Analysis of Urban SAR Data Using Morphological Pre-processing and Neural Networks

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Classification of high-resolution remote sensing images from urban areas has been addressed in [1] and [2] using two main steps:

- feature extraction based on the construction of a differential morphological profile which characterizes each pixel both in terms of intensity and in terms of local geometry.
- classification based on a neural network (eventually after selection of the most significant features).

In this paper, a further evolution of [1] and [2] is presented and applied in neural network classification of an AIRSAR image of Los Angeles, California. For the feature extraction step, two different approaches are used for the construction of the morphological profile of each pixel: 1) alternating sequential filters (ASF) and 2) the applications of openings and closings with linear structuring elements under varying angles. The effect of using speckle filtering prior to the construction of the morphological profiles is also investigated. In the paper, the maps obtained from the classification of the different morphological profiles are used for classification and street tracking.

From the data, street extraction is made in two steps. The first one is aimed at trying and discarding the "blobs" that do not possess the usual characteristics of the roads such as elongation. This is made by a routine hat tries and associate each "blob" present in the filtered image to a "street prototype" database [4]. If the shape of the blob under test is too different from the ones found in the database, it will be removed from the image. It is possible to remove even only a part of the entire blob that shows too peculiar features. The second step uses modified Hough transform routine [5] for real road extraction.

To evaluate the quality of the extracted street network, quantitative indexes are computed, including the correctness and completeness indexes [5]. Both of them require the knowledge of the true network and provide a means to understand to what extent the extracted networks is similar to the reference one. In particular, completeness represents the fraction of ground truth length extracted while correctness is the fraction of segments' length belonging to actual roads.

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