

Newsletter of the
FoCAS Co-ordination Action project



www.focas.eu

FUNDAMENTALS OF COLLECTIVE ADAPTIVE SYSTEMS

FoCAS

Issue 1 Summer 2013

FoCAS

Proactive Initiative
projects:

ALLOW ENSEMBLES

ASSISI | bf

CASSTING

DIVERSIFY

QUANTICOL

SMART SOCIETY

SWARM ORGAN



Jennifer, Fernando Graça and Penouisa Machado, 2008 <http://fmachado.dct.ucp.pt>



FoCAS is a Future and Emerging Technologies Proactive Initiative funded by the European Commission under FP7

About

FUNDAMENTALS OF COLLECTIVE ADAPTIVE SYSTEMS



The FoCAS coordination action is an umbrella project which aims to integrate, coordinate and help increase visibility for research carried out in the FOCAS Proactive Initiative and in research fields related to collective adaptive systems.

Coordination Action

www.focas.eu

FoCAS coordinates the research of 7 projects, but anyone or group can join if they have a research interest in Collective Adaptive Systems:

Activities include:

Roadmapping – defining the future research agenda by engaging with experts within and outside of Europe and running consultation events

Facilitating community building and collaboration opportunities for researchers interested in collective adaptive systems through workshops and conferences

Online media lounge with downloadable resources to encourage improved collaboration between researchers within Europe and internationally

Providing dissemination opportunities, a positive interface between scientists, industry and the science-aware public to demonstrate how CAS can impact on society

Providing training opportunities for researchers through summer schools and exchange opportunities

The socio-technical fabric of our society more and more depends on systems that are constructed as a collective of heterogeneous components and that are tightly entangled with humans and social structures. Their components increasingly need to be able to evolve, collaborate and function as a part of an artificial society.



FoCAS project partners:

Centre for Emergent Computing (Edinburgh Napier University, UK)

Computational Intelligence Group (VU University, Amsterdam)

Agent and Pervasive Computing Group (University of Modena and Reggio Emilia, Italy)

Intelligent Systems & Networks Group (Imperial College London)

Institute for Pervasive Computing (JKU, Linz, Austria)

Future & Emerging Technologies (FET) Proactive Initiative

FET-Proactive initiatives aim at focusing resources on visionary and challenging long-term goals that are timely and have strong potential for future impact. These goals provide a common strategic perspective and a focal point around which a critical mass of research can be assembled and synergies developed.

Proactive initiatives are launched through calls for proposals.



JOHANNES KEPLER
UNIVERSITY LINZ | JKU

FoCAS project in the media

James Sharpe on the Swarm Organ project and futuristic technologies.

James Sharpe, ICREA research professor, Centre for Genomic Regulation (CRG) explains how computer science and biology are going to change the way we build things and therefore the kind of things we can build. He predicts that once we eliminate the separation between the doers, thinkers and the object we are building, human technology will cease to be fragile.

<http://www.theguardian.com/media-network/media-network-blog/video/2013/jul/25/activate-2013-james-sharpe>



James Sharpe on the Swarm Organ project and futuristic technologies – video



FoCAS at ICT 2013 Create, Connect, Grow Vilnius, 6-8 November, 2013

The FoCAS session will be held in room A on 7 Nov at 18.50

More than 4000 researchers, innovators, entrepreneurs, industry representatives, young people and politicians are expected in Vilnius. The event will focus on Horizon 2020 - the EU's Framework Programme for Research and Innovation for 2014-2020.

<http://ec.europa.eu/digital-agenda/ict-2013>



Session title:

FoCAS on multi-disciplinary approaches for smart, green and integrated transport

Underlying Horizon2020's vision is the assumption that breakthrough solutions can emerge from multi-disciplinary collaboration. This networking session organised by FoCAS will specifically consider how multi-disciplinary approaches can best be used to address societal challenges, and will also identify some limitations. One ICT priority (smart, green and integrated transport) has been selected to demonstrate some principles for the multi-disciplinary approach.

FoCAS projects

FoCAS Coordination Action Partners and People:

Centre for Emergent Computing (Edinburgh Napier University, UK):

Ben Paechter | Emma Hart | Jennifer Willies | Callum Egan | Ingi Helgason

Computational Intelligence Group (VU University, Amsterdam):

Gusztav Eiben | Mark Hoogendoorn

Agent and Pervasive Computing Group (University of Modena and Reggio Emilia, Italy):

Giacomo Cabri | Franco Zambonelli

Intelligent Systems & Networks Group (Imperial College London):

Jeremy Pitt

Institute for Pervasive Computing (JKU, Linz, Austria):

Alois Ferscha

Coordinating research into the Fundamentals of Collective Adaptive Systems

1. New functionalities for adaptive ICT systems
2. New insights into the general properties of large scale distributed systems

FUNDAMENTALS OF COLLECTIVE ADAPTIVE SYSTEMS



FoCAS coordinates the research of 7 projects, but anyone or group can join if they have a research interest in Collective Adaptive Systems. The Proactive initiative projects FoCAS supports are described here.



JOHANNES KEPLER UNIVERSITY LINZ | JKU

ALLOW ENSEMBLES



Imperial College London

IPVS & IAAS (Stuttgart, Germany): Michael Matthiesen | Kurt Rothermel | Dimka Karastoyanova | Frank Leymann | Adnan Tariq

Embedded Intelligence Research Group, DFKI (Germany): Paul Lukowicz | George Kampis

Service Oriented Applications Research Unit, FBK (Italy): Marco Pistore | Antonio Bucchiarone | Annapaola Marconi

Distributed Software Engineering (Imperial College London, UK): Naranker Dulay | Alessandra Russo

Transformation Service Laboratory (University of Crete, Greece): Christos Nikolaou | Marina Bitsaki | Mariana Karmazi

The recent advances in pervasive technologies enable construction of large-scale socio-technical systems which tightly interweave humans and their social structures with technology. The overall goal of Allow Ensembles is to develop a new design principle and establish a new foundational framework for collective adaptive systems (CAS) based on the concept of cell ensembles.

www.allow-ensembles.eu

ASSISI | bf



Artificial Life Lab (Austria): Thomas Schmickl | Karl Crailsheim | Ronald Thenius | Sibylle Hahshold | Martina Szopek | Michael Bodi

Robot Systems Laboratory (EPFL, Switzerland): Francesco Mondada | Christophe Barraud

Cybertronica UG (Germany): Serge Kernbach | Olga Kernbach

Laboratory for Robotics and Intelligent Control Systems (LARICS, Croatia): Stjepan Bogdan | Damjan Miklic | Karlo Griparic | Tomislav Haus

Interdisciplinary Laboratory for Energy of Tomorrow (LIED, Paris, France): Jose Halloy | Bertrand Collignon | Axel Séguet

Dept of Informatics, Lisbon University (Portugal): Luis Correia | Ana Paula Cláudio | Pedro Mariano | Fernando Silva

The main goal of ASSISI is to establish a robotic society that is able to develop communication channels to animal societies (honeybees & fish swarms) on its own.

These robots will adapt by evolutionary algorithms until they have learned to interact with animals in a desired way. This new technology is aimed to lay new foundations on the way in which humans can interfere with animal societies in order to manage the environment.

www.assisi-project.eu

CASSTING



CNRS (LSV, Cachan, France): Nicolas Markey

Formal Methods and Verification Group (ULB, Belgium): Gilles Geeraerts

Effective Mathematics Team (University of Mons, Belgium): Thomas Brihaye

Distributed and Embedded Systems Unit (Aalborg University, Denmark): Kim Larsen | Arne Skou

Seluxit ApS (Aalborg, Denmark): Daniel Lux

Energi Nord A/S (Aalborg, Denmark): Susanne M. Sørensen

Logic and Theory of Discrete Systems (RWTH, Aachen, Germany): | Christof Löding

The objective of CASSTING is to develop a novel approach for analysing and designing collective adaptive systems in their totality, by setting up a game theoretic framework. Here components are viewed as players, their behaviour is captured by strategies, system runs are plays, and specifications are winning conditions. We will develop formalisms for modelling collective adaptive systems as games, and algorithms for synthesising optimal strategies (and components).

www.cassting-project.eu

DIVERSIFY



INRIA (France): Benoit Baudry | Olivier Barais | Marco Biazzi | Martin Monperrus | Johann Bourcier | Benoit Combemale

SINTEF (Norway): Franck Fleurey | Franck Chauvel

Distributed Systems Group (Trinity College Dublin, Ireland): Siobhan Clarke | Hui Song | Vivek Nallur

ECOBIO (University of Rennes 1, France): Cendrine Mony | Benoit Gauzens

Ecological Board: Michael Hutchings (Uni. of Sussex) | William Kunin (Uni. of Leeds) | Carlos Melian (EAWAG) | Elisa Thébault (BIOEMCO)

DIVERSIFY explores diversity as the foundation for a novel software design principle and increased adaptive capacities in collaborative adaptive systems. Increased diversity in the system provides a pool of software solutions that can eventually be used to adapt to unforeseen situations at design time. The scientific development of DIVERSIFY is based on a strong analogy with ecological systems, biodiversity, and evolutionary ecology. DIVERSIFY brings together researchers from the domains of software-intensive distributed systems and ecology in order to translate ecological concepts and processes into software design principles.

www.diversify-project.eu

QUANTICOL



Laboratory for Foundations of Computer Science (University of Edinburgh, UK): Jane Hillston | Stephen Gilmore | Vashti Galpin

Formal Methods & Tools Group (CNR-ISTI, Italy): Mieke Massink | Maurice ter Beek | Luca Bortolussi | Stefania Gnesi | Diego Latella

Programming and Software Engineering (LMU, Germany): Mirco Tribastone

Laboratory for Computer Communication and Application (EPFL, Switzerland): Jean-Yves Le Boudec | Nicolas Gast

System Modeling and Analysis (IMT Lucca, Italy): Rocco De Nicola | Valerio Senni | Alberto Lluch Lafuente | Francesco Tiezzi | Michele Loreti

The design of collective adaptive systems (CAS) must be supported by a powerful well-founded framework for modelling and analysis. CAS consist of a large number of heterogeneous entities with decentralised control and varying degrees of complex autonomous behaviour. These entities may be competing for shared resources even when collaborating to reach common goals. The pervasive but transparent nature of CAS, together with the importance of the societal goals they address, mean that it is imperative that thorough a priori analysis and verification of their design is carried out to investigate all aspects of their behaviour before they are put into operation.

<http://blog.inf.ed.ac.uk/quanticol>

SMART SOCIETY



uni*tn*.it



U*h*oP*Per*



UNIVERSITY OF
Southampton

i*maginary*

Information Engineering & Computer Science (University of Trento, Italy): Fausto Giunchiglia | Vincenzo Maltese

Software Systems & Processes Group (Edinburgh, UK): David Robertson | Stuart Anderson | Michael Rovatsos | Subramanian Ramamoorthy

U-Hopper s.r.l. (Italy): Daniele Miorandi | Iacopo Carreras

Research Centre for Artificial Intelligence (DFKI, Germany): Paul Lukowicz | George Kampis

Oxford e-Research Centre (Oxford University, UK): Marina Jirotko | David de Roure

Information Systems Engineering (Ben Gurion University, Israel): Ya'akov (Kobi) Gal

i-maginary (Italy): Lucia Pannese

Privacy & Security Research Group (Karlstad University, Sweden): Simone Fischer-Hübner | Leonardo A. Martucci

Distributed Systems Group (TU Vienna, Austria): Schahram Dustdar | Hong-Linh Truong

Intelligent, Agents, Multimedia Group (University of Southampton, UK): Luc Moreau

Our goal is to move towards a hybrid system where people and machines tightly work together to build a smarter society. We envision a new generation of CAS centred on the two foundational notions of compositionality and diversity where humans and machines “compose” by synergically complement each other thus bridging the semantic gap between low-level machine and high-level human interpretation of data and where they interoperate collectively to achieve their possibly conflicting goals both at individual and societal levels.

<http://groups.inf.ed.ac.uk/smart-society>

SWARM ORGAN



UNIVERSITEIT VAN AMSTERDAM



Systems Biology (Centre for Genomic Regulation (CRG), Barcelona, Spain): James Sharpe | Olaf Kostbahn | Joaquim Calbo

Computational Science (University of Amsterdam, The Netherlands): Jaap Kaandorp

Nature Inspired Computing & Engineering (University of Surrey, UK): Yaochu Jin

Computational and Systems Biology (John Innes Centre, UK): Veronica Grieneisen

The SWARM-ORGAN project will focus on systems containing large numbers of autonomous but relatively simple agents, whose goal is to collectively organise themselves into complex spatial arrangements despite each agent having only local awareness. This particular question is directly relevant to both biological morphogenesis, and to new paradigms of distributed technology such as robotic swarms and amorphous computing.

<http://uva.computationalscience.nl/news/swarm-organ-genetically-programmable-self-patterning-swarm-organs>

FUNDAMENTALS OF COLLECTIVE ADAPTIVE SYSTEMS



FoCAS supported projects:

ALLOW ENSEMBLES

New design principle for large-scale collective systems

ASSISI_BF

Animal and robot Societies Self-organise and Integrate by Social Interaction

CASSTING

Collective Adaptive System SynThesis with Non-zero-sum Games

DIVERSIFY

Ecology-inspired software diversity for distributed adaptation in CAS

QUANTICOL

A Quantitative Approach to Management and Design of Collective and Adaptive Behaviours

SMARTSOCIETY

Hybrid and Diversity-Aware Collective Adaptive Systems

SWARM-ORGAN

A theoretical framework for swarms of GRN-controlled agents which display adaptive tissue-like organisation

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The socio-technical fabric of our society more and more depends on systems that are constructed as a collective of heterogeneous components and that are tightly entangled with humans and social structures. Their components increasingly need to be able to evolve, collaborate and function as a part of an artificial society.

Twitter: [@FETFoCAS](https://twitter.com/FETFoCAS)

FoCAS is a FET FP7 project 2013-2015