

SONDRA

LABORATOIRE SONDRA - CENTRALESUPÉLEC ONERA NUS DSO RESEARCH ALLIANCE



SONDRA (CentraleSupélec ONERA DSO Research Alliance) was officially launched on 28 April 2004 in Supelec. The mission of SONDRRA is to conduct unclassified basic research in advanced Electromagnetics and Radar domains.

Catching the invisible with new radar and surveillance concepts

As part of its missions, SONDRRA contributes also to a better assessment of new technologies that are of interest to overcome various problems related to maritime surveillance in congested water areas, ground and air surveillance, homeland security especially in urban areas. The characterization of the environment, whether "natural" or anthropogenic is more and more complicated as we aim at augmenting the sensitivity and performances of the surveillance systems in the current context of the new connected world and of increased maritime, air and ground traffics. Radar and EM detection technologies remain of great interest to catch "invisible targets", i.e. target either masked by cloud cover, urban infrastructures, foliage or simply blocked by the horizon line of sight.

The alliance between the 4 parties offers a unique opportunity of development. NUS and CentraleSupélec provide an academic environment, effective at generating new collaborations with academic partners. On the other hand, DSO and ONERA are very attentive to experimental validation and transition to applications. The success of SONDRRA is probably due to its capability to carry physics and signal processing research and to systematically register the research projects in a consistent framework leading to concrete actions and real validation, hence taking all attention from overseas stakeholder.

By the association of four high level research establishments in the rich research environment which represents the University of Paris-Saclay, SONDRRA represents a world class laboratory for graduate education and research which produces innovative research outcomes for ONERA and DSO.

SONDRRA contributes to research through 3 scientific areas, Physics and Modelling, New Concepts and Signal Processing and New Generation Hardware.

- **Physics and Modelling:** to predict the propagation of electromagnetic waves in complex media as forested or urban environments; radar is known to propagate through the foliage and inside urban canyons, hence providing unique capabilities for tracking vehicles that are not be visible by optical sensors. Skywave propagation through the ionosphere is also studied to monitor the effects that can affect the medium.
- **New Concepts and Signal Processing:** in order to maximize the performances of existing or future radar by applying processes based on Artificial Intelligence.
- **New Generation Hardware:** new activity focusing on a system approach, applied to the field of electromagnetism and radar by studying new concepts of antennas and specific hardware components for signal conversion.

The two first scientific themes are those more developed in SONDRRA lab considered a large contribution of Artificial Intelligence for the modelling, analysing, and processing, whereas the third concerns National University of Singapore, NUS.

HIGHLIGHTS 2022



5th SONDRA workshop in Avignon – 14-16 June 2022

This expected event was a great successful with a record of participation of 131 participants and near that 30% of Singaporean people.

3 SONDRA directors at DSO 50th anniversary celebrations



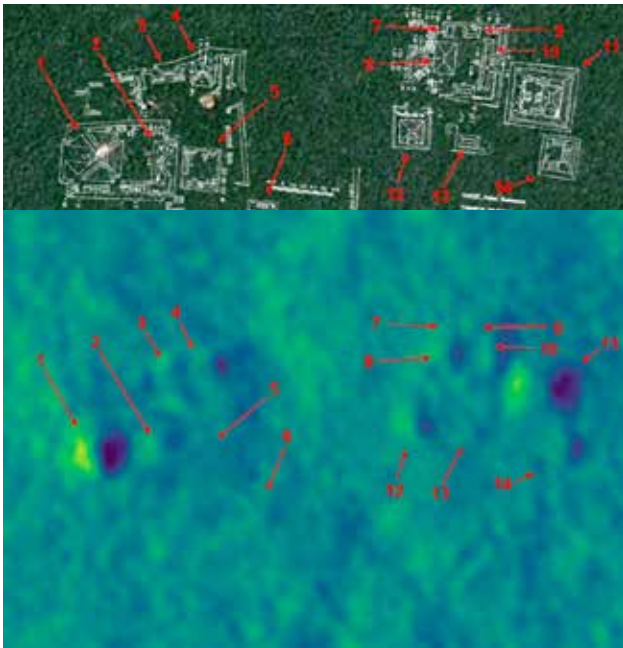
Stéphane SAILLANT (2019-Now), Kah Bin LIM (2004-2007), Marc Lesturgie (2007-2017).

Visit of Singapore Ministry of Defense, Deputy Secretary(Tech)/ Future Systems and Technology Architect Brigadier General Mr. Chad-Son Ng 7 November 2022

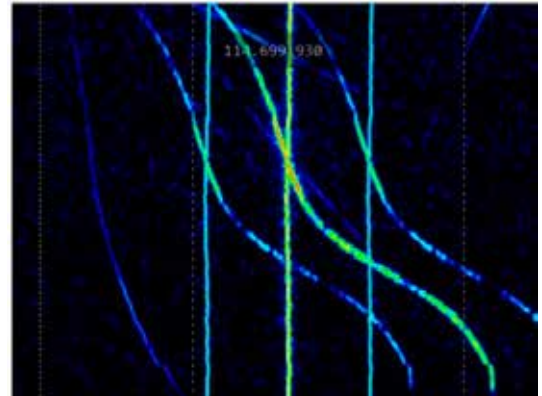


Best student paper award" at the EUSIPCO 2022 conference for his work "Robust Geometric Metric Learning". Antoine Collas

EXAMPLES OF STUDIES



Optical image with map overlaid and markers added (top)
Satellite output SAR image with markers added (bottom).
The large pyramids and several smaller buildings are detected.



Plane detection in passive radar mode using opportunistic sources of signal

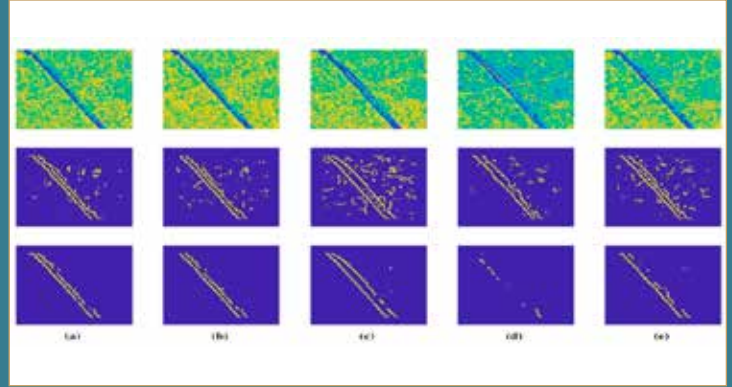


SIERA project (SONDRA Innovative Embedded RAdar Aircraft)

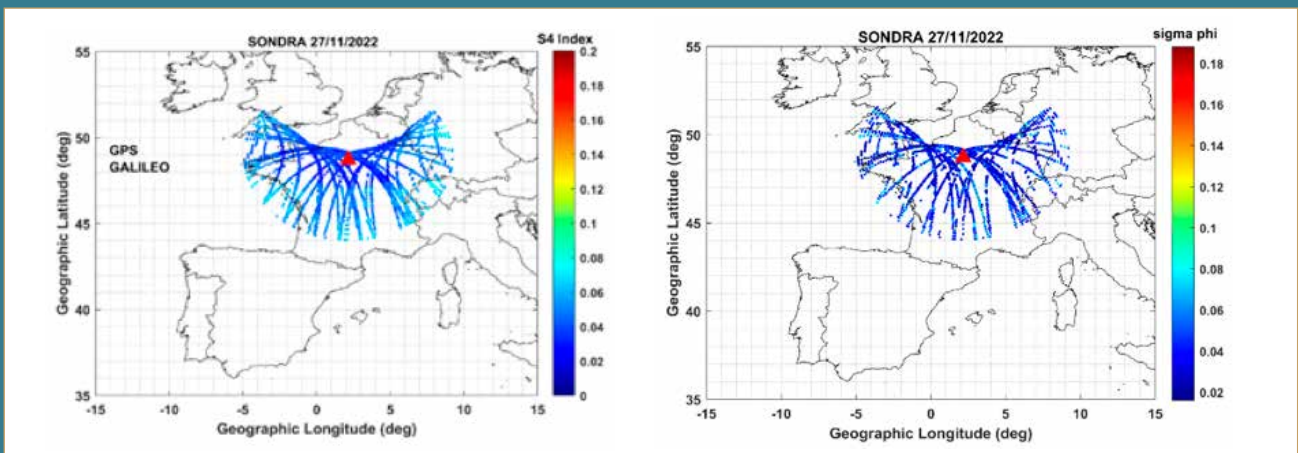




Ships detection results, overlaid on optical imagery using FBR (Frozen Background Reference) technique



Roads detection from TerraSAR-X and SENTINEL-1 satellite imaging



Day-wise scintillation variation deduced from GALILEO contellation: Right: amplitude scintillation index - Left: Phase scintillation index

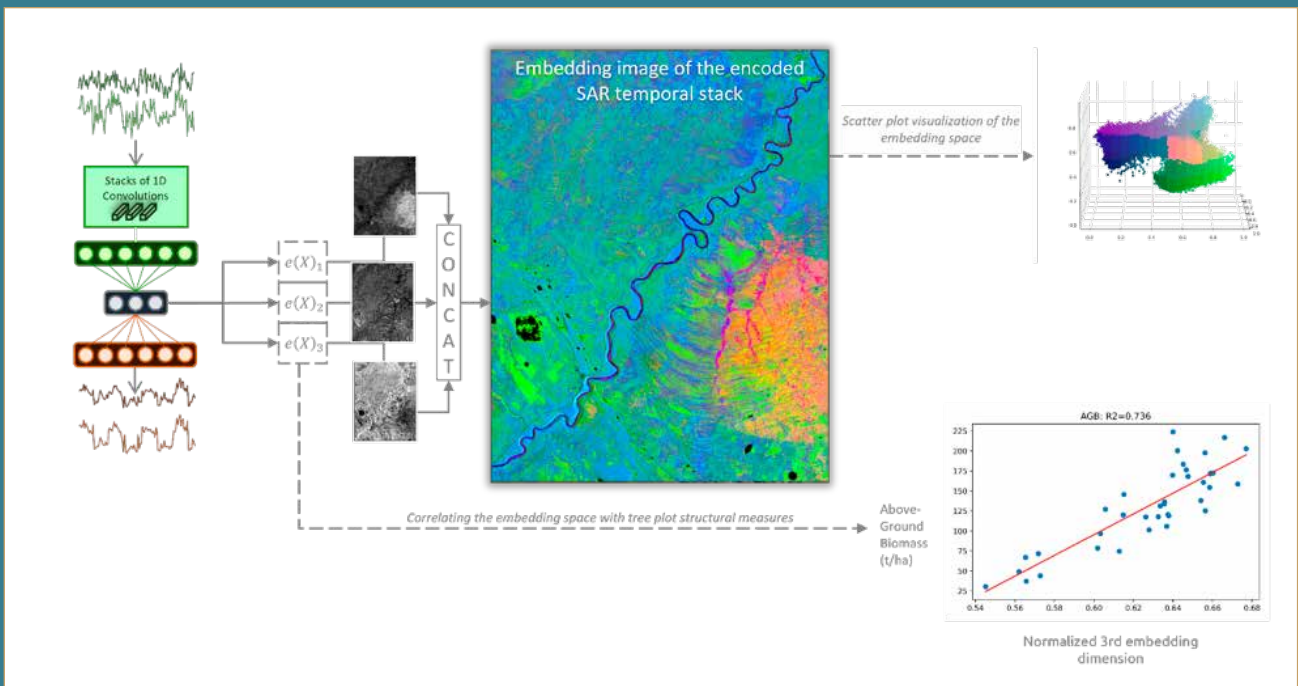


Illustration of the extraction of Above Ground Biomass from the embedding representation of Sentinel-1 time series

Industrial Partners

- DSO
- ESA
- THALES
- ONERA

Academic Partners


NUS (National University of Singapore), NTU (Nanyang Technological University Singapore), UNIVPM (Università Politecnica Delle Marche, Ancona, Italie), Colorado School of Mines (USA), SATIE (ENS Cachan), GIPSA (Grenoble), IETR (Rennes).

Key figures

- Professors, Associate Professors & Researchers 8
- Engineers & Administrative staff 3
- PhD Students 10
- Postdoc 1
- Publications of the year (WoS) 13


<http://sondra.fr/>

Director: Stéphane Saillant

 +33 (0)1 69 85 18 01

 stephane.saillant@centralesupelec.fr

Assistant: Virginie Bouvier

 +33 (0)1 69 85 18 02

 virginie.bouvier@centralesupelec.fr

CentraleSupélec
Campus Paris-Saclay
Breguet building
3 rue Joliot-Curie
91190 Gif-sur-Yvette

