2023 ESoA Course

Theory, Techniques, and EM Applications
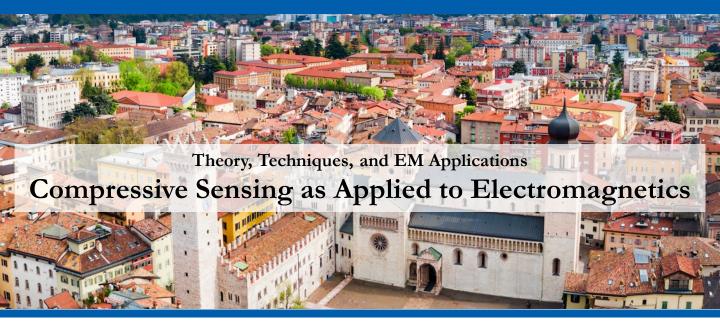# Compressive Sensing as Applied to Electromagnetics

The **Compressive Processing** (CP) paradigm is fundamentally **interdisciplinary**, with interplay between **applied/pure mathematics and engineering** serving to fertilize new researches opening new frontiers. The impact of CP goes far beyond compression and classical signal processing. Whenever acquiring/inverting data/information is difficult, dangerous, or expensive, CP allows to proceed with **much less data/information** than previously thought possible. Such a possibility has been rapidly exploited in several and different ranges of practical engineering problems almost always leading to striking results that significantly advanced the state-of-the-art.

The course is targeted to make attendees (i) understanding the basics of CP, (ii) learning the leading-edge and most recent advances on CP-based algorithms, while (iii) overviewing the most appealing applications of CP in advanced engineering fields. Applicative examples including exercises will corroborate the theoretical concepts, as well.

Course Topics
- Review of the basics and fundamentals of CP
- Compressive sampling: acquisition problem and incoherent sampling
- Compressive sensing: retrieval problem and sparse signal reconstruction
- Advanced CP-based sampling methodologies at the state-of-the-art
- Advanced CP-based retrieval methodologies at the state-of-the-art
- Engineering applications of CP: capabilities, limitations, and perspectives
- Applicative examples including exercises regarding specific engineering applications of CP sampling and CP retrieval methodologies

Lectures
- Prof. GUSTAFSSON Mats (Lund University, Sweden)
- Prof. ISERNIA Tommaso (University Mediterranea of Reggio Calabria, Italy)
- Dr. LAHAIE Ivan (KBR, Inc., USA)
- Prof. MARTINEZ LORENZO José (Northeastern University, Massachusetts, USA)
- Prof. MASSA Andrea (ELEDIA - University of Trento, Italy & UESTC, China & Tsinghua, China & TAU, Israel)
- Prof. MIGLIORE Marco Donald (ELEDIA - Università di Cassino e del Lazio Meridionale, Italy)
- Prof. OLIVERI Giacomo (ELEDIA - University of Trento, Italy)

References
[1] E. J. Candes and M. B. Wakin, "An introduction to Compressive Sampling," IEEE Signal Proc. Mag., 2008.
[2] G. Oliveri, M. Salucci, N. Anselmi, and A. Massa, "Compressive sensing as applied to inverse problems for imaging: theory, applications, current trends, and open challenges," IEEE Antennas Propag. Mag., 2017.
[3] A. Massa, P. Rocca, and G. Oliveri, "Compressive sensing in Electromagnetics - A review," IEEE Antennas Propag. Mag., 2015.

Dates: October 23-27, 2023

Location
- *In presence:* Polo di Mesiano, Via Mesiano 77, 38123 Trento, Italy
- *Online:* Zoom Platform (video registrations will be available for 2 weeks after the event)

Lessons
- 32 h total (including exam – not mandatory)
- 12 h hands-on (in Matlab)

Prerequisites: Basics of Maths

ECTS: 4

Registration Fees (*)
- Free for UniTN Students
- 550€ - academic and non-profit institutions
- 1100€ - non-academic and profit institutions
both for in-presence and on-line attendance
Registration is mandatory

Course Coordination
- Prof. OLIVERI Giacomo
- Prof. ISERNIA Tommaso

Further Information
- summer-schools@eledia.org
  (*) The fees include the course teaching and the slides/material

Register at: https://edu.eledia.org/courses/esoa-2023-trento

UNIVERSITÀ DI TRENTO
Dipartimento di Ingegneria Civile, Ambientale e Meccanica

European School of Antennas and Propagation

Università degli Studi di Trento
eledia research center