MAPPING URBAN SURFACE IMPERVIOUSNESS USING SPOT MULTISPECTRAL SATELLITE IMAGES

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ABSTRACT

In recent years, impervious surface has emerged not only as an indicator of the degree of urbanization, but also as a major indicator of environmental quality. Therefore, estimating and mapping (detecting, monitoring, and analyzing) impervious surface is valuable not only for environmental management but also for urban planning. Driven by societal needs and technological advances, many municipal government agencies have started to collect and map impervious surface data for civic and environmental uses. In spite of its significance, the methods for estimating and mapping impervious surfaces and applications of impervious surface data have not been sufficiently explored. Among the various digital remote sensing approaches, image classification based on pixel analysis is one of the most widely used methods in the extraction of impervious surfaces, but results are often not satisfactory because of the heterogeneity of urban landscapes and the high spectral variation within the same land-cover class.

In this paper, we performed a classification of the degree of imperviousness in the urban areas of county of Miyun, China's Beijing Region based on object-oriented method, with the support of a subset of SPOT multispectral data and eCognition software. The approach mainly involves establishing an image object hierarchy consisting of three levels of different resolution. In our study, different classifications have been applied to different image object levels. Information from different image object levels has to be used in the process of mapping the degree of imperviousness. Firstly, we created a classified super-scale image object level by reclassifying pre-classified land use map. On this highest object level only three classes distinguished: possibly impervious (urban areas), which are the areas of interest, rural areas that are not impervious, and water. Secondly, we create a classified image object level by multiresolution segmentation in a very high resolution on the near infrared layer of the data subset. The objects in this level should be small enough to represent urban structures (e.g. buildings, road surface and parking lot) that are fully impervious. Thirdly, we create a middle level of image objects by multiresolution segmentation in a relative middle scale. This segmentation yields objects that correspond to urban plots. Finally, we perform a final class-related classification in the middle level, using the above sub-scale and super-scale information. Other than Water and Not Impervious, for each object classified as urban plot the part of its sub-objects' area classified as Fully Impervious will be calculated. Thus, image objects in urban areas in the middle level have divided into six classes (0%, 1-25%, 26-50%, 51-75%, 76-99%, and 100% impervious)

according to the degree of imperviousness they represent. After the classification completed, a thematic map of showing the degree of imperviousness in urban areas has been created.

The object-based approach is still fairly new in various remote sensing application fields, but it is attracting more and more attention on the part of this community. In our study, we have proved that for estimating and mapping of the degree of urban impervious surface, the object-oriented remote sensing image analysis method is an effective, simple and rapid way to acquire the urban impervious surface information.

Keywords Remote sensing; SPOT; fuzzy function; multi-resolution segmentation; Classification; object-oriented

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