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GENERAL POLYGONS USED TO DETERMINE TRAINING AND TEST AREAS IN DIGITAL REMOTE SENSING IMAGERY

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ABSTRACT

Polygonal fields specified by the (x, y) coordinates of the polygon vertices offer several advantages over the more conventional rectangular areas specified by the beginning and ending scan line numbers and inter-line point numbers.

1) The computer algorithms described here accurately delimit irregular areas to include all interior pixels, which is important on coarse resolution data where many fields have few pixels.

2) The vertex coordinates specifying polygonal areas are amenable to entry by light pen or cursor on a CRT image display, or via an X-Y digitizer machine from hard copy imagery.

3) Coordinate transformations used for geometric rectification, temporal overlays, or transforming photography or map coordinates to the scanner data can be applied to the corners of test areas to produce polygons in the new coordinate system.

4) Optional automatic compensation for a finite rectangular or elliptical pixel resolution size allows extracting pure center field pixels from fields defined in terms of the true boundary locations; an extra tolerance can be incorporated into the pixel size to allow for errors in locating the boundaries.

5) When a suitably formatted magnetic tape or disk file is used to store the polygonal output from processing a large irregular scene area, sizable savings can be realized in storage space and access times for subsequent processing.

The first of three distinct algorithms determines for one pixel at a time whether the center of that pixel lies inside or on the edge of a simple connected polygon having integral vertex coordinates, where the pixel size is ignored.

The other two more elaborate algorithms will accept any real (x,y) coordinates defining the vertices of any simple polygon (with no edges interesecting), where the polygon needn't be convex or connected. To ensure that the entire area of a pixel is inside the polygon, of these two algorithms one assumes an elliptical pixel shape by in effect using the perpendicular distance from a polygon edge to the pixel center. The other algorithm provides for rectangular pixels by comparing the pixel corners and sides with the polygon edges corners and sides with the polygon edges and vertices respectively. Since the calculations are potentially fairly time-consuming, the algoirthms are oriented towards scan line driven processing such that they can efficiently do calculations for line segments avoiding pixel by pixel calculations.

Since the handling of polygonal fields has been incorporated into many programs on two computers at ERIM, it has proven to be popular with many users who find polygons more convenient and accurate to use than rectangles for specifying areas.