



RESEARCH MASTER INTERNSHIP 2009-2010

Department Electronics, Optronics and Signal

Location : Toulouse, campus ENSICA

Supervisor : Stéphanie Bidon

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INTERNSHIP DESCRIPTION

Domain : Signal processing

Title : **SPACE-TIME ADAPTIVE PROCESSING WITH TEMPORAL SPARSE SAMPLES**

For airborne radar systems, the clutter is spread over angle and Doppler. Space-time processing is thus required to detect target signals embedded in strong clutter echoes. Detection performance depends mostly on the accurate knowledge of the noise covariance matrix. Traditionally, this matrix is estimated from adjacent range cells.

In a homogenous environment, the secondary cells share the same covariance matrix as the cell under test. Unfortunately, this assumption is often corrupted for practical scenarios. Indeed, many phenomena can lead to a heterogeneous environment. To circumvent the detection losses caused by heterogeneity, one has to design special detection schemes. Different strategies have been proposed. Among them, the “minimal sample support” strategy aims at designing algorithms that need relatively few training samples so as to whiten the data.

We propose here to develop a new low sample support algorithm that uses sparse temporal samples, i.e., “a temporal sparse STAP”. The feasibility of such processing will be investigated. More precisely, the following points will be studied :

- Structure and rank of the noise covariance matrix of the sparse data,
- Clutter rejection performance,
- Choice of the “optimal sparsity”.

[Ward94] J. Ward, *Space-Time Adaptive Processing for Airborne Radar*, Technical Report 1015, Lincoln Laboratory, Massachusetts Institute of Technology, 13 December 1994.

[Chambers96] C. Chambers, T. C. Tozer, K. C. Sharman and T. S. Durrani, “Temporal and spatial sampling influence on the estimates of superimposed narrowband signals: When less can mean more,” *IEEE Trans. Signal Processing*, vol. 44, pp. 3085-3098, Dec. 1996.

Methods: theoretical analysis and numerical modelling

20 % Theoretical Research

80 % Applied Research

0 % Experimental Research

Possibility to go on a Ph.D.:

Yes

No

APPLICANT PROFILE

Knowledge and required level: signal processing, estimation.

Software : Matlab

Applications should be sent by e-mail to the supervisor.