Abstract

It is known that feature extraction from satellite imagery plays a fundamental role for environmental assessment and during the emergency management phase. Rapid mapping before and after catastrophic events intensively employs automatic and/or semi-automatic procedures to define the situation before the event, and to delineate damages and extract information after it. Earth observation (EO) data with different spatial and spectral resolution is used for this task since the advent of the first satellites designed for this scope. In recent year the availability and the design of new EO programs created and widespread large amount of free to use satellite data. This thesis has two aims, one is to investigate the use of existing free to use data that acquired from recently launched Multispectral Instrument (MSI) carried by Sentinel-2 to extract surface water, the second aim is to explore the usage of very high resolution (VHR) geometric data to perform building footprint extraction and to assess damages to structures after catastrophic events. Rapid mapping procedures often use computer aided photo interpretation (CAPI) that are very time consuming and are done manually by an operator. The study addressed this issue proposing different type of semi-automatic feature extraction procedures that permit to reduce the use of CAPI. The Surface water extraction was performed on Sentinel-2 data using Google Earth Engine, an emerging data infrastructure as a service. This work was done using a combination of normalized indexes and Otsu's an automatic thresholding technique. The second work was carried out in collaboration with the Joint Open Laboratories of TIM and the Telecommunication Department of the Politecnico di Torino. The aim of the study was to construct a convolutional neural network (CNN) able to extract building footprints from VHR satellite imagery. The final study was the proposal of a new building damage scale tailored for VHR vertical images.

With the first study it is proposed an operational procedure capable to extract surface water features from Sentinel-2 images in a consistent manner worldwide. The second study proposed a novel approach to define building footprints with promising results. Finally, the third work permitted to propose a standard building footprint damage scale which permitted an amelioration of the accuracy of damages detected from vertical imagery. Furthermore, the scale has been accepted by the international working group on satellite emergency mapping (IWG-SEM). All three studies find an application for emergency management specially during the rapid mapping phase. Additionally, the studies find application also for mapping purposes and for environmental assessment. Future directions will try to address and adapt

the proposed procedures to different emerging data processing technologies. Moreover, the quality of the methods will be assessed over more case studies areas and with more accurate ground truth data.