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THREE-DIMENSIONAL OBJECT REPRESENTATION FOR EXPLOITATION OF REMOTELY SENSED IMAGES

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The value of digital 3-D object representation as an aid to exploit remotely sensed images has been demonstrated. Experience has shown that knowledge about what is being viewed is required to accomplish non-trivial object recognition tasks when such an aid is used. Previous approaches representing knowledge as constraints in a relaxation scheme or as templates for pattern matching, lack flexibility and realism. This paper presents recent research results on a shaded surface computer graphics approach that uses a knowledge base consisting of a library of three-dimensional objects represented as surfaces and skeletons. Objects include pieces of terrain, vehicles and buildings. The surfaces for these objects are generated by mapping surfaces onto topological contours or onto a series of cross sectional object outlines. For branching contours (n contours in section i connecting to m contours in section i+i), the surfaces are mapped by first concatenating the section i contours into a single large contour, similarly concatenating the section i+i contours, then performing the one to one mapping. Capping off single arbitrarily shaped contours is done by computing the medial axis transform of the contours, constructing the medial axis contour and then mapping a surface from the contour to the medial axis contour. The skeleton of a general three-dimensional closed polygonal surface may be obtained through use of a three-dimensional extension of the medial axis transform. This research has resulted in a mapping algorithm that provides a more general method for obtaining surface descriptions of non-analytic contour defined objects suitable for placement in a scene and for shaded surface rendition. Furthermore, depth profiles of the scene may be generated, which are useful for comparisons with actual depth information.

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