Segmentation 2

Deepayan Bhowmik

Image Segmentation

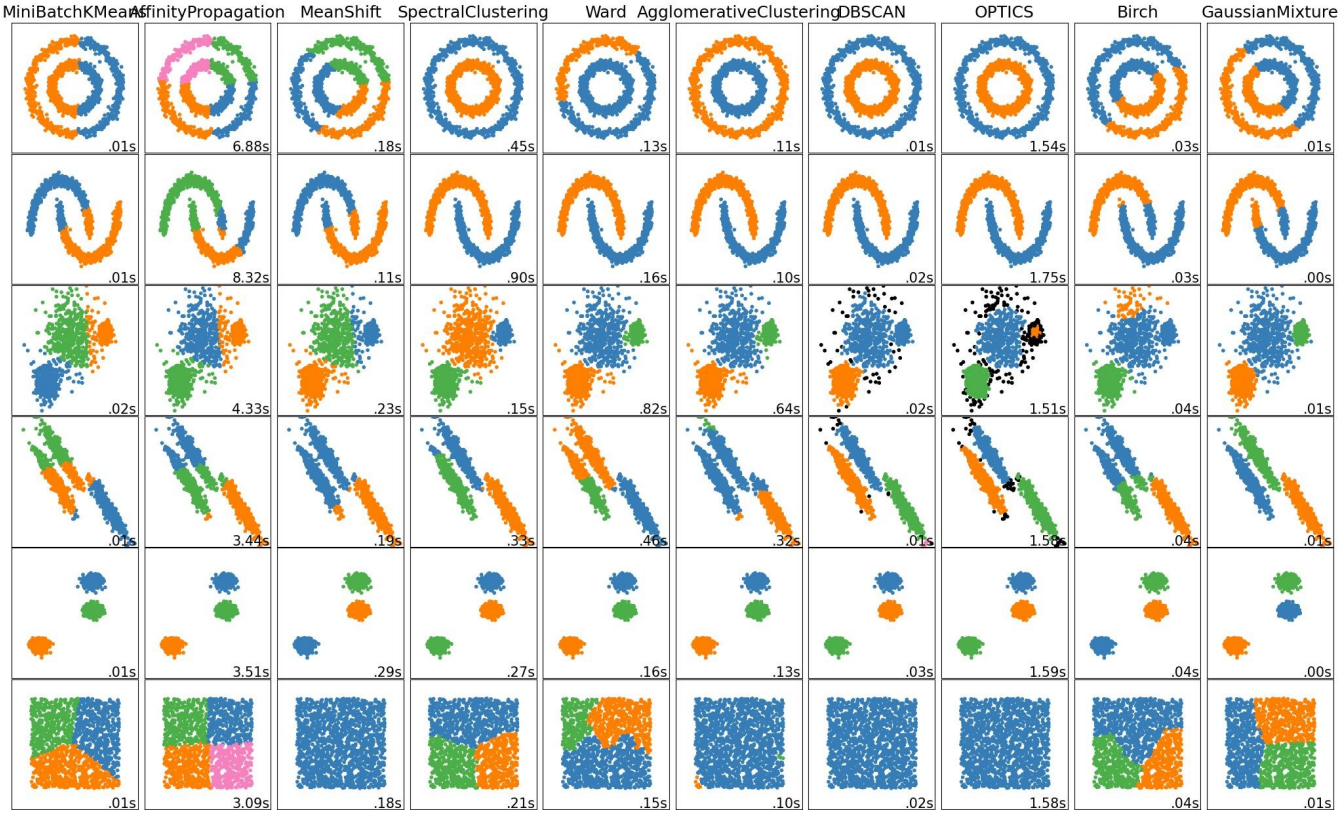


Image Segmentation

K-Means is a very important and powerful algorithm for data clustering. It is an Unsupervised Machine Learning technique which we can apply to find new patterns in our data.

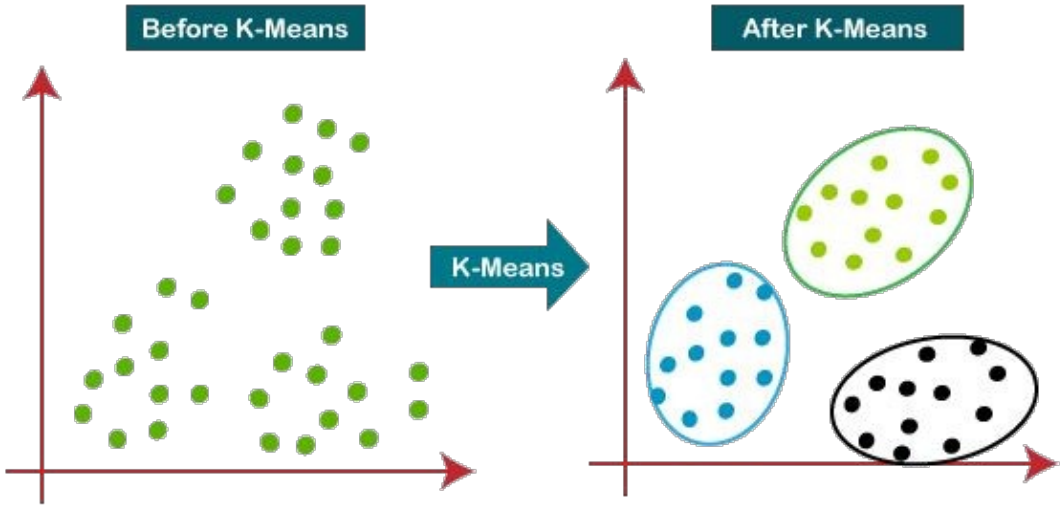


Image Segmentation - Gray

Nr. of clusters: 3 5 10




Image Segmentation - RGB

Nr. of clusters: 3 5 10

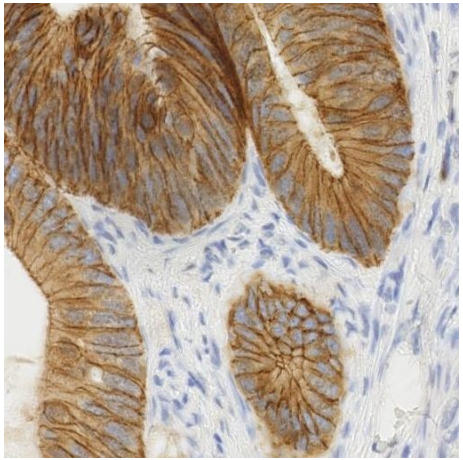
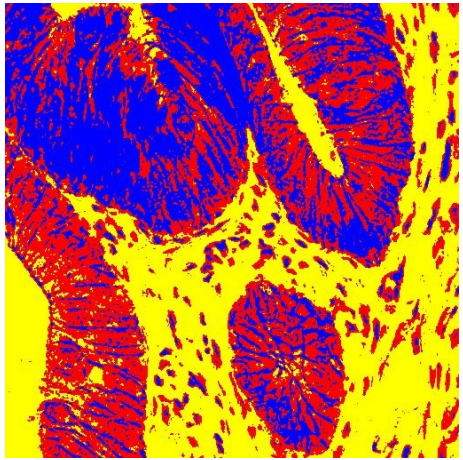
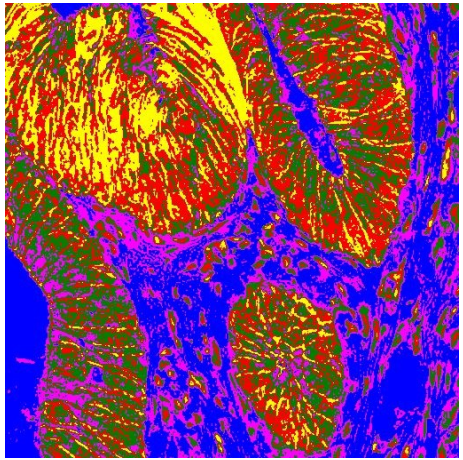
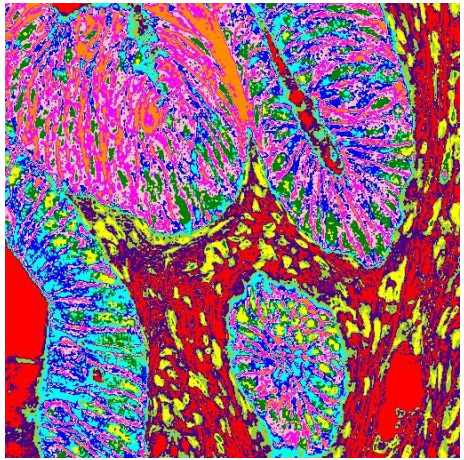





Image Segmentation - CIELAB

Nr. of clusters: 3 5 10

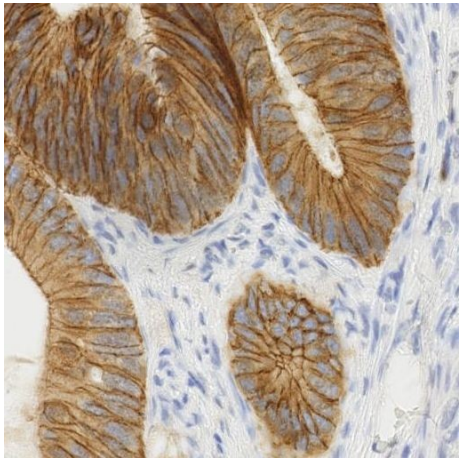
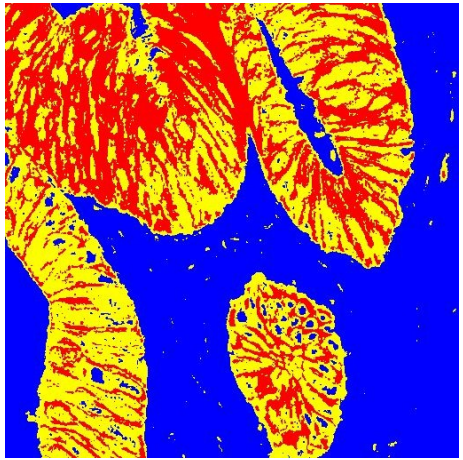
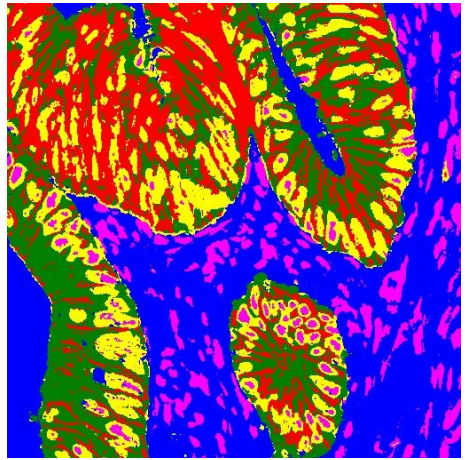
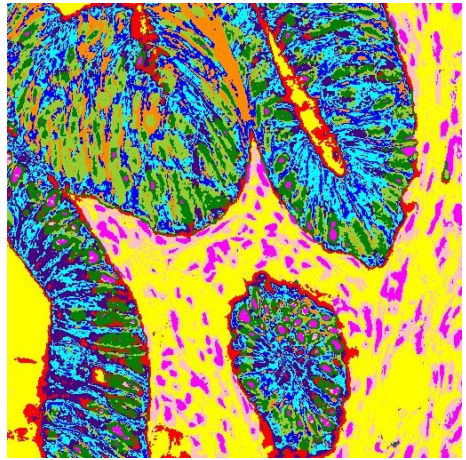





Image Segmentation - HSV

Nr. of clusters: 3 5 10

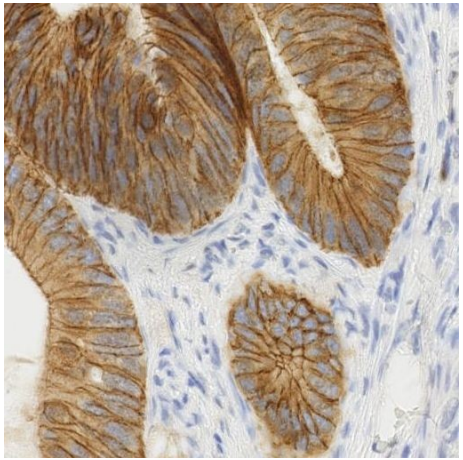
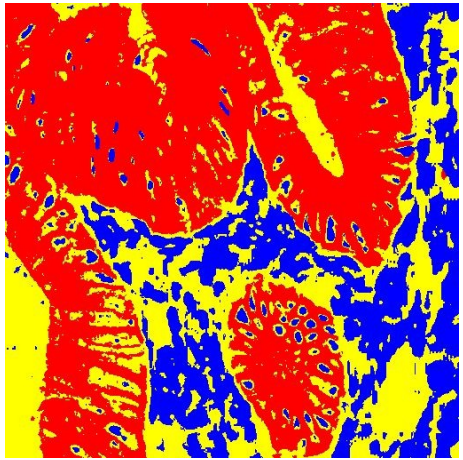
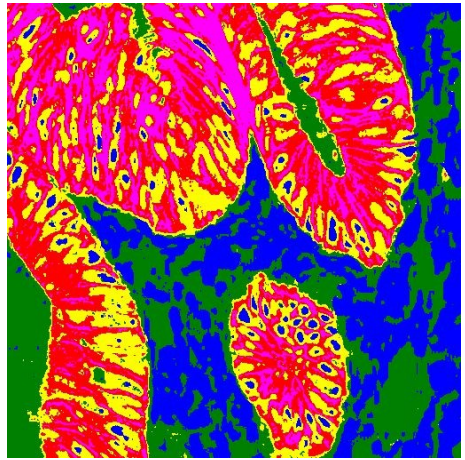
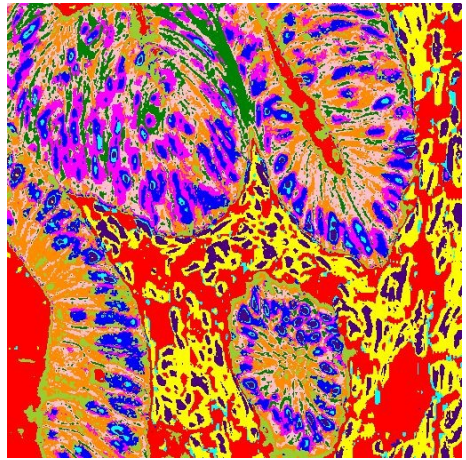





Image Segmentation

The BIRCH algorithm uses a tree structure to create a cluster. It is generally called the Clustering Feature Tree (CF Tree). Each node of this tree is composed of several Clustering features (CF).

Figure 2. BIRCH Overview

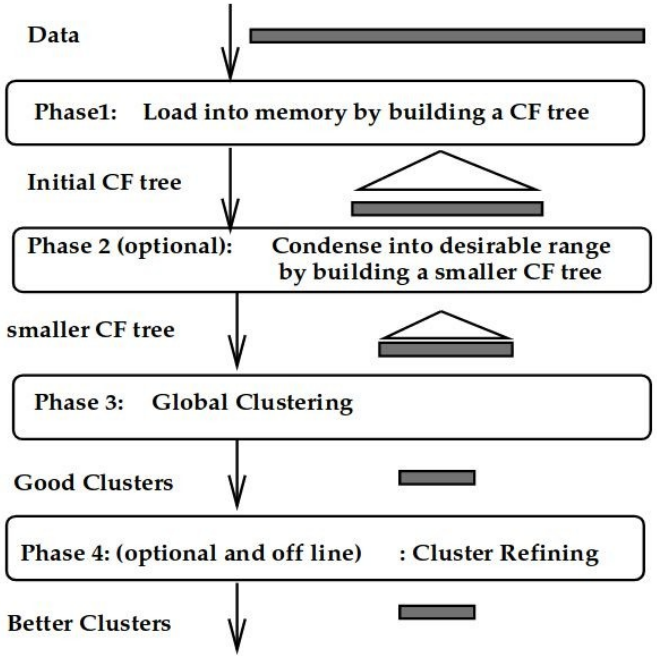


Image Segmentation - Gray

Nr. of clusters: 3 5 10




Image Segmentation

Agglomerative Clustering is a strategy of hierarchical clustering. Hierarchical clustering (also known as Connectivity based clustering) is a method of cluster analysis which seeks to build a hierarchy of clusters. Hierarchical clustering, is based on the core idea of objects being more related to nearby objects than to objects farther away. As such, these algorithms connect 'objects' to form clusters based on their distance. A cluster can be described largely by the maximum distance needed to connect parts of the cluster.

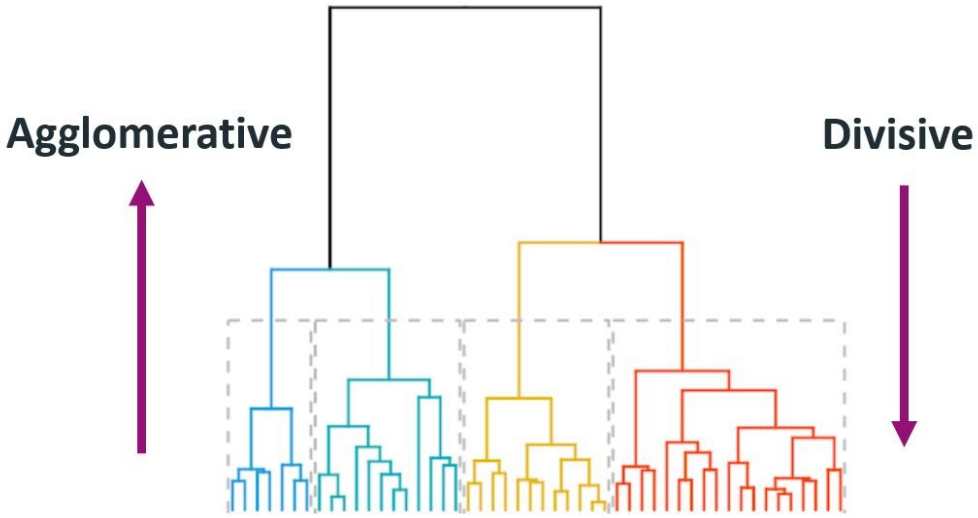


Image Segmentation - Gray

Nr. of clusters: 3 5 10

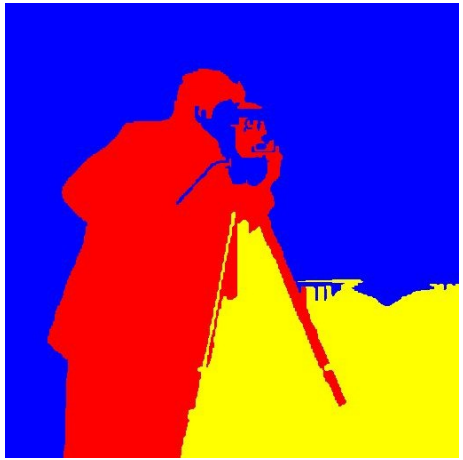
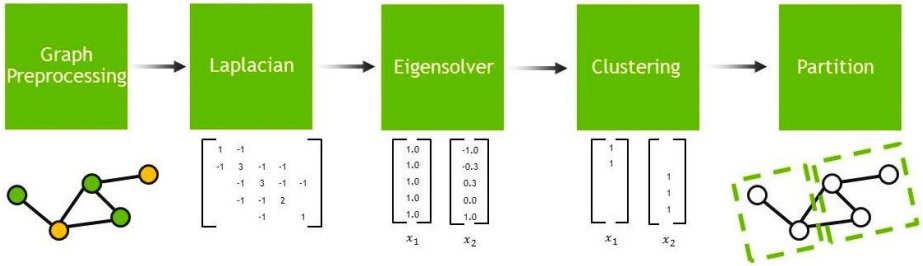



Image Segmentation

Spectral Clustering uses the connectivity approach to clustering', wherein communities of nodes (i.e. data points) that are connected or immediately next to each other are identified in a graph. The nodes are then mapped to a low-dimensional space that can be easily segregated to form clusters. Spectral Clustering uses information from the eigenvalues (spectrum) of special matrices (i.e. Affinity Matrix, Degree Matrix and Laplacian Matrix) derived from the graph or the data set.



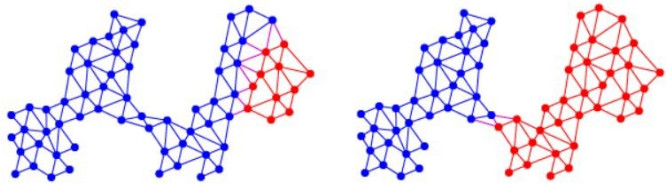


Image Segmentation - Gray

Nr. of clusters: 15 20 25



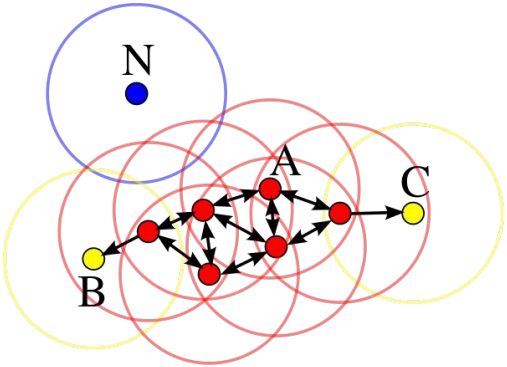

Note: images were scaled down for speed

Image Segmentation

DBSCAN algorithm:

- Find all the neighbor points within eps and identify the core points or visited with more than MinPts neighbors.
- For each core point if it is not already assigned to a cluster, create a new cluster.
- Find recursively all its density connected points and assign them to the same cluster as the core point.
- A point a and b are said to be density connected if there exist a point c which has a sufficient number of points in its neighbors and both the points a and b are within the eps distance. This is a chaining process. So, if b is neighbor of c, c is neighbor of d, d is neighbor of e, which in turn is neighbor of a implies that b is neighbor of a.
- Iterate through the remaining unvisited points in the dataset. Those points that do not belong to any cluster are noise.

Mean Shift is an unsupervised machine learning algorithm. It is a hierarchical data clustering algorithm that finds the number of clusters a feature space should be divided into, as well as the location of the clusters and their centers. It works by grouping data points according to a “bandwidth”, a distance around data points, and converging the clusters’ centers towards the densest regions of data.



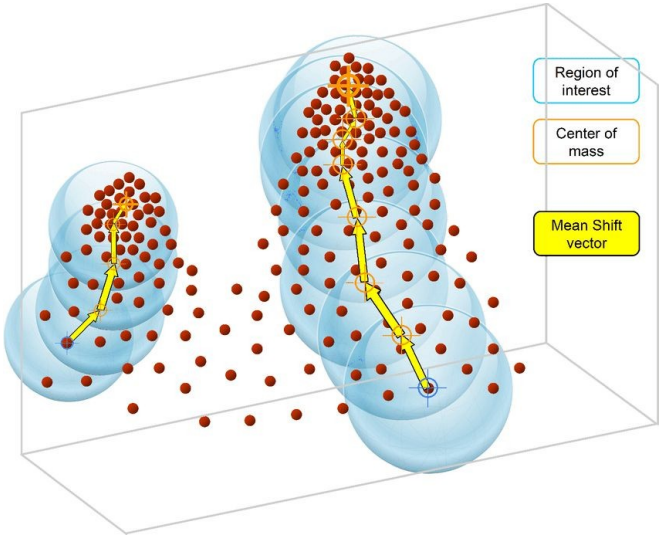
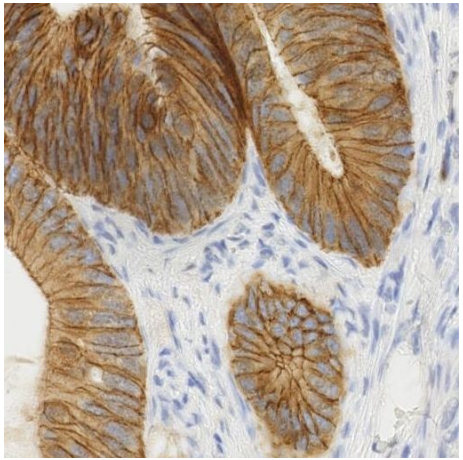
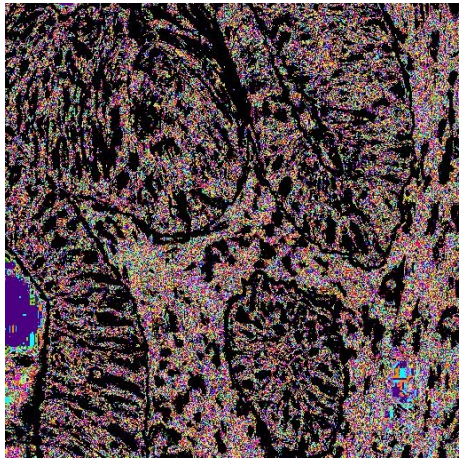


Image Segmentation - RGB

DBSCAN

MeanShift





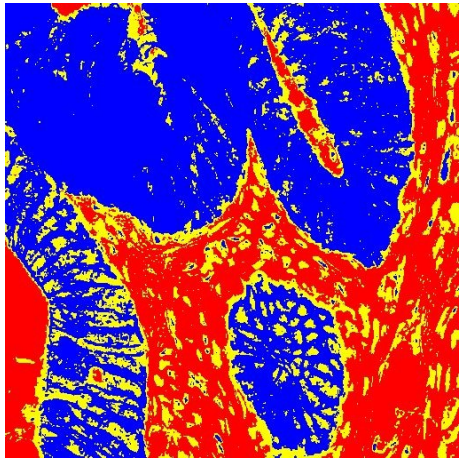
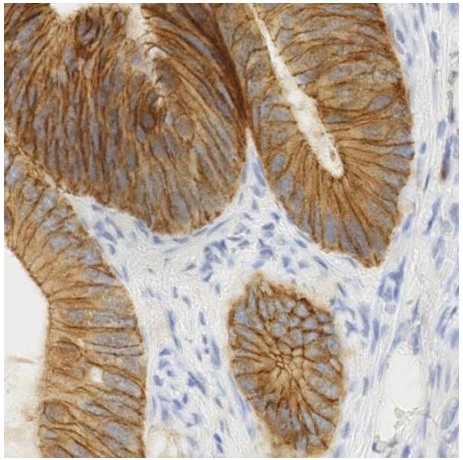


Image Segmentation - RGB

GraphCut



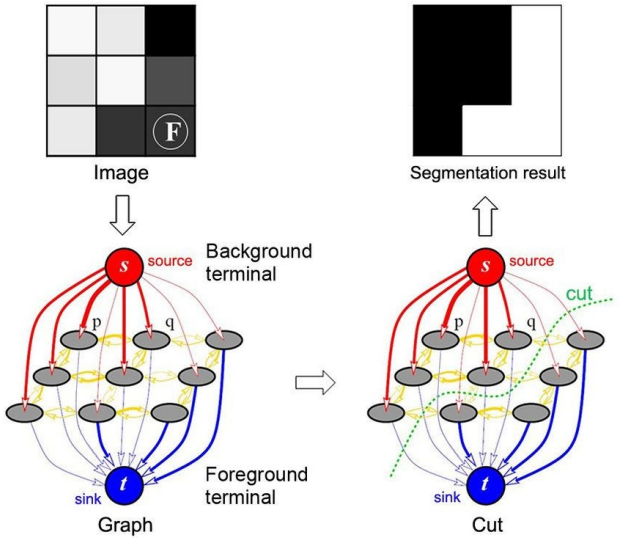
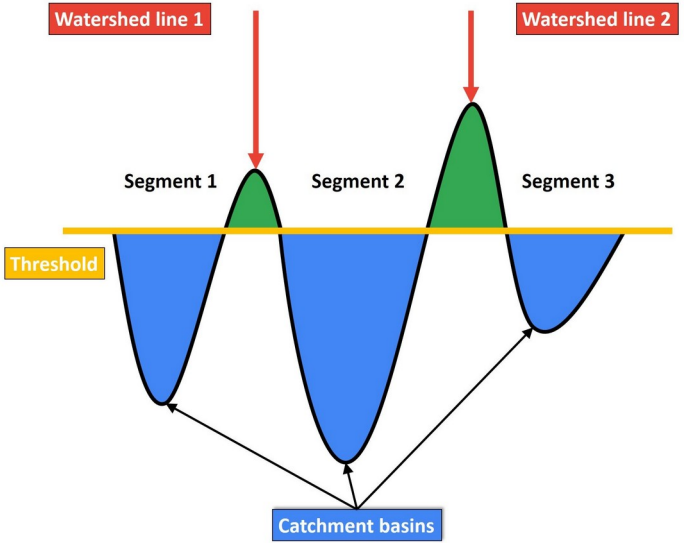


Image Segmentation - Gray

Watershed



Applications

“We propose a methodology that incorporates k-means and improved watershed segmentation algorithm for medical image segmentation. The use of the conventional watershed algorithm for medical image analysis is widespread because of its advantages, such as always being able to produce a complete division of the image. However, its drawbacks include over-segmentation and sensitivity to false edges. We address the drawbacks of the conventional watershed algorithm when it is applied to medical images by using k-means clustering to produce a primary segmentation of the image before we apply our improved watershed segmentation algorithm to it.”

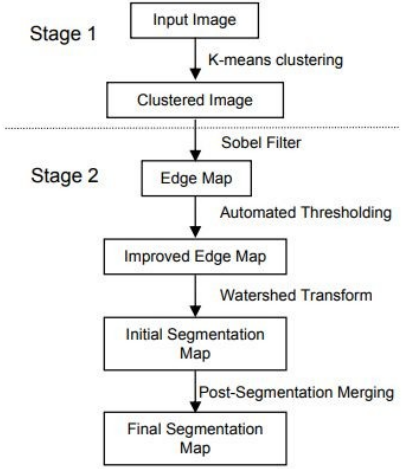


Figure 2. Flowchart of proposed methodology

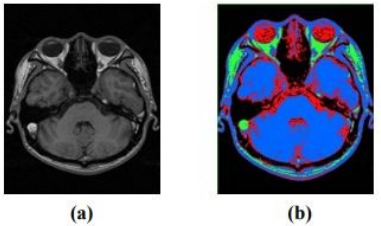


Figure 3. (a) MR image (b) MR image after K-means clustering

H. P. Ng, S. H. Ong, K. W. C. Foong, P. S. Goh and W. L. Nowinski, "Medical Image Segmentation Using K-Means Clustering and Improved Watershed Algorithm," 2006 IEEE Southwest Symposium on Image Analysis and Interpretation, Denver, CO, USA, 2006, pp. 61-65