The On-Line GIS Magazine
Brought to You by GISCafe.com

Create Accurate Orthophotos with Softcopy Photogrammetry

Continued ...

DTM Generation

Once the interior and exterior orientations have been determined using aerial triangulation, it is possible, by using stereo pairs of imagery, to determine terrain elevation very precisely using pixel matching between adjacent stereo paris. The process of extracting terrain digitally has been one of the major benefits of softcopy photogrammetry. Using analytical stereo plotters, an operator could collect several thousand elevation points in a day. Using digital auto-correlation, thousands of points can be collected in seconds. This allows for the creation of very dense points clouds reflecting minute variations in terrain. The scale of the imagery, the scanning quality, and the quality of the aerial triangulation all contribute to the final DTM accuracy. In general good results are obtained with window sizes of 25 pixels. An aerial photo scanned to produce one foot pixels can make a DEM with 5 foot postings and can produce 2 foot contours. Areas with shadows, tall buildings, and dense vegetation will have difficulty producing terrain information automatically and must be done manually in a stereo editor or masked out. The resulting DEM can be further refined in a stereo editor to incorporate breaklines, like curbs and building footprints, resulting in a digital terrain model (DTM).

Orthorectification

While the DEM and resulting DTM are desired products of the softcopy process, the orthophoto is usually the end product. The orthophoto removes the effect of the camera and sensor orientation, systematic errors in the camera/sensor/film system, topographic relief displacement, and the earth's curvature. The final orthophoto will be a true planimetric map, well suited to capturing further GIS data or for preparing engineering designs. In the production of orthophotos, the higher the quality of the control, aerial triangulation and DEM , the more accurate the orthophoto. Sometimes a USGS 10m or 30m DEM is used for orthophoto production, however high accuracy results may not be produced because of registration errors and elevation errors. Areas with extreme relief changes may be blurred in the orthophoto, but the planimetric measurements should be accurate in most other areas. Orthophoto resolution is dependent on the original scale of the photography and the scanning resolution. Satellite imagery is also orthorectified and is less sensitive to DEM errors given the larger pixel size. IKONOS imagery does appear to require accurate DEM's to be successfully orthorectified to the 2m CE90 level. Point locations, line lengths, and areas should all be planimetrically accurate on a good orthophoto.

Stereo Editing and Feature Collection

The advent of 3D GIS and 3D CAD systems has opened another option up to users. Using information from the interior and exterior orientations, it is possible to view stereo pairs using 3-D glasses. Features can be digitized interactively and the associated elevation data can be assigned to each vertex captured. Buildings can be digitized as volumes and stream profiles can be determined to a high degree of accuracy using this technique. ERDAS 3-D Analyst (http://www.erdas.com/) is one type of software

available to do this type of work.

Conclusions

Modern softcopy photogrammetry software is available to allow GIS users to do their own DEM and orthophoto production. The cost savings in both time and money make this a good option for progressive GIS shops willing to take advantage of this exciting technology. Good aerial photo mission planning, ground control surveys, and operator skills are required to produce accurate results. Satellite photogrammetry is a promising technology suitable for use over large areas and in inaccessible regions. The power of aerial triangulation can help make accurate GIS basemaps a reality and will make your GIS database ortho-accurate and based on a set of real-world GPS coordinates.

About the Author:

Kyle Bohnenstiehl has been involved in remote sensing, GPS and GIS for over 10 years and is currently a remote sensing scientist with the Department of Interior. His work has taken him throughout the Andes of South America and the desert Southwest where he has worked with tribes, NGO's, government and private sector groups to create innovative solutions using the latest geotechnology. He can be reached at Kyle@nagis.com

Comments? Feedback? **Click here** to tell us what you think about this topic or if you have additional information you'd like to share on this subject!