REZUMATUL TEZEI DE DOCTORAT

Methods and algorithms for Earth Observation image information mining

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In this thesis, we focus on the theoretical study and elaboration of advanced methods for multi-spectral and synthetic aperture radar image understanding based on interactive and automatic algorithms. Following the idea of developing a feature extraction framework for knowledge discovery, we analyze and adapt state of the art feature extraction methods that can be integrated into an Earth observation data mining system. In the quest of image information mining, we also developed new feature extraction methods for spectral, texture and shape analysis and created test databases needed in the quality and quantity evaluation step. Using the proposed framework we integrated and developed a functional data mining system architecture.

In the first chapter we are presenting the problems we want to solve within this thesis, presenting the motivation, the goals and our contributions in the image information mining domain. In Chapters 2 and 3 are presented general principles of remote sensing, having the goal to provide a better understanding of Earth observation image acquisition, image processing and knowledge extraction.

Our contributions regarding the elaboration of advanced methods for multi-spectral and synthetic aperture radar image understanding are presented in Chapter 4. Methods for spectral and texture analysis are proposed along with bag of words and feature point descriptors. Also, some case study applications that can be used in EO data understanding scenarios are assessed. Based on the methodology and algorithms for feature extraction presented in the previous chapters, in Chapter 5, we highlight the actual status of the data mining systems used in EO data analysis and understanding. Also we are defining concepts regarding human machine communication, having the goal to optimize user interaction in data mining systems. Moreover, in this chapter we present the Data Mining Tool software we developed based on the framework proposed in this thesis and we present some of the data mining tools and prototypes that emerged from our research.

An analysis of our developments is presented in Chapter 6 in which can be observed the evolution of our work. Starting from a concept of Earth observation feature extraction, we developed new methods and proposed a data mining system architecture which was used in developing new prototypes and systems of image information mining.