FEDERATION OF AUTOMATIC CONTROL

IEEE Advancing Technology for Humanity

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IEEE SMC Systems, Man, and Cybernetics Society

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Welcome Message

It is with great pleasure that we welcome all the participants of the 9th Conference on Control, Decision and Information Technologies (CoDIT 2023) at the University of Rome La Sapienza, Facoltà di Ingegneria Civile e Industriale, July 3-6, 2023.

CoDIT, at its 9th edition, is now an affirmed conference in the field of Control, Optimization, Decision, Computer Science and Information Technologies. From its first edition in 2013 in Tunisia, CoDIT has gained more and more international importance, reaching this year over 830 submissions, which yield to the organization of 68 Technical sessions. The Conference is enriched by 4 plenary talks from internationally recognized researchers on emerging research topics. This year the Conference features also a cultural event with the Gala Dinner held at The Botanical Garden of Rome, between Via della Lungara and Gianicolo Hill.

The conference is organized under the technical sponsorship of the IEEE Control Systems Society, the IEEE Systems, Man, and Cybernetics Society, the IEEE Robotics and Automation Society, and the International Federation of Automatic Control (IFAC) with the great support of the University of Rome "La Sapienza".

Finally, an event of this size and importance couldn't be organized without the strong commitment of all the members of the organizing committee and support and help of a large number of volunteers. Thank you all!

On behalf of the Organizing Committee

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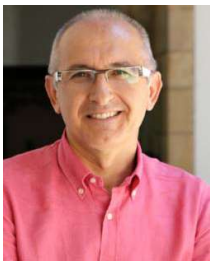
University of Tunis
Tunisia



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Keynotes

KEYNOTE 1

(July 03, 2023 / 10:30-11:20)

"Recent trends in opinion dynamics modeling"

Prof. Maria Elena Valcher

University of Padova, Italy

Chair: Prof. Bahram Shafai, Northeastern University, USA **Room :** Sala del Chiostro

Abstract

Over the last few decades, the 12aifeng12 and analysis of sociological phenomena have attracted the interests of researchers from various fields, such as sociology, economics, and mathematics.

Opinion dynamics models aim at describing and predicting the evolution of the opinions of a group of individuals as a result of their mutual influence/appraisal.

Some of the most celebrated models to describe how opinions of a group of mutually interacting individuals evolve are the Hegselmann-Krause (or Bounded-Confidence) model and the Friedkin-Johnsen (FJ) model. The former captures the natural attitude of individuals to be influenced only by the individuals whose opinions are reasonably close to their own. The latter, instead, models the attitude of individuals to form their opinions by balancing exogenous and endogenous influences, namely to find a compromise between the opinions of the other individuals and their a priori beliefs.

In this talk we will present recent results about extended versions of these two models, and present some future directions and challenges related to opinion dynamics models.

Biography of Prof. Maria Elena Valcher

Maria Elena Valcher received the Master's degree in electrical engineering and the Ph.D. degree in system engineering from the University of Padova, Padova, Italy, in 1991 and 1995, respectively.

Since January 2005, she has been a full Professor with the University of Padova. She has authored or co-authored 80 papers, which appeared in international journals, 95 conference papers, 2 text-books, and several book chapters. Her research interests include multidimensional systems theory, polynomial matrix theory, behavior theory, cooperative control and consensus, positive switched systems, and Boolean control networks.

Dr. Valcher was in the Editorial Board of the IEEE Transactions on Automatic Control from 1999 to 2002 and Systems and Control Letters from 2004 to 2010. She has been on the Editorial Boards of Automatica since 2006, Multidimensional Systems and Signal Processing since 2004, SIAM Journal on Control and Optimization since 2012, European Journal of Control since 2103, and IEEE Access since 2014. She was Vice President Member Activities of the CSS from 2006 to 2007, Vice President Conference Activities of the CSS from 2008 to 2010, and CSS President in 2015. She was a recipient of the 2011 IEEE CSS Distinguished Member Award. Since January 2017, she has been the Editor-in-Chief for the IEEE Control Systems Letters.

KEYNOTE 2

(July 03, 2023 / 14:20-15:10)

"State estimation and event inference in discrete event systems"

Prof. Carla Seatzu

University of Cagliari, Italy

Chair: Prof. Maria Pia Fanti, Polytechnic University of Bari, Italy **Room :** Sala del Chiostro

Abstract

Partially observed discrete event systems are a general formalism dating back to the definition of nondeterministic finite state automata. The assumption is that the sequence of events generated by a system is observed through a mask, so that an observer may have incomplete information concerning the system's evolution and, correspondingly, the past and current state. This framework has been used to formalize and solve several problems. The most basic problem is that of state estimation, which in the automatic control literature is usually solved by building an observer. A related problem is that of fault diagnosis which consists in establishing if a system is affected by a malfunctioning and identifying its nature. An additional interesting problem in the context of fault diagnosis is diagnosability analysis, which aims to determine if a system is diagnosable, i.e., if the occurrence of a fault can be identified in a finite number of steps. More recent problems in the area of cyber-security, are opacity, a privacy issue of great importance to ensure data secrecy, and the dual notion of intrusion detection, i.e., understanding if a system's evolution has been affected by the action of some external agent. In the case of cyber-physical systems, all the above problems become more challenging because the estimation may be subject to malitious cyber attacks, thus ad hoc approaches need to be formulated.

The objective of this talk is that of describing the general setting of partially observable discrete event systems showing, by means of examples, how some of the above-mentioned problems can be addressed. A 13aifeng13he on the most relevant open issues is this area is finally presented.

Biography of Prof. Carla Seatzu

Carla Seatzu is Full Professor of Automatic Control at the Department of Electrical and Electronic Engineering of the University of Cagliari where in 2018-2022 she was Coordinator of the B.Sc. Degree in Electrical, Electronic and Computer Engineering; in 2015-2018 she was Vice-President of the Faculty Committee of Engineering and Architecture; in 2014-2019 she was Vice-Coordinator of the Ph.D. Program in Electronic and Computer Engineering. Her research interests include discrete-event systems, Petri nets, hybrid systems, networked control systems, manufacturing and transportation systems. She is author of over 270 publications, including over 80 papers in international journals and 1 textbook. Her h-index in Scopus is equal to 38.

She is editor of 2 international books and the proceedings of 2 international conferences. Currently she is Senior Editor of the IEEE Control Systems Letters and the IEEE Trans. On Automation Science and Engineering. She is Department Editor of Discrete event dynamic systems. She actively collaborated to the organization of several international events: she was Program Chair of the 23rd IEEE Int. Conf. on Emerging Technologies and Factory Automation (2018), Workshop Chair of the 55th IEEE Conf. on Decision and Control (2016) and General Co-chair of the 18th IEEE Int. Conf. on Emerging Technologies and Factory Automation (2013). She is Chair of the IFAC Technical Committee on Discrete Event and Hybrid Systems and has been Co-Chair of the IEEE Industrial Electronic Society – Technical Subcommittee on Industrial Automated Systems and Control. She has been visiting professor in several foreign universities in Spain (Zaragoza), USA (Atlanta), Mexico (Guadalajara), and China (Xi'an, Hangzhou).

KEYNOTE 3

(July 04, 2023 / 10:20-11:10)

"Modeling, Analysis, and Design of Influence in Multi-Agent Systems"

Prof. Bruno Sinopoli

Washington University, USA

Chair: Prof. James H. Lambert, University of Virginia, USA **Room :** Sala del Chiostro

Abstract

Systems of intelligent agents interacting according to their own policies may yield behavior that is contrary to the social good of the community. To achieve regulatory control objectives that change the group's equilibrium behavior, an intelligent central planner (CP) must understand the learning mechanisms at the individual level, characterize how global intervention disrupts these learned action processes, and choose control policies that induce the desired change. This framework describes phenomena such as social media, financial networks, and cyber-physical systems like power grids. In this talk I model this influence structure as a Markov decision process (MDP) with the CP as the controller. I characterize the CP's capabilities for a given scenario by analyzing the reachability of control objectives and finding policies that attain reachable objectives. I discuss how to implement cluster-based control policies, from how to efficiently compute near-optimal clustered policies to using properties of submodular optimization to assign agents to clusters. Next, I consider the problem of model-free policy design that is robust to agent dropout. First, game theoretic techniques measure the potential impact of each agent on the CP's value function, and the desired robustness criterion is embedded into the MDP. The post-dropout MDP can be evaluated with high probability via policy importance sampling, and safe policy search routines find desirable robust policies while maintaining a baseline value. Future work is motivated that would enable more sophisticated control techniques to handle systems at scale and with greater complexity.

Biography of Prof. Bruno Sinopoli

Bruno Sinopoli is the Das Family Distinguished Professor at Washington University in St. Louis, where he is also the founding director of the center for Trustworthy AI in Cyber-Physical Systems and chair of the Electrical and Systems Engineering Department. He received the Dr. Eng. Degree from the University of Padova in 1998 and his M.S. and Ph.D. in Electrical Engineering from the University of California at Berkeley, in 2003 and 2005 respectively. After a postdoctoral position at Stanford University, Dr. Sinopoli was member of the faculty at Carnegie Mellon University from 2007 to 2019, where he was a professor in the Department of Electrical and Computer Engineering with courtesy appointments in Mechanical Engineering and in the Robotics Institute and co-director of the Smart Infrastructure Institute. His research interests include modeling, analysis and design of Resilient Cyber-Physical Systems with applications to Smart Interdependent Infrastructures Systems, such as Energy and Transportation, Internet of Things and control of computing systems. More recently, he has been working on understanding connections between Machine and human learning and influence mechanisms in multi agent systems.

KEYNOTE 4

(July 04, 2023 / 14:10-15:00)

"Optimization of Multi-Robot Systems"

Prof. Dimitri Lefebvre

Université Le Havre Normandie, France

Chair: Prof. Dimos Dimarogonas, KTH Royal Institute of Technology, Sweden **Room :** Sala del Chiostro

Abstract

In the last years, Multi-Robot Systems (MRS) have experienced considerablerecognition due to various real-world applications. Multi-Robot TaskAllocation (MRTA) is among the most interesting MRS problems. This problemconcerns the situation when a set of given tasks must be performed by ateam of mobile robots that collaborate with the intention of optimizing an objective function. The first objective of this talkis to present the MRTA challenges and applications, and to give a summary of the differentoptimization techniques proposed recently by researchers to solve MRTA problems.

The second objective is to provide an operational and methodological response for the monitoring of industrial areasin the perspective of MRTA. The aim is to optimize monitoring patrols of mobile agents that are responsible for the surveillance of such areas. Such agents are mostly formed by automated guided vehicles or unmanned aerial vehicles that carry various sensors. Apart from the specificities of each class of agents, the proposed approach is motivated by the need to inspect sites that may be dangerous or difficult to access, in particular after an event or a disaster.

The optimization of the missions is carried out in compliance with functional and operational constraints in the triple perspective of tasks allocation, patrol planification and trajectoriesrouting as far as these aspects are strongly correlated. The questions that will be discussed are as follows. How to define the patrol and trajectory of each robot? How many agents are required to perform a given set of tasks? How many sensors and what types of sensors must each of these agents equip? Such questions are studied in an MRTA setting, and an approach based on an informed search method is proposed for that purpose.

The longer-term challenge that is initiated here is to manage the resources for monitoring and intervention in high risked areas in an automated way by combining predictive and decision-making methods, and using model-based approaches as well as database-based approaches. Future challenges will be presented in the last part of the presentation including tasks updating, reliability aspects, optimization in distributed settings, infrastructure changes, maps recovery, security and communication issues and many others.

Biography of Prof. Dimitri Lefebvre

Dimitri Lefebvre (Senior Member, IEEE) received the S.B. in Science and Engineering in 1990, the M.Eng. degree in Automatic Control and Computer Science in 1992, and the Ph.D. degree Automatic Control and Computer Science in 1994, all from University of Sciences and Technologies and Ecole Centrale in Lille, France. In 1995, he joined the University of Franche Comté, Belfort, France, where he served as AssociateProfessor with the Department of Electrical Engineering and the Research Group about Systems and Transportations. Since 2001, he has been with University Le Havre Normandie, France as Full Professor. He is currently with the Research Group on Electrical Engineering and Automatic Control (GREAH) in Le Havre and was from 2007 to 2012 the head of the group. His current research interests include discrete event systems and stochastic systems with applications to security and safety in the domains of electrical engineering, robotics, transportations and logistics. He is the authors of more than 100 articles published in indexed journals and more than 200 communications in international conferences.