عنوان مقاله:

Self Organizing Map and SRTM: Application in Yardangs Identification in the Lut Desert, Iran

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خلاصه مقاله:

Yardangs, an exclusive landform due to intensive wind erosion, cover a large area in the hyper-arid Lut desert of Iran. This paper presents a new approach using a Self Organizing Map (SOM) as an unsupervised algorithm of artificial neural networks for analysis and characterization of yardangs.The NASA Shuttle Radar Topography Mission (SRTM) has provided Digital Elevation Models (DEM) for over 80% of the land surface. Version 3.0 SRTM data provided by the CGIAR-CSI GeoPortal are the result of substantial editing effort on the SRTM DEM produced by NASA. The SRTM 3 arc seconds data were re-projected to a 90 m UTM grid. Bivariate quadratic surfaces with moving window size of 5×5 were fitted to this DEM. The first derivative, slope steepness and the second derivatives minimum curvature, maximum curvature and cross-sectional curvature were calculated as geomorphometric parameters and were used as input to the SOMs. 42 SOMs with different learning parameter settings, e.g. initial radius, final radius, number of iterations, and the effect of the random initial weights on average quantization error were investigated. A SOM with a low average quantization error (0.1040) was used for further analysis. Feature space analysis, morphometric signatures, three-dimensional inspection, auxiliary data like Landsat ETM+ and high resolution satellite imagery from Quick Bird facilitated the assignment of semantic meaning to the output classes in terms of geomorphometric features. Results are provided in a geographic information system as thematic maps of landform entities based on form and slope, e.g. yardangs (ridge), corridors (valley) or planar areas. The results showed that all yardangs and the corridors between were clearly recognized and classified by this method when their width was larger than the DEM resolution but became unrecognizable if their width is much smaller than the grid resolution. The identified yardangs and corridors are aligned NNWSSE parallel to the prevailing direction of the strong local 120 days wind and cover about 31% and 42% of the study area respectively. The results demonstrate that a SOM is a very efficient tool for analyzing geo-morphometric features such as aeolian landforms under hyper-arid environmental conditions providing very useful information for terrain feature analysis in inaccessible regions.

کلمات کلیدی:

Self Organizing Map; Yardangs; SRTM; Morphometric feature; Neural Network

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