A new Object Based Image Analysis toolbar for ArcGIS 10.x designed for combined multibeam bathymetry and backscatter interpretation.

Tim Le Bas[1], Anthony Scarth[1] & Peter Bunting[2]

[1] National Oceanography Centre, Southampton, UK. SO14 3ZH.

[2] Aberystwyth University, UK. SY23 3FL.

For many years interpretation of multibeam bathymetry data, and backscatter imagery, have been done by hand by expert interpreters. More recently computer based methods for the interpretation of multibeam bathymetry and backscatter imagery have been developed, based on individual pixels or the average of small windows of pixels to calculate a class or thematic value, which in turn might provide 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. This led to Object Based Image Analysis (OBIA) where the objects are distinct segments of the image with characteristics of spatial, statistical and temporal scales. There are two main aspects to OBIA: Segmentation and Classification. Homogeneous groups of pixels are identified and form objects or segments which can have different sizes and shapes (polygons). From the pixel value statistics, the geometry and texture of the objects, an interpreter can define statistical models to generate a defined classification. This mimics how human experts create their interpretation.

OBIA is available in various commercial software packages, but these can be expensive and/or require extensive user training. However users in the research community do require access to these cutting edge techniques, and to a software that is sufficiently generic, accessible and user friendly. Fortunately the RSGIS library of analysis and classification routines has been created (Bunting et al., 2014) to provide an open source software platform for the processing of remotely sensed and GIS datasets. It gives access to many of the techniques needed. RSGISLib consists of 16 C++ libraries and over 300 user commands. Users interact with RSGISLib either through an XML or a Python script under the Linux operating system. However, as many users use the Microsoft windows and ArcMap environment, we have converted it to a Windows based python library, and therefore making it available within ArcGIS. This will lead to a better integration of the OBIA methodology in many habitat mapping workflows.

We present a new toolbar for ArcGIS 10.x with many new tools and functions, including segmentation and classification. It has been specifically developed for the processing of seafloor acoustic data, but can also be used with other grid-based datasets. Input to the segmentation process is any multi-layered raster imagery, for example; a Landsat image, or a set of raster datasets made up from derivatives of bathymetry. The size and number of polygons in the segmentation are set by the user and are dependent on the imagery used. The polygons are defined by a 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 toolbar and RSGIS library are freeware and are available for the ArcToolbox 10.x under the Windows (v7 and v8) operating system. Meaningful classification of the polygons using their numerical characteristics is the next goal. A tool for this is also available but system specific numerical characteristics still need to be defined. 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