

Advanced Sampling and Retrieval Methods The Compressive Processing Paradigm

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) over-viewing 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

- Dr. ANSELMINI Nicola (<https://www.eledia.org/eledia-unitn/people/anselmi-nicola>)
- Prof. MASSA Andrea (<https://www.eledia.org/eledia-unitn/people/massa-andrea>)
- Prof. OLIVERI Giacomo (<https://www.eledia.org/eledia-unitn/people/oliveri-giacomo>)
- Dr. POLI Lorenzo (<https://www.eledia.org/eledia-unitn/people/poli-lorenzo>)
- Dr. POLO Alessandro (<https://www.eledia.org/eledia-unitn/people/polo-alessandro>)
- Prof. ROCCA Paolo (<https://www.eledia.org/eledia-unitn/people/rocca-paolo>)

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
 - 200 Euro - online attendance
 - 400 Euro - in presence attendance
- Registration is mandatory

Course Coordination

- Prof. MASSA Andrea
- Prof. OLIVERI Giacomo

Further Information

- summer-schools@eledia.org

(*) The fees include the course teaching and the slides/material

Register at: <https://edu.eledia.org/courses/phd-school-2023-compressive-sensing>