

A SOFT COMPUTING METHOD FOR AUTOMATED DAMAGE MAPPING USING VHR IMAGERY

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ABSTRACT

In disaster management operations right after a disastrous earthquake, damage maps are essential as they reveal the exact location of hard hit areas in urban settings. This study investigates the feasibility of an automated soft computing algorithm in generating damage maps. The main idea is to classify different areas of each building roof as three classes relative to three distinct damage levels. Then, a fuzzy inference methodology is used to determine the damage grade of each building by the means of evaluating the percentages for three damage levels detected for individual building roofs. For implementation, satellite images of before and after the 2003 Bam, Iran earthquake, are used in addition to some available ancillary data. Firstly, a pre-processing step was completed involving the co-registration and enhancement of images. Thereafter, the roofs of buildings were extracted from the images by using the ancillary data. The Haralick's textural features were computed for the images where an optimum set of three such features were selected using the Genetic Algorithm. Then, the roof of the buildings were classified in three classes namely "intact", "partially-damaged" and "fully-damaged" using the selected optimum textural indices and by exploiting a Support Vector Machine (SVM) supervised classification algorithm. Thence, for individual building roofs, the percentage of pixels within each class was calculated as the input of a Fuzzy Inference System (FIS). Mamdani fuzzy inference engine was used to determine the damage grade of each building as to produce the damage map. The proposed algorithm was evaluated by comparing the produced damage map with a reference damage map as ground truth where the results demonstrated the efficacy of the method showing an overall accuracy of 76% for such rapid screening process.

1. INTRODUCTION

Natural disasters have affected lives of millions of peoples around the world each year. It is possible to reduce the impact of disasters such as earthquakes with effective disaster management strategies. A rapid screening procedure is essential to evaluate the magnitude and the extent of damage timely in disaster management activities such as search and rescue and relief planning. Remote Sensing and GIS technologies have been progressively advanced and routinely exploited in rapid disaster damage assessment for the