Bioimage Computing

Programming Assignment - 1

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Question-1

SLIC algorithm

- This is a clustering algorithm that works on a centroid model just like the k-means algorithm.

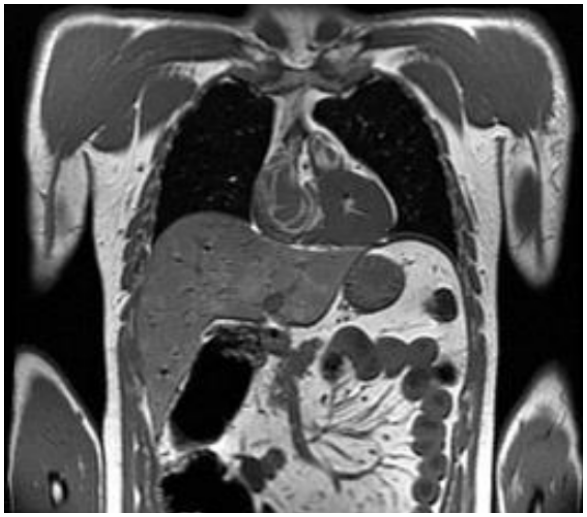
Given cluster centers n_1,n_2… and clusters are C1, C2, …

- In SLIC, we iteratively go to pixels, and based on its distance from various cluster centers, we assign a cluster to it.
- And at the end of each iteration, we update the cluster center based on new pixels of the cluster by taking an average.

The iteration process is similar to that of k-means, but here, instead of going to all the cluster centers, we only check inside pre-decided proximity. (We have done that for 2*area of the cluster(S))

The program was run on Q1.png (given in classroom) the output for that can be found in the folder: *q1/sample-output*

Sample Input Image:



Sample Output (Q1 M=20 K=100 5th iteration):

Question 2

Thin Plate Spline (TSP) Algorithm

- This is an algorithm for the non-rigid registration of an image.
- We take Φ_{ij} to be equal to $n^2 * \log(n)$ where n = distance between Y_j and X_i.
- The set of pixels of two images is X and Y.
- First of all, we make G using values of Φ_{ij}.
- Then using G, we make T and Y.
- And then W is $T^{-1} * Y$.

For two images (X and Y) whose 8 pixels are as follows:

```
X = [[27, 36], [12, 18], [57, 89], [99, 100], [178, 124], [134, 111], [145, 167], [11, 14]]
Y = [[45, 59], [26, 43], [67, 54], [88, 90], [178, 142], [123, 134], [134, 187], [9, 7]]
```

W will be:
[[4.25215324e+07 4.50451108e+07]
[6.16288572e+07 6.50137605e+07]
[3.40550557e+07 3.66635515e+07]
[1.77753146e+07 1.97073038e+07]
[2.73939903e+07 3.26950377e+07]
[1.45223768e+07 1.72965439e+07]
[3.26452646e+07 3.71534702e+07]
[9.83216790e+07 1.03889863e+08]
[6.70000000e+02 7.16000000e+02]
[8.17530000e+04 8.45210000e+04]
[7.50800000e+04 8.05130000e+04]]

With the last 3 lines representing a_{i0}, a_{i1}.