

GMM Segmentation

Image segmentation into two regions (foreground and background) using Gaussian Mixture Model (GMM) and maximal likelihood estimation via the Expectation-Maximization (EM) algorithm. The segmentation is performed according to manually annotated positive and negative samples. Live preview of the segmentation operation is shown in the axial slice.

Mark Positive – when active, it is possible to select voxels that should belong to the foreground by holding down the left mouse button together with the Shift key and drawing.

Mark Negative – selection of points that should belong to the background.

Clear Samples – clears all markings.

Perform GMM Segmentation – performs the segmentation of whole the volumetric data according to the annotated data.

FCM Segmentation


Fuzzy C-Means segmentation method performs an automatic segmentation of the volumetric data into a given number of regions according to intensities of voxels. Because this method overwrites existing segmentation data, it should be used as a starting point for a new segmentation.

Num. of Regions – the desired number of regions.

Perform FCM segmentation – performs the automatic segmentation for whole the dataset.

Thresholding

Thresholding adds all voxels having the density value between two given thresholds into the active region. When other than low quality is set, a small voxel's neighbour is also taken into account to improve the segmentation result in presence of noise.

Lower Threshold – only those voxels having density value higher than this threshold will be added. If you want to pick the threshold value from the volume data, press the Dropper button  and click the left mouse button inside any ortho slice.

Higher Threshold – only voxels with density value lower than this threshold will be added to the current region. The value can also be picked from the volume with the help of the Dropper button.

Quality – when a quality higher than Low is selected, voxel value will be estimated as a weighted average of a close neighbourhood to improve the algorithm performance on noisy data.

Incremental Thresholding – determines whether the segmentation erases the existing segmentation data or just marks and adds voxels that are within the thresholds.

Perform Thresholding – performs the thresholding.

Median Filter

Median filter is typically used to get rid of very small isolated areas. The principle of the algorithm is that every voxel value is replaced by the median value of a neighbourhood with given filter size. This algorithm performs well on noisy data, but also smooth out some details. Therefore, use it with care.

Filter Size – sets the median size, i.e. size of the local neighbourhood.

Use All Regions – determines whether the filter will be applied on the active region only, or on all the regions.

Perform Median Filtering – applies the median filter on the segmentation data.

Morphological Operations

Allows you to apply Binary Dilation and Binary Erosion operators of the specified squared element size on the segmentation data. The operation is performed on the data that belong to the active region only.



Element Size –size of the structure element (strength of the operation).

Dilate – performs the dilation, which is an operation which expands all areas and fills small holes and creeks in the segmentation volume.

Erode – performs the erosion, which is an operation that shrinks the segmentation data and therefore reduces thick lines and areas, removes solitary points and separates areas with thin joins.

Level Set Segmentation

You can think of the Level Set segmentation as a 3D flood-fill from a user specified starting point. Moreover, there is an extra smoothing of the region boundary which can have a large impact on the final result. Helper mask controlling the filling can be based on automatically estimated thresholds or an existing segmentation data. User can decide whether the method can overwrite other existing regions, or whether it adds the result to the existing segmentation.

Points – allows you to specify/add a new starting point for the segmentation process. The last point added or all the points can be cleared using buttons  and .

Add to existing segmentation – if enabled, all voxels that are not selected by the Level Set segmentation are left classified as they are.

Preserve other regions – the method will ignore all voxels that already belong to a region which different from the active one.

Smoothing – strength of the smoothing operation.

Fill Mask – changes the method used to derive the helper mask that affects the area which will be filled by the segmentation.

Perform Level Set Segmentation – performs the segmentation according to the current settings.