

GIS 4 Geomorphology

Geomorphometry of Mountain Landscapes &
Upland Watersheds...a little Wildlife, too

Welcome !

Ask a Question

Maps I Make

Linear Features Interp

Linear features in landscapes, both manmade and natural, are numerous. Fencelines, railroad tracks, debris flow tracks, fault scarps, structurally-controlled drainages, levees, and roads are just a few.

Automatic linear feature recognition is not available in ArcGIS 10 or previous versions. You must interpret/digitize linear features manually from a DEM-derived hillshade raster (various illumination angles), High Pass filter raster (edge enhancement), Aspect raster (emphasizes straight slope-plane intersections), or an aerial photo. Linear topographic features in a hillshade raster are generally more visible when illumination is perpendicular to their trend and at a raking angle (sun low in the sky). Thin snow cover and winter imagery can help in detection of subtle features.

Hillshade Method

Create a hillshade as a basemap for interpretation (see [A Better Hillshade](#) lesson). Vary the illumination properties to highlight differently oriented features with the following. Open the Image Analysis window, Window > Image Analysis, then click the Options button (at upper left of the window) > Hillshade. Change the sunlight azimuth, illumination angle, and Z factor. Change the hillshade color ramp here under the Processing tab.

High Pass Filter Method

Spatial Analyst > Neighborhood > Filter, Input = DEM, Filter Type = High Pass. Improve interpretability with Properties > Symbology, set 2 classes, color first class No Color and the second Black. Change the contrast and brightness with Properties > Display, try 90 and 15, respectively. Lineaments may be traced using Draw tools (create graphics), the graphics converted to features, a geometry field calculated in the table, and the data exported to rose diagram software. Alternatively, export an image to Illustrator. Density of lineaments (line feature counts) may be determined by various means including a.) buffering each line (use small-offset distance), b.) creating centroid points (point counts) for each line, upsampling to a larger "pixel", and running a cluster analysis, c.) or contouring/rasterizing centroid points or grid counts. More intense study could involve interpretation from several independent images, subsequently georeferenced. High pass filters can also be useful in emphasizing circular features in low relief landscapes (i.e., eroded cinder cones). High pass is also a filter available in Photoshop.

Aspect Raster Method

Spatial Analyst > Surface > Aspect, Input = DEM. Default output is in azimuth values and appears as a 10-class multi-color raster with break values in 45° increments (Flat, N, NE, E, SE, S, SW, W, NW). There are 2 North classes (337.5-0, 0-22.5). Adjust the display colors to show/hide groups of aspects (Properties > Symbology).

Choose primary colors. Make lineament interpretations for each display and color lines derived from each difference. Use Draw tools (Customize > Toolbars > Draw > Line) to create graphics, which can be converted to features if desired. See example below.

Group 1: Remove color for S, SW, W, NW classes. Interpret lineaments.

Group 2: Remove color for N, NE, E, SE classes. Interpret lineaments.

Photointerpretation Method

Digitize or hand-draw lineaments on high resolution aerial photography (NAIP) or visible/IR satellite imagery including thermal imagery (LANDSAT, SPOT, etc.). Lots of imagery available online.

Stream Segment Orientation Method

Stream segments can also be used as basemap for lineament analysis.

MatLab Method

Automated method by Soto-Pinto et al. (2013). Numerical method for automatic linear feature pattern analysis. Method consists of several steps: image contrast normalization, small linear feature extraction via convolution or Canny algorithm, and larger lineament identification with the Hough transform. Interesting implications for earthquake and volcanic event prediction.

Stream Channel Orientation

Enrico & Tommaso (2011) map valley orientation of tributary streams draining of the Sangro River basin, Italy, and plot their orientations (azimuths) by stream order on rose diagrams.

Rose Diagrams Software Sources:

Rose by Todd Thompson

Rozeta

Geolsoft

GEOrient

Structural-geology.org

Soto-Pinto et al. (*in press* 2013) Computers & Geosciences

Refs

Enrico & Tommaso (2011) INTECH/New frontiers in tectonic research (Schattner, editor)