Université catholique de Louvain **UCL** SECTEUR DES SCIENCES ET TECHNOLOGIES

INFORMATION AND COMMUNICATION TECHNOLOGIES, ELECTRONICS AND APPLIED MATHEMATICS

Invitation à la soutenance publique de thèse

Pour l'obtention du grade de Docteur en Sciences de l'Ingénieur

Mademoiselle Adriana GONZALEZ

Ingénieur civil électricien

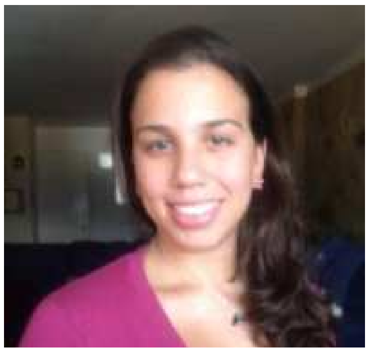
Solving Inverse Problems in Imaging using Robust and Regularized Optimization

Digital images play an important role in the human life since they allow observing, analyzing, studying and characterizing the world surrounding us. Their use is ubiquitous in many applications such as medicine, biology, astronomy, security and industrial manufacture. Nonetheless, the desired digital images are often not available and need to be recovered from corrupted, incomplete and/or indirect observations. The determination of the unknown image from the available observations is called an inverse problem. In this thesis, we study several inverse problems in imaging applications and we investigate how to solve them using optimization techniques. These techniques are based on an accurate characterization of the physical model and the properties of the image of interest, making them robust to the distortions in the acquisition and modeling processes. In contrast to previous works, the proposed techniques improve the image quality and the modeling of the actual acquisition processes.

In the first part of the thesis, we consider a recent tomographic application called optical deflectometric tomography. The inverse problem investigated consists on obtaining, from noisy and incomplete observations, an accurate image that describes the spatial distribution of the refractive index of a transparent object. In the second part of the thesis, the 2-D phase unwrapping problem is analyzed. This problem consists of estimating a phase image from its noisy wrapped observation. By working with a forward model formulated in the derivative domain, the unwrapping problem is relaxed and solved using convex optimization techniques. In contrast to existing unwrapping methods, the proposed approach aims at simultaneously unwrap and denoise the phase image. Finally, in the last part of the thesis, the blind deconvolution problem is studied in the context of astronomical imaging. In this problem, both the actual image and the sensing operator (a convolution kernel) are unknown and are simultaneously estimated from noisy observations.

Vendredi 13 mai 2016 à 15h00

Salle Shannon
Bâtiment Maxwell (M-a105)
Place du Levant, 3
1348 Louvain-la-Neuve



Membres du jury :

Prof. Laurent Jacques (UCL), promoteur
Prof. David Bol (UCL), président
Prof. Christophe De Vleeschouwer (UCL), secrétaire
Dr. Philippe Antoine (Lambda-X, Belgique)
Prof. Christine De Mol (ULB)
Prof. Pierre Weiss (ITAV Toulouse, France)