\*\*Segmentation in Feature Space:\*\*

- \*\*Intentional Image Acquisition:\*\* Selection of medical imaging techniques intentionally captures pixel or voxel values covering more semantics regarding object class membership than in photography.

- \*\*Classification in Feature Space:\*\* Segmentation can be viewed as classification in feature space, where image intensities serve as features.

- \*\*Dimensionality and Sample Size:\*\* Feature space typically has low dimensionality but a high number of samples characterizing object classes.

- \*\*Classifier Functionality:\*\* Classifiers estimate likelihood functions from samples and compute posterior probabilities for each object class.

\*\*Clustering in Feature Space:\*\*

- \*\*Clustering Definition:\*\* Grouping scene elements into clusters when it's not known a priori how many and which classes they belong to.

- \*\*Assumption:\*\* Elements from the same object have more similar features than those from different objects.

- \*\*Methodology:\*\* Generic methodology applicable to any feature type, with techniques differing based on feature space dimensionality and density.

- \*\*Interactive Clustering:\*\* In low-dimensional feature space, clustering can be done interactively by displaying the 2D distribution and delineating clusters.

\*\*Partitional Clustering and K-means Clustering:\*\*

- \*\*Partitional Clustering:\*\* Divides data into non-overlapping clusters, where each data point belongs to exactly one cluster.

- \*\*K-means Clustering:\*\* Popular partitional clustering method that partitions data into K clusters by iteratively updating cluster centroids.

\*\*Mean Shift Clustering:\*\*

- \*\*Objective:\*\* Identifies all possible cluster centers in feature space without prior knowledge of the number of clusters.

- \*\*Method:\*\* Shifts markers toward local maxima using a gradient ascent algorithm, labeling each location and its corresponding cluster.

\*\*Kohonen’s Self-organizing Maps:\*\*

- \*\*Definition:\*\* Artificial neural network trained using unsupervised learning to produce a two-dimensional representation of the input space, called a map.

- \*\*Functionality:\*\* Useful for classification and visualizing low-dimensional views of high-dimensional data.

- \*\*Similarity to Biological Systems:\*\* Resembles biological systems like the human cortex, where multi-dimensional sensory input spaces are represented by two-dimensional maps.

- \*\*Topology-preserving Map:\*\* Imposes a topological structure on the nodes in the network, preserving neighborhood relations during mapping.