

DAILY ASSESSMENT FORMAT

Date:	03 July 2020	Name:	Karegowda kn
Course:	IIRS OUTREACH PROGRAMME	USN:	4a116ec029
Topic:	Photogrammetric products from satellite Stereo images	Semester & Section:	6 sem B sec
Github Repositor y:	Karegowda-courses		

FORENOON SESSION DETAILS

Report--

A photogrammetric product is a representation of aspects of a scene derived from imagery of the scene. The representation may be geometric and include point coordinates, object geometry or measurements, or other attributes derivable from image geometry. In some cases, qualitative object properties may be added onto the basic geometric data.

Historical Background

Traditionally, photogrammetric products meant hardcopy maps depicting elevation as contours and features as lines. With the advent of digital softcopy photogrammetry for production and the widespread adoption of GIS to utilize cartographic data, emphasis has shifted almost exclusively to products in digital form. The increasing availability of digital imaging sensors has accelerated this trend. Indeed, the most rapidly growing types of photogrammetric products involve digital imagery, geo-located and processed for various GIS and consumer applications and delivered over the Internet.

Scientific Fundamentals

The basis of a GIS is its geospatial information; photogrammetry is unique in its ability to provide accurate spatial data with high information content over wide areas. The orthoimage is a prime example; when used as a GIS base map, it provides a foundation for positional information as well as context for the display and interpretation of other data.

Elevation Products



Elevation products [1] represent the elevation of the earth's surface. Both raster and triangulated irregular network (TIN) representations are used, with the choice depending on the particular application. Raster representations [1, 2] are the most common, since they can be displayed and manipulated using standard image processing software and hardware. DEMs can be defined relative to any coordinate system, either projected coordinate systems such as UTM or directly in latitude longitude. DEMs are described by their resolution or post spacing, the distance between adjacent elevation samples.

For instance, USGS DEMs are usually described as 30- meter or 10-meter DEMs (for those in UTM), while NGA Digital Terrain Elevation Data (DTED) comes with 3-arcsecond or 1-arc-second (latitude-longitude) post spacings. European DEM products include, from the UK, Landform PROFILE® Plus (2 m grid, 0.5 m RMSE for urban and flood plain areas up to 10 m grid with 2.5 m RMSE for mountain and moorland areas), from Germany, ATKIS DGM5 or DGM 25 with 5 m (not available everywhere) or 25 m grid spacing, and from France, BD ALTI® with 50 m grid spacing. Another important property of DEM products is the elevation reference surface, or datum. DEMs in the past were referenced to local height data relative to sea level, but today are usually referenced either to a global geoid model (e. g., GEOID99) or to a reference ellipsoid (e. g., WGS84).

TIN representations [1,3] consist of a set of irregularly distributed points connected by edges to form a surface consisting of connected triangles. TINs are typically more efficient than raster's in terms of the storage space required for an equivalent level of detail or accuracy, since more points can be concentrated in complex areas and fewer points used in flat areas, although three coordinates must be stored for a TIN point versus only the Z coordinate for raster representations. TIN points can be placed at the edges of breaks or in the bottoms of depressions in the terrain, whereas a raster's fixed sampling interval may not capture such terrain detail. In some cases raster's are augmented by break lines which depict abrupt changes in surface slope. TINs are more complicated to display than raster's since 3D graphics are required instead of simple raster displays.

TINs work well for graphics and simulation applications since current graphics cards are highly optimized to deal with sets of triangles. Exploitation is also more complicated, since determining the elevation at a given X, Y coordinate requires first identifying the triangular face of the TIN containing it, then interpolating the elevation from the three vertices of the face. Contours (lines of equal elevation) [1, 3,4] were formerly the standard elevation representation, due to ease of visual interpretation and their suitability for photogrammetric extraction. However, they are now secondary products derived from raster's or TINs as required. Most elevation models depict the earth's surface as it would appear without buildings or vegetation and are referred to as digital elevation models (DEM) or digital terrain models (DTM). Constructing a DEM requires manual interpretation of the scene to remove non-terrain objects and to estimate the terrain elevation.

Current automated processes such as automated stereo correlation or 3D sensors such as LiDAR or IFSAR represent the first (reflective) surface, containing buildings and the tops of trees or vegetation. These are referred to as digital surface models (DSM) and may be used for



orthoimage production. Automated editing methods are somewhat successful in reducing DSMs to DEMs, but some manual editing is still required. The majority of DEMs are currently produced by photogrammetric methods, although 3D sensors such as LiDAR are being rapidly adopted. To produce a DEM, the operator views the scene in stereo and places a 3D measuring dot superimposed on the model on the ground at the desired post spacing.

Alternatively, the operator may capture 3D points at representative locations on the terrain and thereby generate a TIN from which a DEM can be interpolated if required. Automated stereo methods replace the operator by performing the stereo matching using image correlation techniques. DEMs may be distributed in image formats, such as geotiff, or in special data formats such as USGS DEM or NGA DTED. DEM specifications typically specify the Z RMS error against some number of independently measured elevation points. Common DEM errors include noise spikes or pits due to measurement or processing errors. There may also be systematic offsets due to operator biases or caused by automated processes measuring the tops of vegetation instead of the ground surface

Image Products Before an image can be used in a GIS, there must be some means to relate the locations of objects within the image to their locations in the world. This geometric relationship between a pixel in the image and a point on the ground is embodied in the sensor model sometimes referred to as the image metadata.

The sensor model includes:

- The location of the perspective center of the sensor in world coordinates and the angular orientation of the camera with respect to the world coordinate system. This is sometimes referred to as the exterior orientation, since it places the sensor within an exterior reference system. For non-frame sensors, these parameters may be expressed as functions of time to model the path of the aircraft or the orbit of the satellite carrying the sensor.
- The interior orientation, the geometric parameters of the sensor itself. This includes the principal distance (the focal length for images at infinity) and the specification of origin, orientation, and scale of the image coordinate system.
- A set of equations, based on the principles of perspective geometry and using the parameters of exterior and interior orientation, which relates a point in the image to a point in the world. Given the sensor model, one can model the path of a ray of light from a point in the world through the perspective center of the sensor and onto the imaging plane to calculate its image coordinates; alternatively, one can use the sensor model and the image coordinates to calculate the ray in space passing through the object in the world.



