

Preface

When I found out my thesis was going to be published I began to wonder what would make the best incipit. I started asking around for suggestions from friends with a higher experience in the publishing world. I received plenty of advice (thanks to all), however the one that caught most of my attention was: “Armando, you should start your preface by telling, in a humorous way, an experience you had during your PhD and remains impressed in your memory... in this way, surely you will capture the attention of your readers throughout all the rest [of the preface]”. I have to admit that I actually evaluated the possibility that the suggestion was coming from a witty friend that just wanted to have a laugh at my preface expenses. But then, I realised that for most of life’s mistakes you have to make them in order to learn from them. So, I started to ponder for something witty that would be worth the preface of this thesis. As an actual fact, I could not think of anything! Well, perhaps it is better I rephrase this last sentence. I could not think of one unique funny event because there were many episodes that got stuck in my mind, like a bottle neck.

I could tell you about the time I felt like Indiana Jones in the neither lost nor doomed German forests (hopefully, I am not breaking any copyright right now) looking for possible real targets that were giving positive detections to the algorithm. Or, I could try to describe the expressions of my roommate colleagues when they found me in one of my trances induced by the progressive rock music I would listen to whilst working. Or perhaps, I could tell about my first conference, when my friends described me as a “mental road-police waving around” to illustrate the directions of polarisations, but in actual fact I was just fighting against the feeling of running away screaming. The truth is that I find all the processes of investigation to be an incredibly fascinating game. Sometimes you win and feel like you deserve the Nobel prize for a silly calculation that a fresher could have done, and sometimes you lose and you cannot stop thinking about the return match and a new strategy that will bring you to victory. With the impossibility of finding a single episode, I cannot do more than just say that all the words, maths and simulations the reader will find in the following are the result of a game that I enjoyed a lot to

play in both the good and bad moments. My ultimate hope is that the reader will enjoy the content as well. But now I am already too impatient to start telling more about the content of this thesis!

Synthetic Aperture Radar (SAR) is an active microwave remote sensing system able to acquire high resolution images of the scattering behaviour of an observed scene. In this thesis, the contribution of SAR polarimetry (POLSAR) in detection and classification of objects is described and found to add valuable information compared to previous approaches. The first two chapters will be dedicated to introducing the concepts of SAR and polarimetry that forms the basis of the following developments.

The core of this thesis is a new target detection/classification methodology that makes novel use of the polarimetric information of the backscattered field from a target and will be presented in two chapters. The first of them, [Chap. 4](#) contains all the mathematical demonstrations aimed to bring the reader from a physical/algebraic concept to a final formula ready to apply. On the other hand, [Chap. 5](#) is concerned with the statistical description of the detector, in order to acquire more information regarding its theoretical performances (in particular its ROC, Receiver Operating Characteristic, curve).

One unavoidable step in proposing a new algorithm to the World is its validation and in this thesis this part is taken strongly into account in two chapters. [Chapter 6](#) proposes a validation based on data collected with an airborne system: E-SAR L-band (DLR, German Aerospace Centre) in a campaign narrowly aimed to target detection (included camouflaged conditions). [Chapter 7](#) is concerned with satellite data, since they represents a particularly interesting scenario for target detection. The datasets includes ALOS-PALSAR L-band (JAXA, Japanese Aerospace Exploration Agency), RADARSAT-2 C-band (Canadian Space Agency) and TerraSAR-X X-band (DLR).

I hope you will enjoy this thesis as much as I did!

A New Target Detector Based on Geometrical
Perturbation Filters for Polarimetric Synthetic Aperture
Radar (POL-SAR)

Marino, A.

2012, XXII, 242 p., Hardcover

ISBN: 978-3-642-27162-5