Automated Texture Classification and Landform Taxonomy for Populating a GIS

Martin J Vickers[a*] and Anthony C Cook[a]

[a]Institute of Mathematical and Physical Sciences, University of Aberystwyth

Introduction

Image processing and classification is an important part of analysis in many fields of scientific research. This poses a problem in that humans are unable to analyse large data sets quickly or accurately [1]. Gibbens [2] presents a method of image set analysis where similarity can be described by distance. The proposed framework for his methodology involved segmenting an image either automatically or by hand to form regions. Image region modelling was then performed to produce a tractable description of the region. This description was used to compare other regions and create a taxonomy. A visual representation of similar regions was generated (see Figure 1) using a clustering algorithm. Subsequently, a taxonomy was created from the NASA Clementine spacecraft [3] data which classified craters on the Moon (see Figure 2) automatically. These classifications were compared to the Baldwin classifier [4] to some success.

A focus of new research is to integrate the taxonomy with existing GIS (Geographic Information System) products. This would allow additional data, such as census, height or vector data, to be used alongside the taxonomy. Whilst Gibbens is successful in the creation of a taxonomy for crater classification, the segmentation technique requires improvement. As this is an unsolved problem, this research aims to address this.

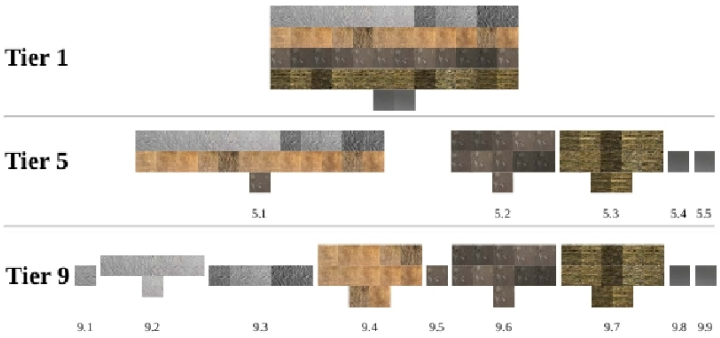

Figure 1. 3 tiers of a taxonomy created from 50 textures. Adapted from Figure 6.17, Gibbens [2].

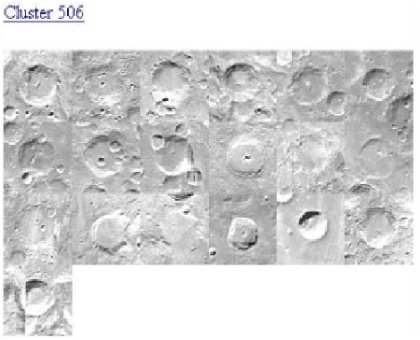

Figure 2. A cluster of similar craters. Adapted from Figure 8.18, Gibbens [2].

Image Segmentation

The work discussed here applies the above methodology to terrestrial imagery and improves the segmentation technique. Segmentation methods that take into account multiple image bands (e.g. NIR), rather than just the visible spectrum, may lead to a successful taxonomy for terrestrial image data. A fully automated approach to segmentation is desired; however, the possibility of utilising manual methods should not be ruled out. A system similar to Galaxy Zoo [5] could be adopted to segment an image as well as perform simple classifications. These data could be compared to the results produced by automated techniques to provide a form of 'ground truth'.

Summery

The aim of this research is to take full advantage of the methodology utilised by Gibbens [2] by constructing a viable platform to create an automated taxonomy which works with varying heterogeneous terrestrial data sets, such as Landsat, SPOT and TopSat. A means of exporting the taxonomy data into a popular GIS format is to be explored making this a desirable and functional tool for geospatial research.

References

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*Correspondence address: mjv08@aber.ac.uk