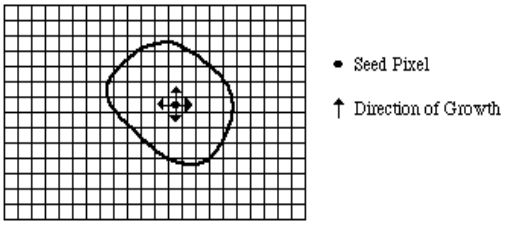
LAB # 08: Image Segmentation

Lab Objective:

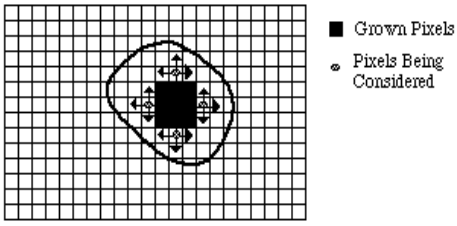
The objective of this lab is to apply region growing and k means clustering algorithm to segment an image.

Lab Description:

Region Growing is also another kind of region-based segmentation method. For region growing, a "seed" point is selected. Whenever this seed is encountered in an image, its surrounding neighboring pixels are checked and a decision is made whether a neighboring pixel should be added to the region or not following a selection criterion. One criterion that can be used is that only that pixel is kept from the neighbors that has the same intensity value as the pixel itself.



(a) Start of Growing a Region



(b) Growing Process After a Few Iterations

Several complete passes of the image are needed in order for region growing to completely work.

K means Clustering:

K means clustering is the most basic and widely used clustering technique for data grouping, in machine learning and in colored image segmentation. The algorithm for K-means clustering is as following

1. Chose the number (K) of clusters and randomly select the centroids of each cluster.
2. For each data point:
   - ❑ Calculate the distance from the data point to each cluster.
   - ❑ Assign the data point to the closest cluster.
3. Re compute the centroid of each cluster.
4. Repeat steps 2 and 3 until there is no further change in the assignment of data points (or in the centroids).

Lab Task 1:

Write a program that take dermoscopic image as input (images used in assignment 1) and applies region growing on it. You have to segment out lesions. Take center of the image as seed point. Display the resultant image.

Lab Task 2:

Write a function that takes dermoscopic skin image (used in task 3 as well) as input and segments the image using K-mean clustering with and k=2. Display the resulting image.

Applications:

I. Locate tumors and other pathologies
II. Face detection
III. Fingerprint recognition
IV. Measure tissue volumes
V. Locate objects in satellite images

References:

i. https://www.cs.auckland.ac.nz/courses/compsci773s1c/lectures/ImageProcessing-html/topic3.htm#adaptive

ii. Yuheng, S., & Hao, Y. (2017). Image segmentation algorithms overview. arXiv preprint arXiv:1707.02051.