UNIVERSITÉ DE RENNES I
Institut de Physique de Rennes
UMR UR1-CNRS 6251
Département Optique & Photonique

COMMISSARIAT À L'ÉNERGIE ATOMIQUE - Saclay
Laboratoire Astrophysique, Instrumentation et Modélisation
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Institut de Recherche sur les Lois Fondamentales de l'Univers

Master 2 Research Project

Polarimetric imaging by compressive-sensing

Keywords : compressive sensing, sparsity, polarimetric imaging, signal/image processing

Compressive sensing (CS) theory has permitted to derive original imaging concepts, such as for instance the single-pixel camera (SPC), which have attracted much attention these past years [bar08,cha08]. More recently, the concept of SPC has recently been applied to a number of domains including, among others, multi/hyperspectral imaging [wag08, ase10, stu12, aug13], THz imaging [cha08], or random media assisted CS imaging [liu13].

Moreover, polarimetric imaging is a non-conventional imaging technique which meets interesting applications in a wide range of research fields (biomedical diagnostic, microscopy, remote sensing, industrial inspection,…), due to its ability to reveal contrasts invisible on standard reflectivity images. However, its spreading in consumer-market applications is limited so far by the complexity of polarimetric measurements. Recent works have permitted to propose new measurement strategies allowing to reduce the number and complexity of polarimetric imaging [des09, ben09, fad12a, fad12b], and CS thus appears as a promising approach to provide simplified polarimetric imaging systems.

In this context, very few attempts were reported so far to extend CS imaging approaches to the domain of polarization imaging [ase10, dur12, sol13]. These rather simplistic approaches could operate, but at the expense of a two (or four)-fold increase in the measurement time, and a degradation in SNR due to the loss in optical intensity through a polarization analyzer.

The objective of this research project is to characterize theoretically a new imaging architecture for performing polarimetric CS imaging which overcomes, in principle, the limitations of previous proposals. This will first require to desgin synthetic and realistic polarimetric imaging scenes, and simulate the signals acquired in this new approach. Various CS reconstruction strategies will be implemented (l1 minimization, joint sparsity, reweighted l1,…) and compared in terms of reconstruction quality of polarimetric images. The last objective of this research project is to assess the performances (in terms of reconstruction quality, noise, …) and practical benefits of the proposed technique with respect to existing solutions.

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Good skills in image & signal processing are required.

Duration : 3-6 months (Master 2 - M2)

Application deadline: 29th of february 2016

Location :

The research project will be mainly conducted in CEA Saclay, including temporary stays in Institut de Physique de Rennes

Supervision :

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