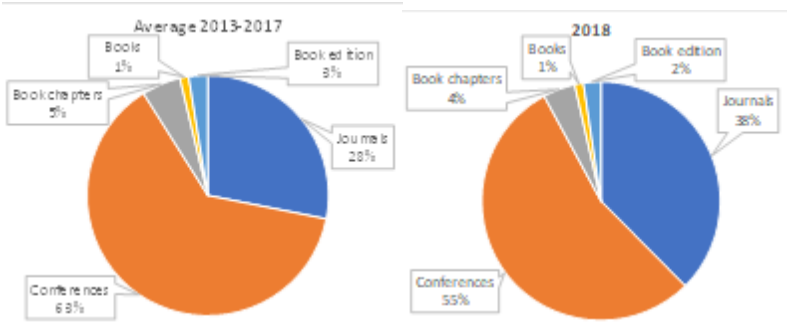
Center of Technology and Systems

NEWSLETTER

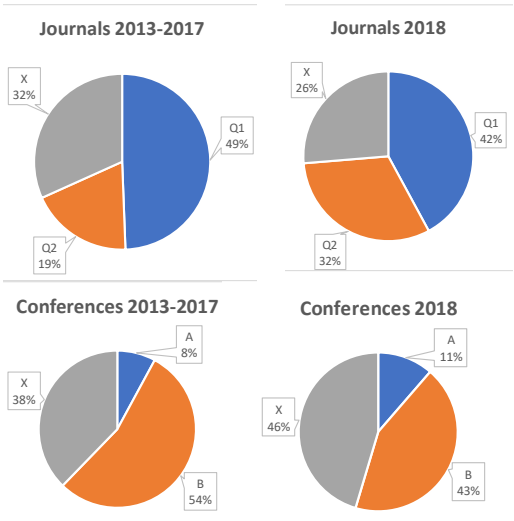
January 2019

CTS Publications in 2018

During last year CTS achieved great results. And this was done in spite of the big organizational effort that was necessary to put in the preparation for the 5-year evaluation of the center by the Portuguese Foundation for Science and Technology. In fact, focusing on the research outcomes we can notice various positive trends:



- A total of **256** publications, in comparison with 237 on average during last 5 years, which corresponds to 7.8% increase.
- his number corresponds to an annual average of 6.56 publications per integrated researcher, or 3.5 if considering also the collaborators, which is an excellent indicator.
- In terms of distribution, there is more emphasis on publications in journals instead of conferences, which is a very good sign. Nevertheless, we should pursue this effort to publish more in journals and less in conferences.
- In terms of quality of journal publications there is a good increase of the percentage of articles in Q1+Q2 journals, with a corresponding decrease of publications in less qualified journals. However, this increase was basically in Q2 journals.
- In terms of quality of conference papers, there are contradictory signs: On one hand there is an increase of papers in A-level conferences (ranking of FCT-NOVA), but on the other hand there is also an increase of papers in less recognized conferences. CTS researchers and PhD students need to pay more attention to the conferences they attend.



Among the X-marked conferences there are some new conferences, focusing on emerging topics, which are not yet in the FCT-NOVA ranking or Australian CORE ranking. It is reasonable to expect that CTS will have some moderate presence in such conferences. Also, some of the "X" conferences, although not included in the mentioned rankings, are indexed in SCOPUS or Web of Science. But there is also some percentage of publications in non-indexed conferences, which should be avoided. Publishing in such conferences often represents a waste.

I would like to take this opportunity to congratulate all of you for the great achievements of 2018 and the effort to improve the quality of publications. This is the path we should pursue.

Let's now focus on doing even better in 2019. Doing better through increasing the percentage of publications in high-quality journals. Doing better through reducing substantially the presence in non-ranked / not-indexed conferences.

Doing better in terms of principles. It is necessary to avoid, at all cost, "honorary" authorships. CTS shall follow healthy authorship rules, such as the IEEE recommendations, which I'd like to re-state here:

"Authorship credit must be reserved for those who met each of the following conditions:

1. *Made a significant intellectual contribution to the theoretical developments, system or experimental design, prototype development, and/or the analysis and interpretations of data associated with the work contained in the manuscript;*
2. *Contributed to drafting the article or reviewing and/or revising it for intellectual content;*
3. *Approved the final version of the manuscript, including references*."

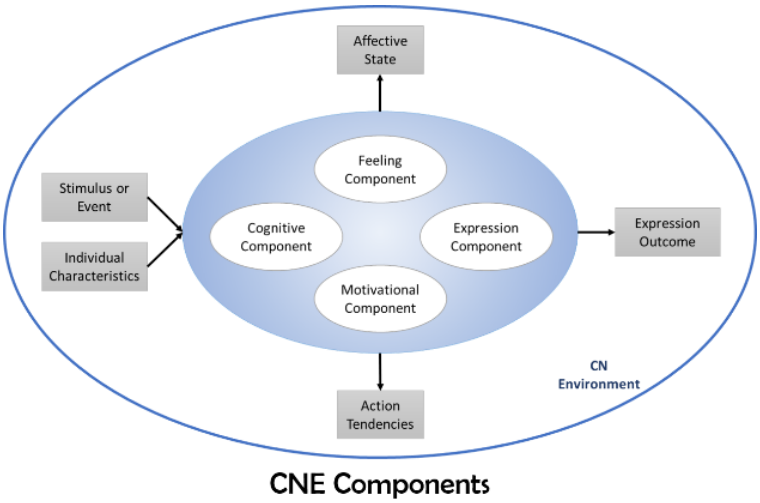
Also doing better in terms of increasing collaboration among knowledge areas. From an analysis of the 2018 publications, we can notice some good signs of cross-fertilization between areas. But we can also notice that some closed "clubs of authors" persist. It is necessary to break such barriers and increase internal collaboration. The big potential of CTS lies on its capability to pursue **interdisciplinary research**!

Let's do even better in 2019!

Luis M. Camarinha-Matos, CTS director.

C-EMO: A Modeling Framework for Collaborative Network Emotions

Recent research in Collaborative Networks (CN) is focusing on the socio-technical aspects of collaboration in detriment of the pure technological ones, especially in what concerns finding approaches to solve management and decision issues such as handling collaboration failures or potential conflict. With the development of such systems the interplay of social interactions, organizational complexity and technology within the CN is recognized, bringing in this way, another contribution to the CN sustainability.

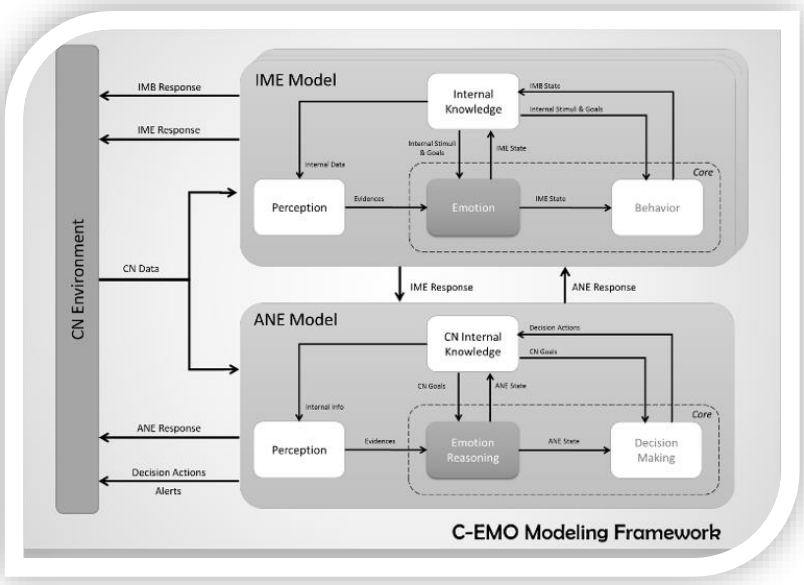


CNE Components

Emotion is an important factor in human and social communication involving feelings, experience, behavior, physiology and cognition. It has been used as a mean of interaction in several fields of science like psychology, sociology, artificial intelligence (AI), and human-computer interaction (HCI) with the use of emotional agents. In the context of CN, "emotions" can influence the experience of participants, which are mainly SMEs, by increasing the achievement and performance level, motivation, commitment, satisfaction and excitement in interaction with each other and with the whole CN. On the other hand, when viewed from a more holistic perspective, emotions are expected to improve the performance and health of CNs, namely in what concerns the collaboration and conflicts management and sustainability, decision-making processes and quality of participant's interactions and relationships.

The idea behind this work aims at supporting managers and decision-makers with a new and innovative approach capable of "sensing" the cognitive aspects of CNs by means of appraising/assessing the "emotional" health/status of the CN itself and the member companies in a non-intrusive way. For that, a modeling framework inspired on human sciences theories and computational models of emotion is proposed, the Collaborative EMOtion modeling framework (C-EMO). In this framework the concept of emotion within a CN environment, the Collaborative Network Emotion (CNE), is introduced and its components described. This work is guided by the following research question: "What could be a suitable modeling framework and modeling methodology approach to support the concept and estimation/appraisal of collaborative network emotions and help decision-making processes, in a non-intrusive way, within a collaborative network environment?".

The knowledge of the collaborative network emotion can serve as another criterion decision-makers use to generate decisions and formulate sound policies (potentially avoiding conflicts) and outcomes to the enterprise collaboration environment / business ecosystems. In addition, the C-EMO modeling framework can also be a solid ground to researchers further experiment with behavioral models.



In this line, the main contributions of this work are separated into three levels: conceptual; modeling approaches; and technological. The conceptual level is divided in two parts: (i) the CNE concept and theory, which is introduced as a novel approach and is based on the appraisal and dimensional theoretical models of human emotion and inspired from the CATHEXIS, WASABI and KISMET computational models of emotion extended to collaborative enterprise networks. The CNE concept, which is composed of the individual member emotion (IME) and aggregated network emotion (ANE), is complemented with the definition of four CNEs: excitement, contentment, frustration and depression. These emotions are defined based on the Russell's circumplex model of affect and characterized according to two dimensions: Valence and Arousal. (ii) the C-EMO modeling framework, which is gives support to the concept and modeling of CNE comprises two novel building blocks: the IME model and the ANE model responsible for the appraisal of the individual emotions and aggregated emotion, respectively. These models are based on the holistic perspective of Scherer which

considers emotion as a process rather than a simply affective state that influences cognition. In this sense, both the IME and the ANE processes are composed of four components: the cognitive component for evaluating the events and stimulus that are significant according to each CN player appraisal criteria; the feeling component for categorizing the appraisal results with the corresponding emotional responses or CNE states (excitement, frustration, etc.); the motivational component for understanding the behavioral intentions that the CNEs carry and the different response actions; and the expression component for transmitting emotions to the CN environment.

The modeling approaches comprises the development of two models, based on system dynamics modeling techniques, to model the dynamics of the appraisal of the individual member emotions (IMEA SD model) and the aggregated network emotions (ANEA SD model); and the development of an agent-based model to represent the CN and its members, and the interactions among them.

At the technological level, the development of a simulation tool implemented using the AnyLogic modeling tool (combining system dynamics and multi-agent systems). With this implementation, the C-EMO modeling framework and the designed modeling approaches are validated through the simulation runs of a set of validation scenarios.

To finalize, the proposed idea can be seen as pioneer research work since no other works related to the study of emotions applied to organizations (not humans) in the context of CN were found so far. In this line, this proposal intends to provide a first step in this innovative research context.

Filipa Ferrada

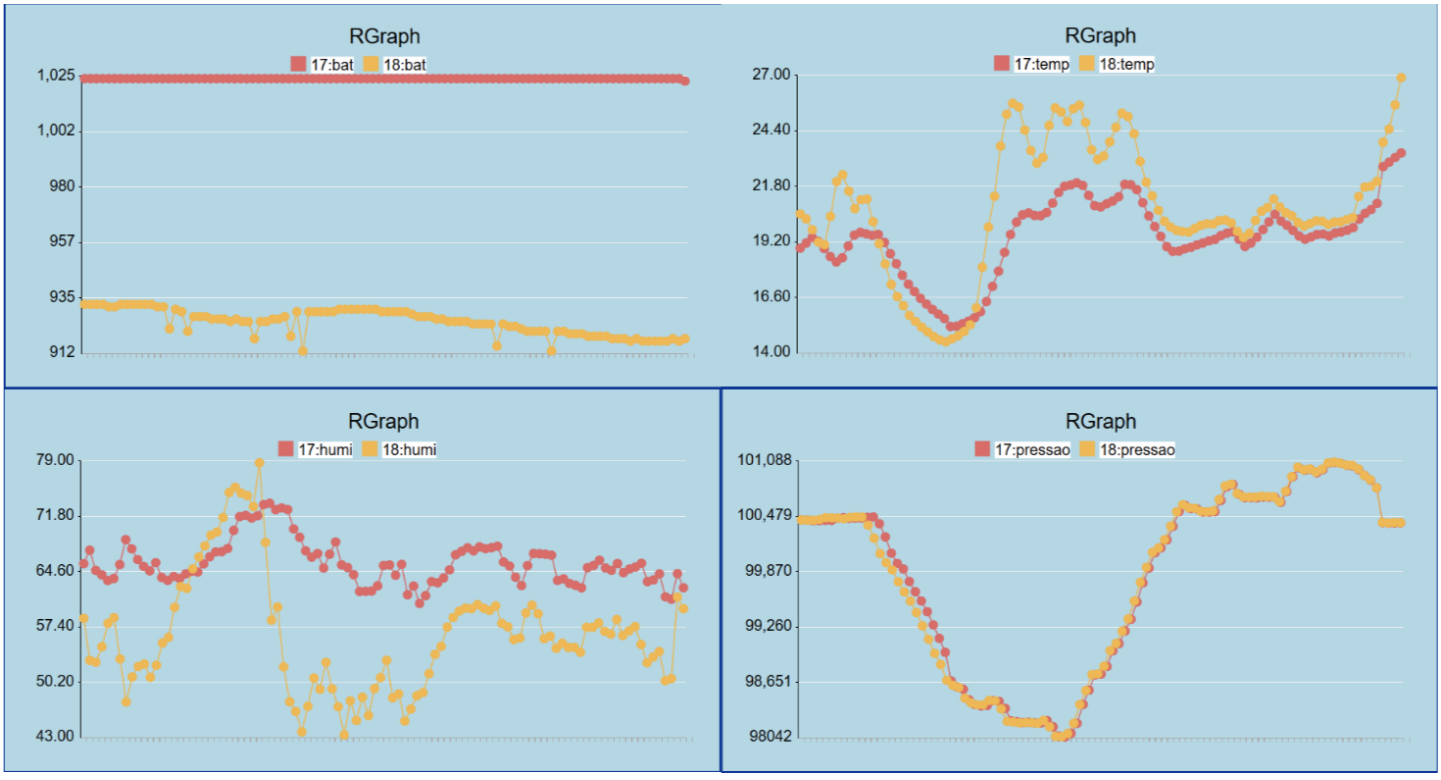
CONTENTS

CTS evaluation day by the Portuguese Foundation for Science and Technology

CPS and IoT: two roads for your data to follow

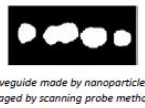
Very commonly IoT (Internet of Things) is heard in the news and gadget stores where users run for their wearables happily connecting to the cloud and enjoying living as an updated human. IoT has devices that produce data on one end and on the other there are services or applications that use that data. But it is not that simple if you look at different models and perspectives in the Internet. Devices can be physical and or virtual, with different data types, producing rates and availability. Data has to be stored somehow whether or not it had pre-processing or will be subjected to post-processing. Things get more interesting when several sets of device data are correlated producing information that gives that data an added value. This can even be expanded to devices belonging to different users and even acquired at different moments in time; allowing a global understanding of that information. Access to the data means that some sort of management, privacy and security is involved. Conclusions taken from the information and eventual decisions, policies about it means that some kind of reasoning, human or not, must be available. And to close the loop, eventual control to the devices with data streaming towards the devices that produced the data or eventually other devices; for example humidity sensors distributed over a large area, a watering system and weather prevision information about rain or drought predictions. IoT is ear catching with a clear meaning: things connected to the Internet; where people already have access too so they can easily guess its potential and dream of new things. Another point of view is CPS (Cyber Physical Systems) where cyber comes from the Greek word which means *"skilled in steering or governing"*, mainly used in the USA and academia, while China, other governments and the market prefer IoT. Is there a difference between IoT and CPS? To make it simple, without Internet you don't have IoT but you can still have some CPS systems working if they do not use the Internet. So CPS (with roots on control, real-time systems and sensor networks) includes all IoT (rooted in communications). As a real application example using the BlueLab IoT platform is the walk made near Sesimbra, Portugal on the 01.12.2018 from 09:30h till 12:35h. An Android system sent the GPS latitude and longitude coordinates, while two prototype devices sent temperature, humidity, pressure and their battery level to the internet. The following figures show the values within that time span. A keen eye can quickly look at these results and see many correlations as well as unanswered questions. IoT users can become Smart Citizens when their IoT devices or CPS systems contribute to the society mainly to Smart Cities or Smart Agros. For that to happen, many loose points must be solved, from calibration, data range, resolution and units, timestamp and jitter, confidence criteria, information sharing, validation and many other aspects. This year will also bring to life some planed Smart Citizen events based on the BlueLab Iot platform. Stay tuned.

Vitor Vaz da Silva

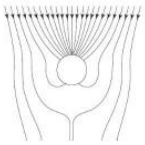


Nano-Engineering and Energy

Cyber-physical systems are based on the triangle matter-energy-information, where computers/physical world interaction give rise to a wide range of applications. The Laboratory of Nanophysics/Nanotechnology and Energy (N2E) led by Rui Lobo is focused on the matter-energy binomial with primarily incidence in nanophysics and energy. In a few words, this is a cornerstone that may enable people interested in these areas to develop joint activity. With major valences in nanophysics, the laboratory provides facilities achieved through projects in which FCT-UNL has been involved. They are also an output of international collaboration, indispensable in any cutting edge research: precision instrumentation for optics, scanning probe microscopies including SNOM, lasers, nanoparticle production, spectroscopy and mass spectrometry, hydrogen conversion and storage, high vacuum, coincidence and high voltage electronics.

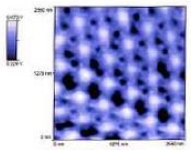


Plasmon waveguide made by nanoparticles assembled and imaged by scanning probe methodology



Energy flow directed toward a metal nanoparticle under plane wave excitation occurring at the plasmonic frequency

SNOM probe with optical aperture assembled in a micro-tunning fork



Near-field optical image of a plasmonic array

From collaboration with congenial groups abroad, some milestones in carbon nanotechnology (especially involving carbon nanotubes) and nanoparticles analysis have been obtained, as well as dealing with different types of scanning probe microscopies. These achievements have been object of publications as Q1 papers, books and other disruptive articles.

Since CTS develops many activities in domains of electronics and electrical engineering with research activities focused in systems with growing levels of intelligence, interconnectivity and global concerns (like sustainability and energy efficiency), an interdisciplinary approach is demanding to create value with research results. Given this framework, envisaged collaboration with other groups can take advantage of the present interests and activities in antenna energy harvesting, hydrogen conversion and storage technology, renewable energy driven CO2 conversion into useful products, thermodynamics for energy efficiency and electromagnetic propulsion.

Nano-engineering requires a fundamental understanding of the physics and chemistry that operates at the sub-micrometer level. Therefore, the knowledge in light scattering, plasmonics, nano-electro- and photo-catalysis together with quantum technologies can be combined with skills of other groups (in particular those involved with energy efficiency, sensors for environment applications, or telecommunications) to pursue the cyber-physical pathway.

Rui Lobo

As an example, the study of light at dimensions smaller than its wavelength and smaller than today's smallest electronic devices deals with metal conduction electrons coherent oscillations (plasmons) and near-fields (evanescent waves). Some nanostructures act as superlenses, and waveguides for electromagnetic energy below the diffraction limit of light which allow to design new optical devices which can be further integrated with microelectronics. As nanoscale sensors are expected to give a recognizable signal in response to the condition or thing it is designed to detect, plasmonics gives rise to a broad of creative applications in the aim of the already mentioned interests of the group.

In conjunction with DoCEIS2019 it will take place the third edition of the International Young Engineers Forum (YEF-ECE). As usual, this event will be a unique opportunity for young engineers to connect with each other enabling experience's sharing and to become internationally active. Last year's edition counted with 17 presented papers, out of 44 submissions from 16 countries.

IMPORTANT DATES

Now	**28 Feb 2019**	**29 Mar 2019**	**12 Apr 2019**
Submission of abstract	Submission of full paper	Notification of authors	Submission of camera ready

http://sites.uninova.pt/yef-ece

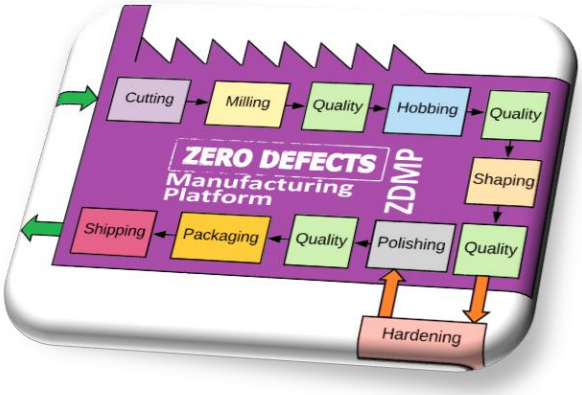
Smart4Health

In 2017 the European Commission listed three main priorities for the Digital Single Market: 1) Citizens´ secure access to electronic health records and the possibility to share it across borders, 2) Supporting data infrastructure, to advance research, disease prevention and personalised health and care 3) Facilitating feedback and interaction between patients and healthcare providers, to support prevention and citizen empowerment as well as quality and patient-centred care.

Smart4Health project (SC1-2018-826117) answers to these priorities by enabling the citizen-centred EU EHR (Electronic Health Record) exchange for personalised health. This will pave the way for the full deployment of citizen-centred solutions and services in a digital single market for wellbeing and healthcare. Smart4Health will enable the bridging between the diverse EU EHR data and citizen-generated health data and will connect citizens to science and personalised health services. Smart4Health involves 18 partners from 8 different EU member states and the US, and is coordinated by UNINOVA. The project will run for 50 months (starting on the 1st of January of 2019) and is funded by the European Union with a grant amount of 21.781.120,00€.

ZDMP

In response to the H2020 call on Factories of the Future, it was submitted the ZDMP proposal (Zero-Defect Manufacturing Platform), with the aim of developing and establishing a digital platform for connected smart factories for achieving excellence in manufacturing through zero-defect processes and products thanks to the use of zero-defect core services for developing APPs. To validate ZDMP concept was included four industrial demonstrators (Automotive, Machine Tools, Construction and Electronics). These demonstrators enable a cross-sector and enhanced cooperation by providing companies of these different sectors in the same supply chain, with the aim of avoiding or reducing the appearance and spread of defects along the supply chain, and increasing cooperation seeking quick solutions in situations where quality problems occur. ZDMP involves 30 partners from 11 different EU member states and is coordinated by UNINOVA. This project will run for 48 months (starting on the 1st of January of 2019) and is funded by the European Union with a grant amount of €16.204.368,00.



Increase the Adoption of Agent-based Cyber-Physical Production Systems through the Design of Minimally Invasive Solutions

The new requirements and characteristics of the market force the companies to find and adopt new solutions. The existent production lines, based on the third industrial revolution and prepared to deal with mass production, are not able to deal with the new requirements. Moreover, the adaptation of the existent production lines requires changes that imply long stoppages and costs. That adaptation requires the change of the entire control logic and, in some cases, the hardware also. These changes require the design of new hardware and afterwards long periods of integration. The integration of the new hardware requires an enormous effort regarding the reprogramming of the control logic. With the improvement of the ICT in the last years the proposed production paradigms started to be implemented, tested and deployed in industrial environments.

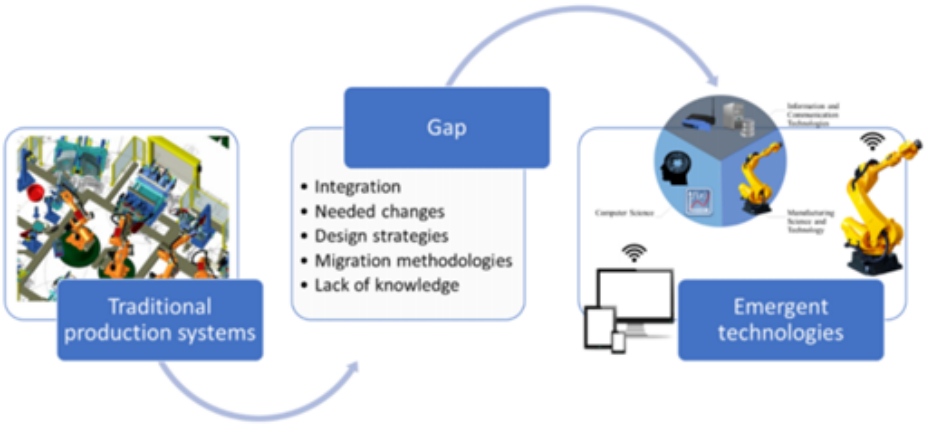
Hence, the concept of Cyber-Physical Production System (CPPS) emerged. Due to the design proposed for the CPPS, based on the abstraction of each component with a logical representation and the capacity to optimise the entire system through the collaboration among them, some implementations were proposed using Multi-Agent Systems (MAS) approaches. The concept of MAS proposes a distributed software where all the agents are autonomous and capable of communicating with each other in order to solve problems and optimise the system collaboratively. Although the companies see the added value of the solutions proposed so far, the changes required to adopt them make their application difficult and in most of the cases impossible. Since the factories are already established, with all the existent control logic and functionalities already running, the application of such solutions implies not only a financial

effort but also stoppages, wastes regarding existent hardware and tools, and the necessity to train the personnel about these new systems and available functionalities.

Hence, it is essential to analyse and assess which are the main difficulties and challenges found during the deployment of the solutions proposed. Moreover, it is necessary to understand which strategies can be delivered in order to close this gap and increase the adoption of these systems.

The approach followed in this PhD work aimed to assess the existent challenges as well as the definition of a strategy and path for the development of agent-based CPPS that imply fewer changes and increase the adoption of these solutions. Firstly, it is crucial to collect which requirements need to be fulfilled by the solutions in order to be considered more attractive for the companies. Furthermore, a list of Design Properties (DP) was prepared. The DPs are generic and applicable to the development of many agent-based CPPS.

André Rocha



NEWS

IEEE-CAS4IIoT: 2nd Seasonal School in Circuits and Systems for the Industrial Internet-of-Things in Lisbon, Portugal.

The 2nd Seasonal School in "Circuits and Systems for the Industrial Internet-of-Things" (CAS4IIoT) presents a joint academia-industry program in the field of IoT. CAS4IIoT - http://sites.ieee.org/portugal-btcasce/cas4iiot/ was organized by the Department of Electrical Engineering (DEE) at the Faculty of Sciences and Technology at NOVA University of Lisbon (FCT NOVA) together with the Centre of Technology and Systems (CTS) at UNINOVA Institute, on November 29-30, 2018. The organization was managed by João Goes CAS4IIoT Chair, Luis Oliveira, IEEE Portugal Section BT/CAS/CE Joint Chapter Chair, and João Oliveira, IEEE Portugal Section SSC Chapter Chair). The Seasonal School was sponsored by the Circuits and Systems (SSCAS) initiative of IEEE Circuits and Systems Society (CASS) and IEEE Solid State Society (SSC) in cooperation with IEEE Portugal Section BT/CAS/CE Joint Chapter and IEEE Portugal SSC chapter.

IoT can be envisaged as a dynamic network of interconnected physical and virtual entities ("things"), with their own identities and attributes, seamlessly integrated in order to e.g. actively participate in economic or societal processes, interact with services, and react autonomously to events while sensing the environment. By enabling things to connect and becoming recognizable, while providing them with intelligence, informed and context based decisions are expected in a broad range of domains spanning from health and elderly care to energy efficiency, either providing business competitive advantages to companies, either addressing key social concerns. The level of connectivity and analytical intelligence provided by the IoT paradigm is expected to allow creating new services that would not be feasible by other means.

CAS4IIoT prepared a group of +70 post-graduated students, design engineers (coming from different countries), and more than 300 undergraduate students (for the open seminars), with the capacity to understand and design a broader range of circuits and systems, in the field of IoT. CAS4IIoT seminars covered a wide range of circuits and applications, spanning from data converters and sensor interfaces to energy harvesting circuits, artificial intelligence, and Industrial IoT, ensuring a good balance between academia and industry, combined with a judicious selection of worldwide distinguished lecturers.

Fraunhofer Portugal Challenge 2018

Filipa Ferrada, a recent doctor of the PhD Program on Electrical and Computer Engineering of FCT-NOVA, supervised by Prof. Luis Camarinha-Matos, and collaborator of CTS, received the **Third Place Award** in the PhD Category of the Fraunhofer Portugal Challenge 2018, with the idea "A Modeling Framework for Assessing Emotions in Collaborative Networks", on October 31st, 2018.

The idea behind this work aims at supporting managers and decision-makers with an innovative approach capable of "sensing" the cognitive aspects of collaborative networks of enterprises by means of appraising/assessing the "emotional" health/status of the network itself and the member companies. The underlying idea is to "borrow" the concept of human-emotion and apply it into the context of collaborative networks, giving its players the ability to "feel emotions". For that, a modeling framework inspired on human sciences theories and computational models of emotion is proposed, the Collaborative EMOtion modeling framework (C-EMO).

The Fraunhofer Portugal Challenge is an ideas contest, organized since 2010, which aims to distinguish students from Portuguese universities who have developed Master's or PhD thesis of excellence, with practical research focused on the areas of Information and Communication Technologies (ICT), Multimedia and other related sciences.

Presidency of SOCOLNET

Luis Camarinha-Matos, Director of CTS, was re-elected as President of SOCOLNET- Society of Collaborative Networks, for the period 2019-2021 in the last General Assembly of this association. **José Barata** and **Tiago Cardoso**, members of CTS, were also elected for the Board of SOCOLNET.

SOCOLNET (www.socolnet.org) is an international technical and scientific association, not for profit, with members in 50 countries, that aims at promoting and stimulating scientific research, education, technological development, scientific and technical interactions among researchers in the area of Collaborative Networks, including virtual organizations, virtual enterprises, virtual communities, virtual laboratories, and related areas.

Luis Camarinha-Matos

José Barata

Tiago Cardoso

PhD theses concluded in 2018 in association to CTS

- Um modelo conceitual de ecossistema de inovação baseado em fluxo de conhecimento - **José Ramos Filho**
- Controlo em Sistemas de Interação Humano-Máquina - **Rui Antunes**
- Modulador Híbrido de Potência Pulsada para Aplicações Biomédicas - O Uso de Semicondutores com Linhas de Transmissão - **João Mendes**
- Advanced PHY/MAC design for infrastructure-less wireless networks- **António Furtado**
- Previsão de consumo de energia eléctrica nos principais pontos injectores da rede de transporte na rede de distribuição - **Svetlana Chemetova**
- Modelo de Evolução dos Laboratórios Remotos e Virtuais - **Raúl Correia**
- Sleep Stage Classification: A Deep Learning Approach - **Ali Gharbali**
- Reference Model for Interoperability of Autonomous Systems - **Mário Marques**
- Feature Extraction and Selection in Automatic Sleep Stage Classification - **Shirin Najdi**
- Transferência de Energia sem Contacto: Estudo das Emissões do Campo Elétrico - **Elena Baikova**
- Increase the Adoption of Agent based Cyber-Physical Production Systems through the Design of Minimally Invasive Solutions **André Rocha**

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