MENELAOS NT

AGENDA OF THE MIDTERM SUMMER SCHOOL

SEPTEMBER 20-24, 2021

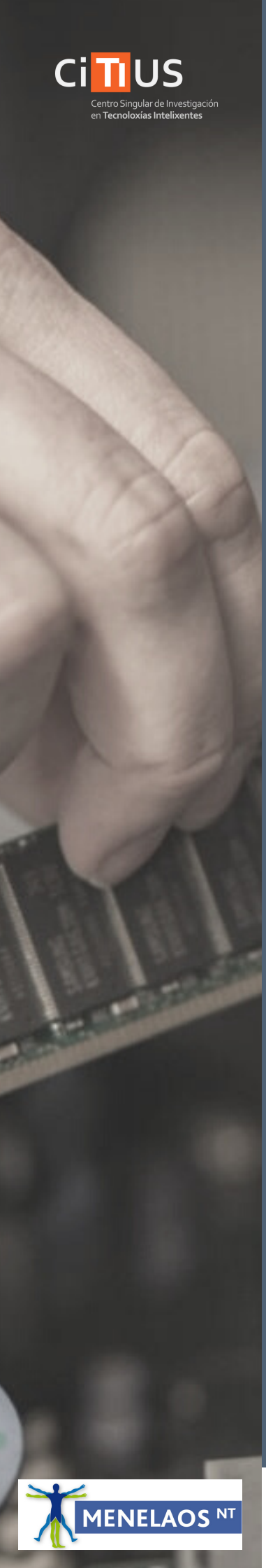
CITIUS- USC

CiTiUS Centro Singular de Investigación en Tecnoloxías Intelixentes

USC UNIVERSIDADE DE SANTIAGO DE COMPOSTELA

CAMPUS VIDA CAMPUS DE EXCELENCIA INTERNACIONAL

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie Grant Agreement No. 860370.



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DAY 1 — Monday, September 20, 2021

09:00-09:30 **Opening**

Paula López Martínez, MENELAOS_NT Coordinator, University of Siegen

09:30-10:30 **1. One Person's Noise is Another Person's Computational Image**

Ayush Bhandari, Lecturer at Imperial College London (ICL)

Abstract: *Almost all modern day imaging systems rely on digital capture of information. To this end, hardware and consumer technologies strive for high resolution quantization based acquisition. Antithetical to folk wisdom, we show that sampling noise arising from quantization results in unconventional advantages in computational sensing and imaging. In particular, this leads to a novel, single-shot, high-dynamic-range imaging approach. Application areas include consumer and scientific imaging, computed tomography, sensor array imaging and time-resolved 3D imaging. In each case, we present a mathematically guaranteed recovery algorithm and also demonstrate a first hardware prototype for basic digital acquisition of quantization noise. Following another example, we discuss how the same philosophy leads to a low-complexity, one-bit, time-resolved imaging framework*

10:30-11:30 **2. MSCA ITN NL4XAI**

José M. Alonso, NL4XAI Deputy Coordinator, CiTIUS- USC
Ettore Mariotti, NL4XAI Early Stage Researcher, CiTIUS-USC

Abstract: *NL4XAI is a European Training Network (ETN) project, funded by the European Union's H2020 program under the Marie Skłodowska-Curie Grant Agreement No. 860621. The NL4XAI network brings together 19 partners and beneficiaries from 6 different EU countries (France, Malta, Poland, Spain, The Netherlands and the United Kingdom) and support the recruitment of 11 Early Stage Researchers (PhD students) working in individual research projects. The NL4XAI network offers a unique research environment providing an excellent structured training programme for the selected Early Stage Researchers, who will face the challenge of making Artificial Intelligence (AI) self-explanatory and thus contribute to translating knowledge into products and services for economic and social benefit, with the support of Explainable AI (XAI) systems.*

11:30-12:00 Coffee break

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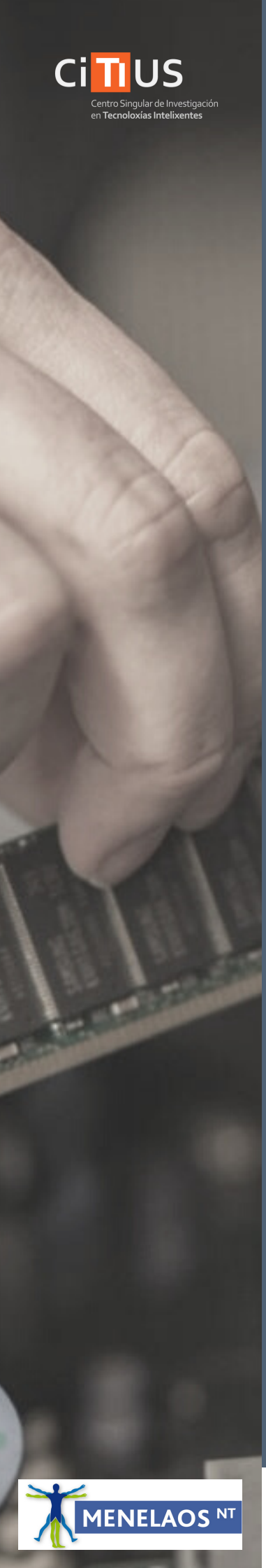

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12:00-13:00 **3. Learning to Describe Images with Vision and Language**

Marcella Cornia, Postdoctoral researcher at the University of Modena and Reggio Emilia

Abstract: *Replicating the human ability to connect vision and language has recently been gaining a lot of attention in computer vision, artificial intelligence, and natural language processing, resulting in new models and architectures capable of automatically describing images with textual descriptions. The first part of the talk will cover the major advances in the field of image captioning, focusing on the recent advent of fully attentive models for vision-and-language tasks and introducing recent solutions for standard image captioning entirely based on the Transformer architecture. The last part of the talk will focus on how to control an image captioning model from the exterior using a control signal that can be given either as a sequence or as a set of image regions which need to be described.*

13:00-15:00 Lunch Time

15:00-16:30 **4. ESRs Individual presentation (Part I)**

4.1. Fabrication of CMOS ToF sensors with 2D/3D capabilities

Seyyed P. Fayyaz Shahandashti, ESR1, CiTIUS- USC

4.2. Design of an AIC CMOS vision system for spatio-temporal event detection

Marko Jaklin, ESR 2, CiTIUS- USC

4.3. Pseudo-passive indoor ToF 3D sending exploiting light-based wireless communications infrastructure

Faisal Ahmed, ESR 3, ZESS-USI

4.4. Efficient very-wide-area ToF 3D sensing by means of Adaptive Compressive Sensing

Álvaro López Paredes, ESR 4, ZESS-USI

16:30-19:00 **5. Gender Issues in Science and Research**

Katharina Schnirpel, Consultant for gender-equal career development, University of Siegen
Juni Mohos, Consultant for gender-equal career development, University of Siegen

Abstract: *The Gender Sensitivity Workshop is designed to sensitise participants to the issue of gender and gender equality with special regard to the context of academia. Through theoretical inputs and practical exercises, participants will be empowered to recognise existing patterns and to self-reflect and deconstruct existing assumptions. The aim of the workshop is to provide relevant knowledge and skills in order to effectively implement gender-mainstreaming in the scientific workspace and thus to increase gender-equality awareness in academic life and research.*

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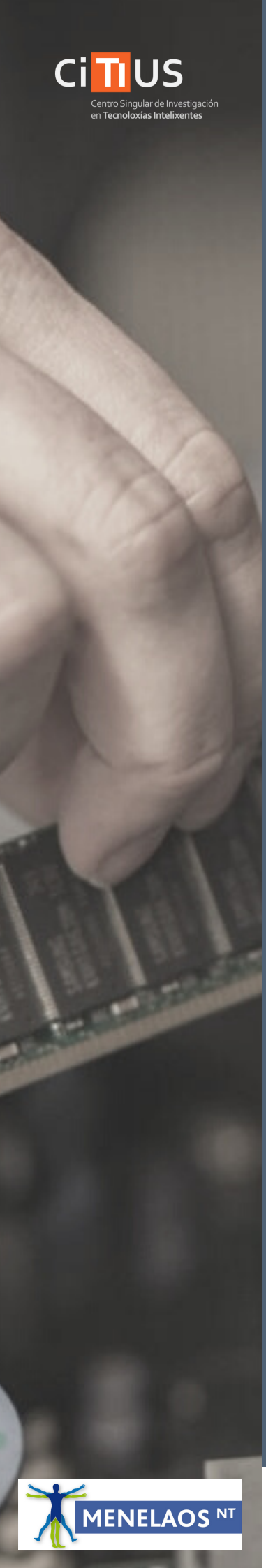

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09:00-10:00 **6. mmW-SAR using non-linear trajectories on small platforms**

Stephan Stanko, Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR

Abstract: *This talk addresses SAR from small plattforms using mmWave signals. First, aspects of miniaturization and motion compensation are discussed. For the former aspect, this can be achieved by using linear frequency modulated signals instead of pulsed signals. For the latter aspect, the requirements reagrding the flight path and the measurment thereof are discused. Secondly, the capabilities of such systems, represented by its 35 Ghz variant, are showcased. Finally, circular SAR using a 94 GHz system is discussed. An aspect receiving attention in this context is the beam stabilization. Again, the technical discussion is complemented by measurment examples.*

10:00-12:00 **4. ESRs Individual presentation (Part II)**

4.5. Deep Depth from Defocus (Deep DFD) for near range and in-situ 3D exploration

Saqib Nazir, ESR 5, UPB

4.6. Adaptive compressed sensing methods for more efficient radar detection and localization

Sanhita Guha, ESR 6, FHR

4.7. Sparse Reconstruction for high-resolution inverse SAR imaging

Muhammad Amjad, ESR 7, SPIS

4.8. Tomographic SAR reconstruction

Prithvi Laguduvan Thyagarajan, ESR 8, ZESS-USI

4.9. Coded waveforms for colocated MIMO radar using sparse modelling

Saravanan Nagesh, ESR 9, FHR

4.10. Mobile mapping applications of CS techniques

Zhouyan Qiu, ESR 12, InSITU

12:00-12:30 Coffee break

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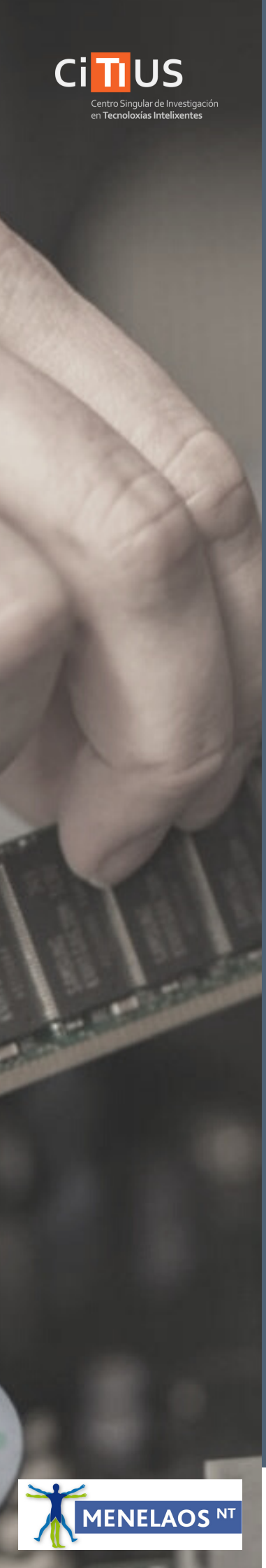

12:30-13:30 **4. ESRs Individual presentation (Part III)**

4.11. Civil works, operation and maintenance of urban infrastructure

Rabbia Rashdi, ESR 13, InSITU

4.12. Learning with adversarial samples for EO multi-spectral images

Omid Ghozatlou, ESR 14, UPB

4.13. Deep learning for SAR data in presence of adversarial samples

Reza Mohammadi Asiyabi, ESR 15, UPB

13:30-15:00 Lunch

15:00-19:00 **7. Entrepreneurship and IPR**

Daniel Müller, Head of the Postgraduate Centre House of Young Talents, University of Siegen

Abstract: *The workshop Entrepreneurship and IPR has two quite distinct, but related focal points. The link between them is the commercial exploitation of research results, an increasingly important topic, certainly in many EU-funded projects and certainly for junior academics. Commercial exploitation might take place by setting up your own business venture after the PhD, often with help from the respective research institution; it might also take the form of registering intellectual property rights (IPR), namely patents, and then exploiting them in one's own firm or selling the rights. The workshop will explore the basic aspects of both focal points interactively.*

DAY 3 — *Wednesday, September 22, 2021*

09:00-10:00 **8. An Introduction to Compressive Sensing and its Mathematical Foundations (Part I)**

Holger Rauhut, Professor, RWTH Aachen University

Abstract: *I will give an introduction to compressive sensing and its mathematical foundations. This field predicts that sparse vectors can be recovered from a small amount of linear measurements via efficient algorithms such as l1-minimization. Known provably optimal measurement scheme use randomness. While unstructured measurements such as arising from Gaussian random matrices give theoretical benchmark performance guarantees including optimal constants, practical problems require more structure, leading to the study of structured random measurement matrices in this context, including random partial Fourier matrices and partial random circulant matrices. I will give an overview on the mathematical theory of compressive sensing with an emphasis on structured random matrices. I will discuss relations to some applications in radar and magnetic resonance imaging.*

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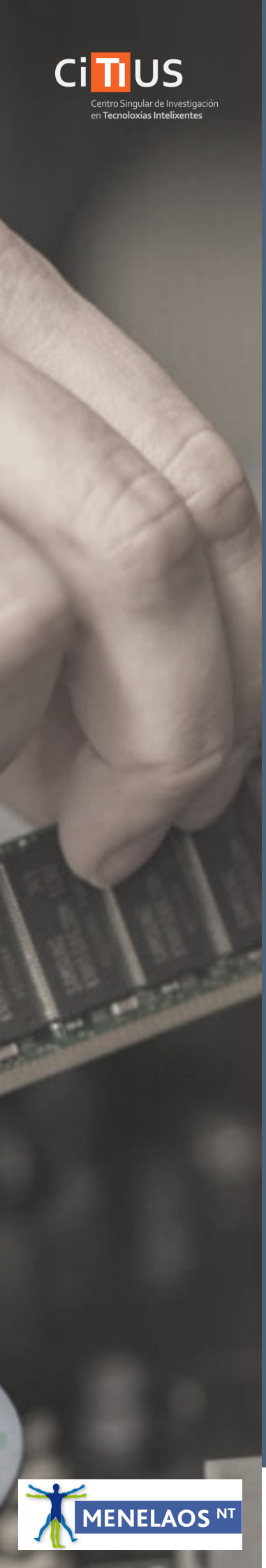

10:00-10:30 Break

10:30-11:30

8. An Introduction to Compressive Sensing and its Mathematical Foundations (Part II)

Holger Rauhut, Professor, RWTH Aachen University

Abstract: *I will give an introduction to compressive sensing and its mathematical foundations. This field predicts that sparse vectors can be recovered from a small amount of linear measurements via efficient algorithms such as l1-minimization. Known provably optimal measurement scheme use randomness. While unstructured measurements such as arising from Gaussian random matrices give theoretical benchmark performance guarantees including optimal constants, practical problems require more structure, leading to the study of structured random measurement matrices in this context, including random partial Fourier matrices and partial random circulant matrices. I will give an overview on the mathematical theory of compressive sensing with an emphasis on structured random matrices. I will discuss relations to some applications in radar and magnetic resonance imaging.*

11:30-12:00 Coffee break

12:00-14:00

9. Quantifying uncertainty in Deep learning models. Application to Food Recognition

Petia Radeva, Full Professor, University of Barcelona

Abstract: *Neural networks have emerged as one of the most powerful prediction systems. A distinguishing feature of statistics, that goes beyond mere construction of prediction maps, is providing uncertainty quantification for inference. A structured approach to the problem of uncertainty assessment lies in Bayesian modeling. Bayesian paradigm for deep learning places a probabilistic blanket over architectures/parameters and allows for uncertainty quantification via posterior distributions. In this talk we will review why do we need uncertainty estimation, what are the sources of uncertainty, how to model and measure it, what kind of uncertainties exist, and which are the most popular methods for uncertainty quantification. In order to illustrate the applicability of uncertainty quantification, we will discuss different possible uses in deep learning models for food image recognition.*

14:00-16:00 Lunch

18:00-20:00 Social Event 1: Tour Exploring Historical Center

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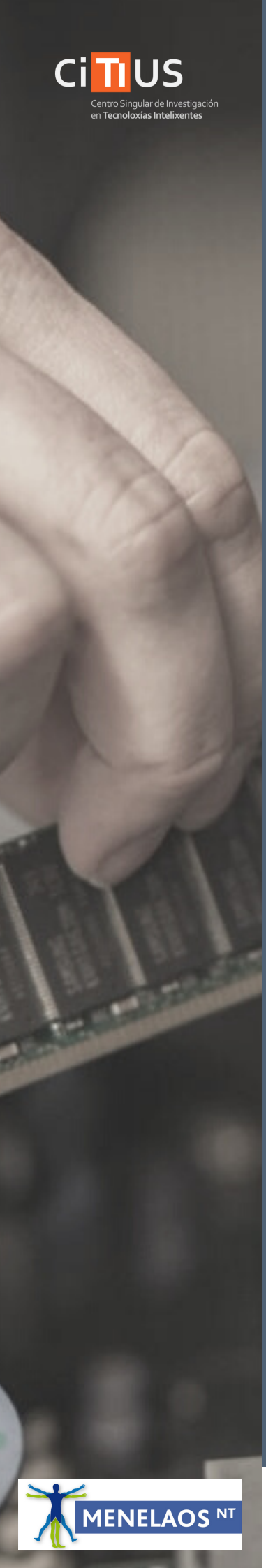

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DAY 4 *Thursday, September 23, 2021*

09:00-11:30 **10. Deep Learning for Earth Observation powered by High Performance Computing**

Gabriele Cavallaro, Deputy Head, High Productivity Data Processing Joint Research Group, Jülich Supercomputing Centre

Abstract: *Deep Learning (DL) is emerging as the leading Artificial Intelligence (AI) technique owing to the current convergence of scalable computing capability.*
HPC systems are an effective solution to the challenges posed by big data analytics. In particular, applications which collect and store massive amounts of data can profit from them significantly. Modern Earth Observation (EO) programs, governments and space agencies are opening their archives (e.g., ESA's Copernicus, NASA's Landsat), making massive volumes of RS data available to everyone. Present and upcoming space missions use small satellite constellations to acquire data with higher spatial, spectral or temporal resolution. Other sources, such as ground and airborne sensors also provide a continuous stream of data.
In this context, the main challenge is to identify efficient approaches to extract interpretable information and knowledge from this pool of data, possibly in near-real time and by integrating between different disciplines. This course will introduce students to cutting-edge HPC technologies for DL methods to address EO applications that deal with large and complex RS datasets.

11:30-12:00 Coffee break

12:00-14:00 **11. Concurrent sensing and processing for 2D and 3D images in CMOS technology**

Ricardo Carmona Galán, Tenured Scienctist, Instituto de Microelectrónica de Sevilla IMSE-CNM

Abstract: *CMOS technology allows combining photon sensing and signal processing on the same substrate. This led to the camera-on-a-chip concept and later to a wide variety of smart vision sensors. These sensors exploit the inherent parallelism found in the visual stimulus. In this lecture we will introduce, in the first place, the fundamentals of CMOS imagers: the sensing structures and interface circuits that allow image capture, their limitations and noise sources. We will review CMOS image sensor architectures and analyze different on-chip processing schemes in order to improve the extraction of image features in terms of speed and energy efficiency. Finally we will dedicate a section to 3D-image sensing structures in CMOS and their ancillary circuitry, with applications to light detection and ranging and beyond.*

14:00-16:00 Lunch

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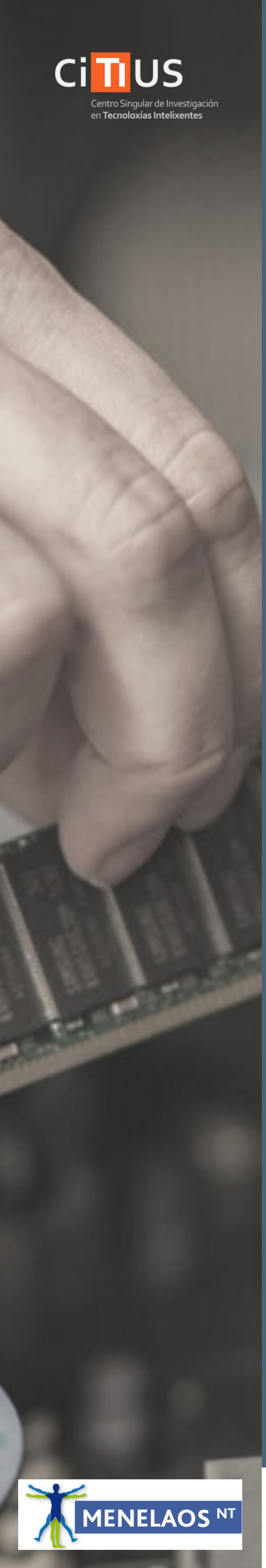

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16:00-17:00 **12. Visual and Acoustic Inference on Low-Cost IoT Systems**

Jorge Fernández Berni, Professor, University of Sevilla

Abstract: *The irruption of deep learning (DL) into the fields of artificial vision and audio recognition in the last few years has led to a paradigm change with respect to classical hand-crafted algorithms. These days, accurate but computationally heavy neural networks are ubiquitously employed. The demanding processing and storage requirements of such networks come into conflict with the limited hardware resources available in IoT devices. Meanwhile, a great deal of technological components at both hardware and software levels have been released to support DL-based deployments. Each of these components claims specific advantages in terms of performance, system integration, energy consumption, etc. This talk will provide insight to navigate this complex scenario in an effective manner. Concepts, figures of merit, procedures, and methodologies to assist on the selection of components for inference on edge devices will be presented. Practical examples in the application framework of remote animal monitoring will be described. In short, a variety of theoretical and practical guidelines will be set out in this presentation about the implementation of visual and acoustic inference on cyber-physical systems with scarce computational and memory resources.*

18:00-19:15 Social Event II: USC heritage visit

20:30-22:30 Dinner

DAY 5

Friday, September 24, 2021

09:00-10:00 **13. ESR Committee Meeting (ESC) (only for ESC members)**

10:00-12:00 **14. Supervisory Board Meeting (SB) (only for SB members)**

12:00-12:30 Coffee break

12:30-14:00 **15. External Advisory Board Meeting (EAB)**

14:00-16:00 Lunch

18:00-22:00 **16. European Researchers' Night**

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