Commentary

Softcopy Photogrammetry and GIS

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Softcopy or digital photogrammetry offers the potential to expand the tools of photogrammetry to GIS users who lack photogrammetric skills. The photogrammetric community, however, has been slow to accept softcopy photogrammetry as a cost-effective solution. This slow adoption rate is not a result of deficiencies in the technology but rather the cost of change to organizations with an installed base of analog and analytical photogrammetric systems. At present, the cost of entry to softcopy photogrammetry can be minimized by taking advantage of microcomputer-based softcopy systems or by using softcopy photogrammetric extensions to generic geographic information system (GIS) software.

Alternatives exist at low cost which provide rigorous solutions employing polynomials for satellite images and photogrammetric solutions with use of fiducials and some camera information without full camera calibration for digitized photographs. These solutions can be obtained with relatively inexpensive hardware such as desktop scanners ($2,000), microcomputers based on Intel 80486 and Pentium chips ($3,000), and simple stereo capability such as anaglyph techniques. Software for such systems is available for approximately $5,000. Studies demonstrating accuracies dependent only on pixel size, ground control point (GCP) accuracy, and relief for satellite images and on scanning resolution and GCP accuracy for digitized photographs are widely available (for example, see Welch and Usery, 1984; Gugan and Dowman, 1988; Welch, 1993). Data volumes in the range of 350 Mb for a stereopair can be processed on microcomputers, allowing high resolution scanning from 400 to 1200 dots per inch for photographs. Also, interesting data on softcopy photogrammetry from Russian satellite systems using microcomputers is now available and demonstrates the high resolutions and accuracies attainable from digitizing stereo space images.

The bias that has long existed against microcomputer-based softcopy photogrammetric systems can no longer stand. Claims based on superior accuracy or data handling capabilities for workstations have been sufficiently countered, and the advent of 32-bit multitasking operating systems brings microcomputer-based softcopy systems squarely in competition with Unix-based workstation solutions. Price differentials of an order of magnitude (over $100,000 for workstation solutions versus $10,000 for microcomputer-based systems) lead to significant advantages for the microcomputer solutions and provide an attractive alternative for GIS users. Dedicated photogrammetric production shops with highly skilled photogrammetrists and specialized requirements, such as large aerotriangulation blocks, may still see advantages in workstation solutions, but the advance of microcomputer hardware and software will soon eliminate even these niche applications.

Digital photogrammetric systems are in an early stage of technological development (Dowman *et al.*, 1992) and, as with digital cartography and other automation processes, the first digital implementations mimic manual processes without taking advantage of the potential for changing the fundamental operations. As technology matures, the digital implementations change to optimize components of the basic theory. Digital photogrammetry currently mimics standard operations used with traditional analog equipment. Operators are required to build ground control and tie points, orient models (interior, relative, and absolute), and compile information in an interactive mode at best. Digital elevation model (DEM) production is the only process which is near complete automation, but the photo setup procedures and the required editing of the resulting model prohibit complete automation of even this task.

Interestingly, the microcomputer solutions appear to have the simplest user interfaces and provide the user the greatest automation of the photogrammetric task. Although significant improvements will occur as the technology matures, the microcomputer-based systems appear to offer the best alternative for the majority of GIS users who need input from digitized photographs and satellite images. Because the geometry of these two data sources is different, GIS users should look for systems which use different modeling solutions; specifically, polynomials or satellite image models for satellite images which have a basic limit on accuracy tied to the pixel size, and rigorous photogrammetric solutions from collinearity equations for digitized photographs. The former is available in most GIS with some variance in the types of polynomials supported, but the latter requires a true softcopy photogrammetric system.

References

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