

Object-Based Image Analysis for Gully-Affected Area Detection in the Hilly Loess Plateau Region of China Using Unmanned Aerial Vehicle

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Abstract : The Chinese Loess Plateau suffers from serious gully erosion induced by natural and human causes. Gully features detection including gully-affected area and its two dimension parameters (length, width, area et al.), is a significant task not only for researchers but also for policy-makers. This study aims at gully-affected area detection in three catchments of Chinese Loess Plateau, which were selected in Changwu, Ansai, and Suide by using unmanned aerial vehicle (UAV). The methodology includes a sequence of UAV data generation, image segmentation, feature calculation and selection, and random forest classification. Two experiments were conducted to investigate the influences of segmentation strategy and feature selection. Results showed that vertical and horizontal root-mean-square errors were below 0.5 and 0.2 m, respectively, which were ideal for the Loess Plateau region. The segmentation strategy adopted in this paper, which considers the topographic information, and optimal parameter combination can improve the segmentation results. Besides, the overall extraction accuracy in Changwu, Ansai, and Suide achieved was 84.62%, 86.46%, and 93.06%, respectively, which indicated that the proposed method for detecting gully-affected area is more objective and effective than traditional methods. This study demonstrated that UAV can bridge the gap between field measurement and satellite-based remote sensing, obtaining a balance in resolution and efficiency for catchment-scale gully erosion research.

Keywords : unmanned aerial vehicle (UAV), object-analysis image analysis, gully erosion, gully-affected area, Loess Plateau, random forest

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