

Morphology

A number of morphologic operations are available, as described in the table below. These operations can be performed on the entire volume or on selected objects if an object map is loaded.

Morphologic Operation	Description	Method
Threshold	isolates structures defined by a difference in intensity	sets voxels between and equal to the specified maximum and minimum to 1 and all other voxels to 0
Erode	peels a layer from the outer edge of large objects and deletes small objects	retains voxels in inner areas of the object, as determined by the structuring element dimensions and shape
Dilate	expands small objects in a binary volume	adds voxels to outer areas of the object, as determined by the structuring element dimensions and shape
Open	removes small objects and breaks isthmuses	erosion followed by dilation
Close	fills thin gulfs and small holes	dilation followed by erosion
Maximum	emphasizes high-intensity regions	grayscale equivalent of binary dilation
Minimum	emphasizes low-intensity regions	grayscale equivalent of binary erosion
Ultimate Erosion	shows the last voxels remaining of disconnected components	performs successive erosions on the object until the last erosion before the components would disappear
Thinning	thins an object in binary or grayscale	thins the object based on the number of iterations specified, using template matching

Morphologic Operation	Description	Method
Homotopic Thickening	thickens an object in binary or grayscale	thickens the object based on the number of iterations specified
Fill Holes	fills holes in a volume	fills holes in 2D or 3D, based on the connectivity value chosen
Connected Components	finds connected regions in a volume	performs a 2D or 3D connected component analysis
Complement	generates inverse of an image	generates the binary or grayscale complement of the image
Umbra	darkens the image	decreases the intensity value of all voxels by the specified intensity cutoff value
Nonmax Suppression	shows voxels of highest intensity	sets voxels which are not at a local maximum to zero
Watershed	performs classic watershed operation	thresholds a binary volume, performs repeated erosions, sets voxels to erosion level and connects components