

Numerical methods for inverse imaging problems and parameter identification

Lecturers: Prof. Gerardo Toraldo (6 h), Dr. Monica Pragliola (14 h)

The first 14 hours lessons will be given every Monday and Wednesday from January 9 to January 25. On January 11 and January 18, 1 hour will be used for Matlab coding and testing.

Monday 9/01/2023 (2 h): Introduction to imaging inverse problems; image formation model, forward model operators and noises in different real-world applications; ill-posedness of imaging inverse problems.

Wednesday 11/01/2023 (2+1 h): Variational methods to overcome ill-posedness; probabilistic derivation of the general variational model via the Maximum A Posteriori approach. Imaging tools in Matlab: testing different blur kernels and noises.

Monday 16/01/2023 (2 h): The Total Variation (TV) and Tikhonov regularization terms: properties and limitations. Basic optimization tools.

Wednesday 18/01/2023 (2+1 h): Alternating Direction Method of Multipliers algorithm for the solution of classical variational models: theory and coding.

Monday 23/01/2023 (2 h): The regularization parameter estimation problem: heuristic and probabilistic approaches for Gaussian and Poisson noise corruption.

Wednesday 25/01/2023 (2 h): Space-variant regularization terms with related parameter estimation strategy to overcome the TV limitations.