DISCRIMINATING ROOF MATERIALS USING HYPERSPECTAL AND LASER SCANNING DATA

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For the planning and environmental authorities of cities, climatic analyses are of great importance for the objective to improve the climate of parts of the city. Particularly, negative effects can be minimised. To model these urban climatic effects, input data, e.g. surface materials of urban areas and their distribution, as the basis for the analysis of urban temperature patterns, are needed.

Urban areas are characterised by intricate mixtures of materials ranging from tiles, concrete, bitumen, metal, sand, stone to vegetation and wood. The fine spectral resolution of hyperspectral data proved a valuable tool in urban material mapping. However, limitations arrive in the classification of urban materials due to e.g. spectrally similar surface materials. This makes the identification more difficult. It has been shown that hyperspectral classification can be improved by integration of height information, in the form of a digital Surface Model (DSM) derived from aerial imagery or laser scanning (i). Thereby, roofs and ground surface materials can be discriminated better; the materials might have similar spectral curves but can be distinguished based on height information as is the case for e.g. bitumen on roofs and asphalt on streets. This was shown in (ii)(iii), where different classification methods (pixel-based and segment-based) resulted in a similar improvement of accuracy when adding height information derived from laser scanning data to the hyper-spectral data for the classification of roof materials.

In this study, height as well as geometry information (slope of roofs) of laser scanning data are used to derive a detailed map of roof surface materials of the campus area of the University of Karlsruhe. The database consists of a hyperspectral HyMap dataset with 4 m ground resolution and a DSM derived from laser scanner data (1 m ground resolution). As the hyperspectral data is used in combination with the DSM, it is resampled to a resolution of 1 m.

A binary building mask is extracted from the laser scanner dataset. In contrast to (iv), who investigated a classification of urban areas on signal level and on decision level, the mask does not contain height information but just differentiates between building and non-building. Thus, a simple tool to discriminate surfaces on the ground from those on buildings is provided. This mask is over-lain on the hyperspectral data to make sure that only roof materials are classified. A spectral library is then devised from training samples of the roof materials. To assure a high accuracy in extracting as pure pixels as possible from the hyperspectral image, aerial photos and ground truth was used. The classification is done pixel-based. In contrast to (v) whose classification is segment-based, also incorporating slope information in their analysis, the slope information is integrated in the hyperspectral dataset using ENVI. The final classification is done using Spectral Angle Mapper.

In this study a detailed map of roof materials is produced and it is evaluated whether the integration of geometry information in a pixel-based classification procedure helps to improve the overall accuracy of the classification.

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