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Mimicking human expert interpretation of remotely sensed raster imagery by using a novel segmentation analysis within ArcGIS

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Traditional computer based methods for the interpretation of remotely sensed imagery use each pixel individually or the average of a small window of pixels to calculate a class or thematic value, which provides an interpretation. However when a human expert interprets imagery, the human eye is excellent at finding coherent and homogenous areas and edge features. It may therefore be advantageous for computer analysis to mimic human interpretation.
A new toolbox for ArcGIS 10.x will be presented that segments the data layers into a set of polygons. Each polygon is defined by a K-means clustering and region growing algorithm, thus finding areas, their edges and any lineations in the imagery. Attached to each polygon are the characteristics of the imagery such as mean and standard deviation of the pixel values, within the polygon. The segmentation of imagery into a jigsaw of polygons also has the advantage that the human interpreter does not need to spend hours digitising the boundaries.
The segmentation process has been taken from the RSGIS library of analysis and classification routines (Bunting et al., 2014). These routines are freeware and have been modified to be available in the ArcToolbox under the Windows (v7) operating system. Input to the segmentation process is a multi-layered raster image, for example; a Landsat image, or a set of raster datasets made up from derivatives of topography. The size and number of polygons are set by the user and are dependent on the imagery used.
Examples will be presented of data from the marine environment utilising bathymetric depth, slope, rugosity and backscatter from a multibeam system.
Meaningful classification of the polygons using their numerical characteristics is the next goal. Object based image analysis (OBIA) should help this workflow. Fully calibrated imagery systems will allow numerical classification to be translated into more readily understandable terms.

Peter Bunting, Daniel Clewley, Richard M. Lucas and Sam Gillingham. 2014. The Remote Sensing and GIS Software Library (RSGISLib), Computers & Geosciences. Volume 62, Pages 216-226 http://dx.doi.org/10.1016/j.cageo.2013.08.007.