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LiDAR DTMs and anthropogenic feature extraction: testing the feasibility of geomorphometric parameters in floodplains

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In floodplains, massive investments in land reclamation have always played an important role in the past for flood protection. In these contexts, human alteration is reflected by artificial features ('Anthropogenic features'), such as banks, levees or road scarps, that constantly increase and change, in response to the rapid growth of human populations. For these areas, various existing and emerging applications require up-to-date, accurate and sufficiently attributed digital data, but such information is usually lacking, especially when dealing with large-scale applications. More recently, National or Local Mapping Agencies, in Europe, are moving towards the generation of digital topographic information that conforms to reality and are highly reliable and up to date. LiDAR Digital Terrain Models (DTMs) covering large areas are readily available for public authorities, and there is a greater and more widespread interest in the application of such information by agencies responsible for land management for the development of automated methods aimed at solving geomorphological and hydrological problems. Automatic feature recognition based upon DTMs can offer, for large-scale applications, a quick and accurate method that can help in improving topographic databases, and that can overcome some of the problems associated with traditional, field-based, geomorphological mapping, such as restrictions on access, and constraints of time or costs. Although anthropogenic features as levees and road scarps are artificial structures that actually do not belong to what is usually defined as the bare ground surface, they are implicitly embedded in digital terrain models (DTMs). Automatic feature recognition based upon DTMs, therefore, can offer a quick and accurate method that does not require additional data, and that can help in improving flood defense asset information, flood modeling or other applications. In natural contexts, morphological indicators derived from high resolution topography have been proven to be reliable for feasible applications. The use of statistical operators as thresholds for these geomorphic parameters, furthermore, showed a high reliability for feature extraction in mountainous environments. The goal of this research is to test if these morphological indicators and objective thresholds can be feasible also in floodplains, where features assume different characteristics and other artificial disturbances might be present. In the work, three different geomorphic parameters are tested and applied at different scales on a LiDAR DTM of typical alluvial plain's area in the North East of Italy. The box-plot is applied to identify the threshold for feature extraction, and a filtering procedure is proposed, to improve the quality of the final results. The effectiveness of the different geomorphic parameters is analyzed, comparing automatically derived features with the surveyed ones. The results highlight the capability of high resolution topography, geomorphic indicators and statistical thresholds for anthropogenic features extraction and characterization in a floodplains context.