

1) Title of the tutorial:

Robust statistical framework for radar change detection applications

2) Instructors name and affiliation:

Dr. Arnaud Breloy, LEME, University Paris Nanterre.

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3) 300 word abstract describing the proposed topic and including an outline of the contents:

From steering-vectors in received signals to anomalies/changes in time series, detection problems are involved in a large range of radar applications. In this scope, statistical tools have always yield popular detection methodologies with reliable theoretical guarantees. Their use is moreover motivated by a general lack of available ground truths in radar applications, which does not allow practitioners to apply standard supervised methods. The efficiency of statistical detection methods is however conditioned by the choice of an appropriate model; which requirement is also an opportunity to introduce prior knowledge (depending on the application). Models and distributions are therefore core components in the development of detection processes, as they can lead to both accuracy and robustness to various assumption mismatches, if carefully selected.

This tutorial will propose an overview of robust statistical detection methods and their recent developments in radar, with an important part dedicated to change detection applications. A focus will be put on elliptical distributions with structured covariance matrices, which have driven the development of numerous robust detection methods in the past decade. This tutorial will also cover recent developments in optimization that permitted to handle these models (Majorization-Minimization algorithms and Riemannian optimization). Finally, a major example will be developed around the problem of change detection in synthetic aperture radar (SAR) image time series.

Outline of the content: General detection/change detection theory (1h). New statistical methods, structured elliptical models, and related optimization algorithms (1h30). Applications to SAR images time series (1h).

4) Target audience and assumed knowledge:

Of wide interest to students, researchers and practitioners of signal processing: a large scope of techniques and applications will be covered.

No specific knowledge assumed.