

CHANGE DETECTION FOR TRAFFIC MONITORING IN TERRASAR-X IMAGERY

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1. INTRODUCTION

During the past years, increasing traffic appears to be one of the major problems in urban and sub-urban areas [1]. Traffic monitoring e.g. detection of congestion and jams, observing filling grade of park & ride car-parks and so on is becoming more and more important. A new type of information is needed for a more efficient use of road networks.

Remote sensing sensors installed on aircrafts or satellites enable data collection on a large scale and thus seem to be very suitable for various traffic monitoring applications. Optical systems are already in experimental use, e.g. 3K camera system [2, 3], but are quite limited due to their daylight operation and cloud-free conditions requirements. Synthetic aperture radar (SAR) sensors due to their all-weather capabilities seem to be well suited for such type of applications. For example, the German radar satellite TerraSAR-X launched on June 15, 2007 acquires high resolution images [4] which are very well suitable for various traffic monitoring applications [5].

2. METHOD

Our aim in this paper is to analyze the changes occurring in two images acquired at two different time moments. In particular we are interested in changes of filling grade of car-parks or even detecting stationary vehicles on the congested or jammed roads. As inputs to the change detection processor serve two repeat-pass single channel images of TerraSAR-X sensor. Each channel is focused, calibrated and single look slant range complex SAR image (SLC). Our change detection approach is based on the combination of various techniques: co-registration of two SAR images by DLR-own interferometric SAR processor [6], removal of the flat Earth phase, channel balancing [7], coherent or incoherent difference of two images and finally image post-processing.

3. EXPERIMENTS AND CONCLUSIONS

To confirm our idea and to validate the method a stack of three TerraSAR-X images in Stripmap mode (SM) were acquired over the same area near Munich, South Germany. Preliminary results show the potential of the proposed method for the change detection in large car-parks in repeat-pass SAR scenes (see Figure 1). For monitoring of smaller car-parks high resolution modes of the sensor such as high resolution Spotlight (HS) may be needed. A priori information such as the boundaries of car-parks e.g. from Geographical Information Systems (GIS) or road network e.g. road data base NAVTEQ [8] is necessary in order to automatize the whole process.

Of course, the method is not limited to only repeat-pass TerraSAR-X images. It can be applied to any two SAR images acquired at two different times, e.g. TerraSAR-X and the future TanDEM-X data [9].

4. REFERENCES

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Figure 1. Example of change detection is presented as RGB image in the upper right part (R: Saturday 7-7-2007, B: Tuesday 26-6-2007) for TerraSAR-X (StripMap, HH, descending mode, resolution azxrg 3mx1.2m) over Munich. We can see clearly how the car-park is half filled on the working day (blue color) in comparison with a weekend. Google image is used as a background.