An Image Processing Algorithm Based on FMAT

Information is deleted in ways that minimize adverse effects on reconstructed images.

Lyndon B. Johnson Space Center, Houston, Texas

The problem of extracting medial axis transformation (MAT) and skeleton (or thinning) plays a key role in image processing, analysis, and recognition because of the simplicity of image (and hence object) representation they allow. There has been extensive research done in extracting the medial axis of a region and skeleton of elongated objects from a two-tone image.

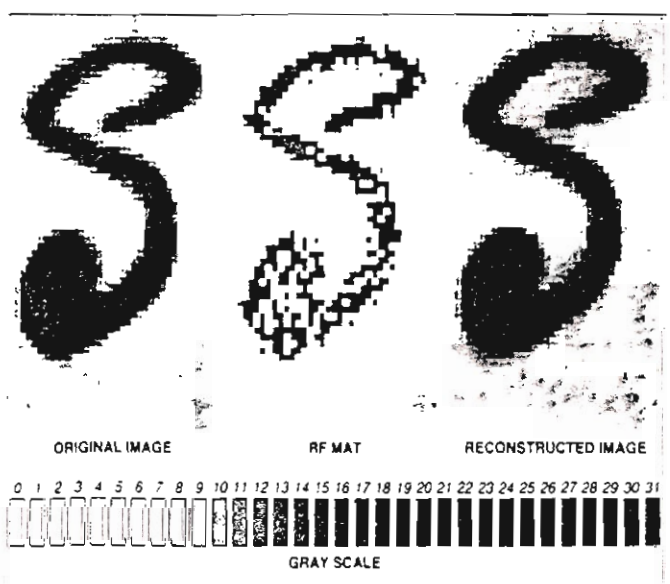
The present work proposes a new gray-scale generalization of MAT, called FMAT (short for Fuzzy MAT). It is formulated by making a natural extension to fuzzy-set theory of all the definitions and conditions (e.g., characteristic function of a disk, subset condition of a disk, and redundancy checking) used in defining a MAT of a crisp set. As a result, it does not need the image to have any kind of a priori segmentation, and it allows the medial axis (and skeleton) to be a fuzzy subset of the input image. The resulting FMAT (consisting of maximal fuzzy disks) is capable of reconstructing exactly the original image.

An attempt of obtaining an optimum FMAT for making the image MAT representation more economical is also made by maximizing compactness of the FMAT output with its various acuts. Such an optimum version keeps only those medial-axis pixels that are responsible for object regions of interest while ignoring the rest. This can also be regarded as an optimum (in the sense of minimizing spatial ambiguity) fuzzy skeleton of an image.

This work was done by Lui Wang of **Johnson Space Center** *and Sankar K. Pal of the National Academy of Sciences. For further information,* ***write in 12*** *on the TSP Request Card.*

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Patent Counsel, Johnson Space Center [see page 20]

MSC-21997



The Original Image of 60 x 36 pixels and 32 gray levels is converted to a reduced-redundancy FMAT (RFMAT), then reconstructed from the RFMAT.