Medical Image Computing

Assignment 3

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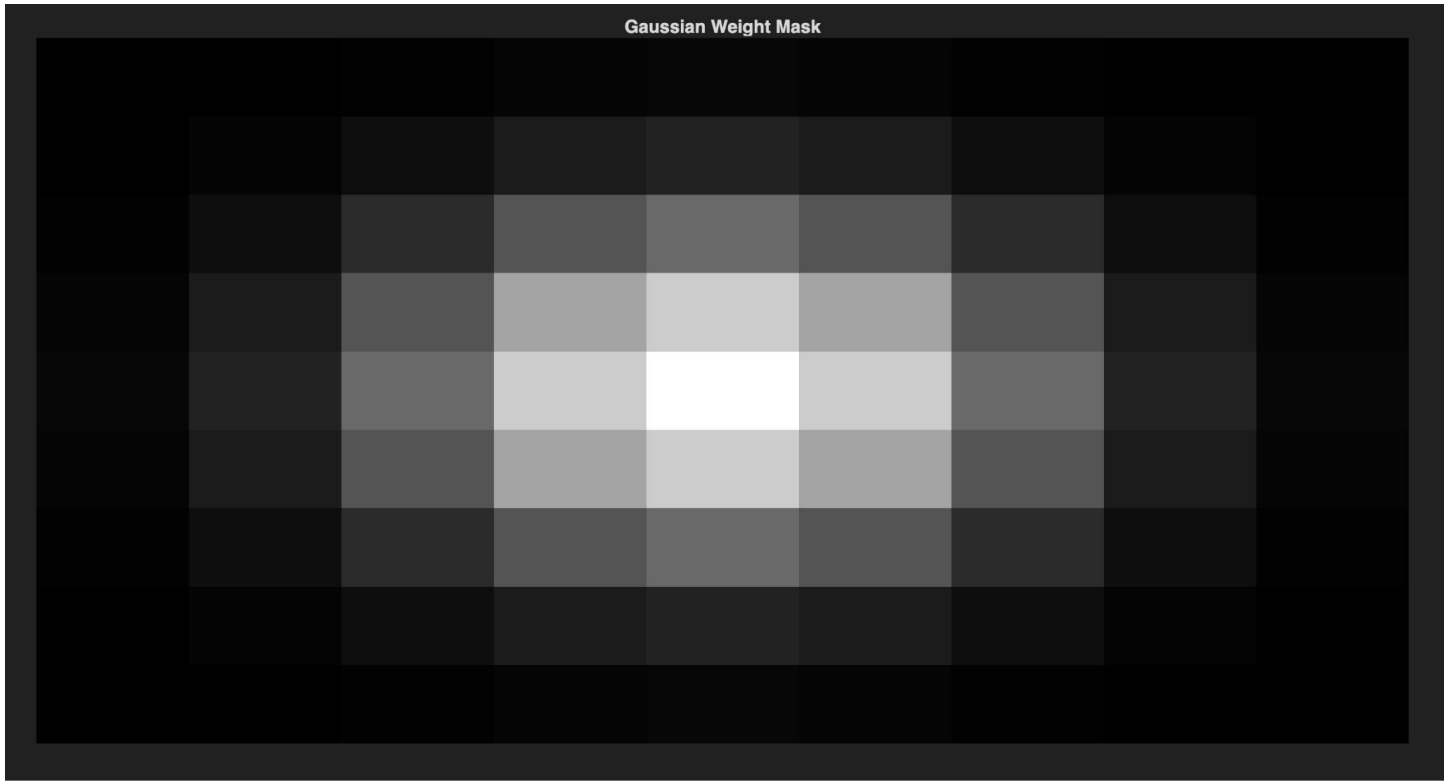
Q1

Segmenting a Brain MR Image

q = 2

W

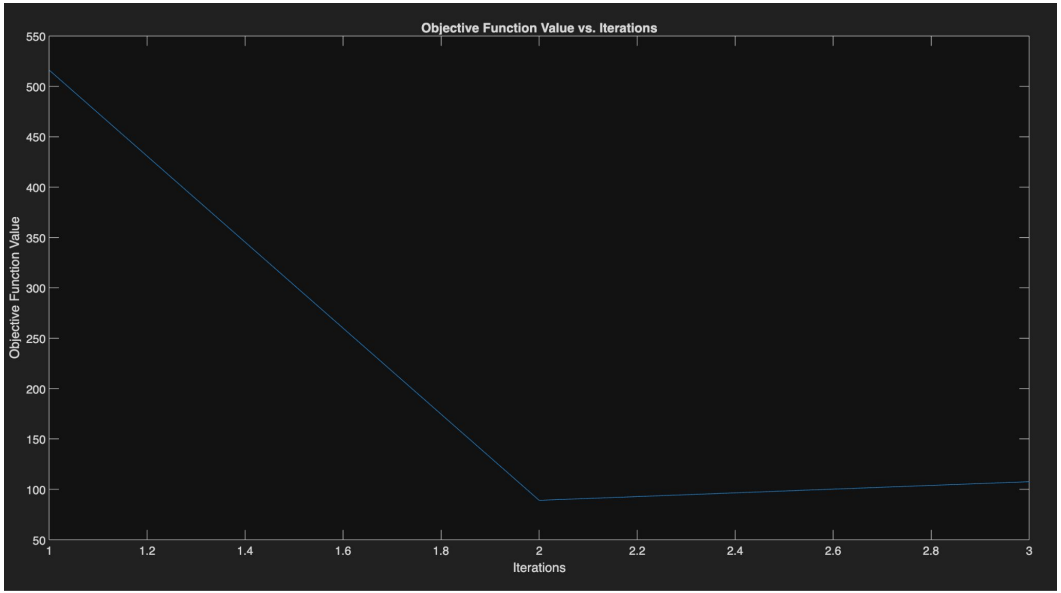


Initial Estimate of membership

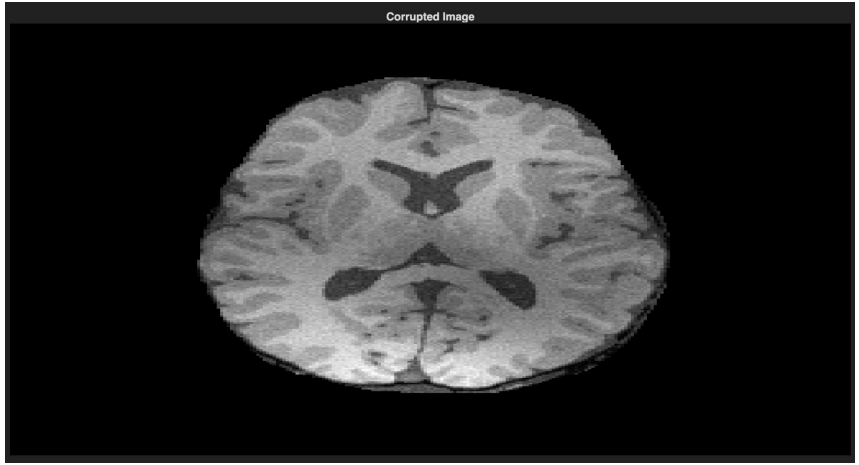
Initial Estimate of class means

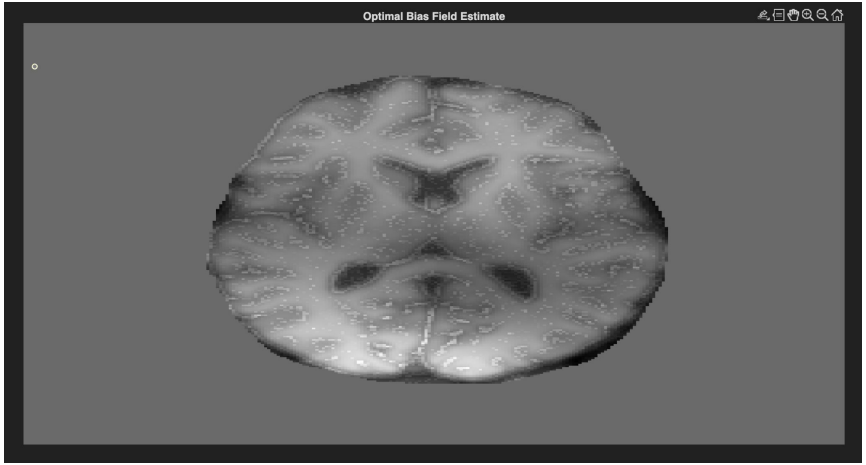
```
0.0654, 0.2246, 0.4518
```

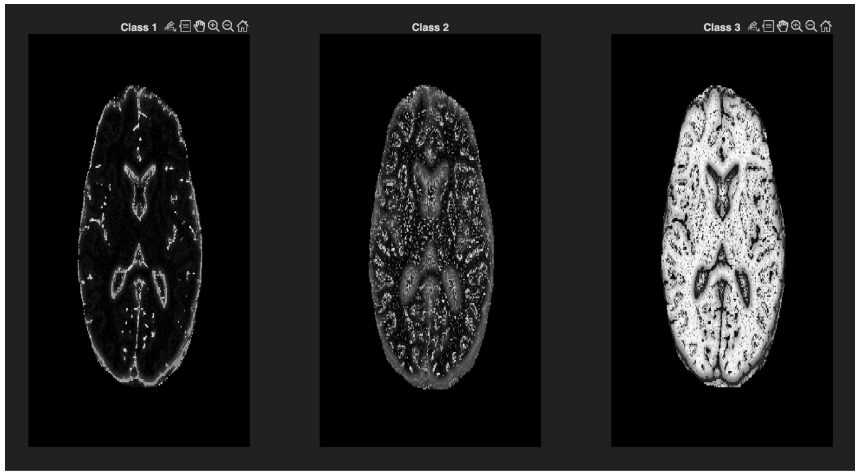
Objective Function

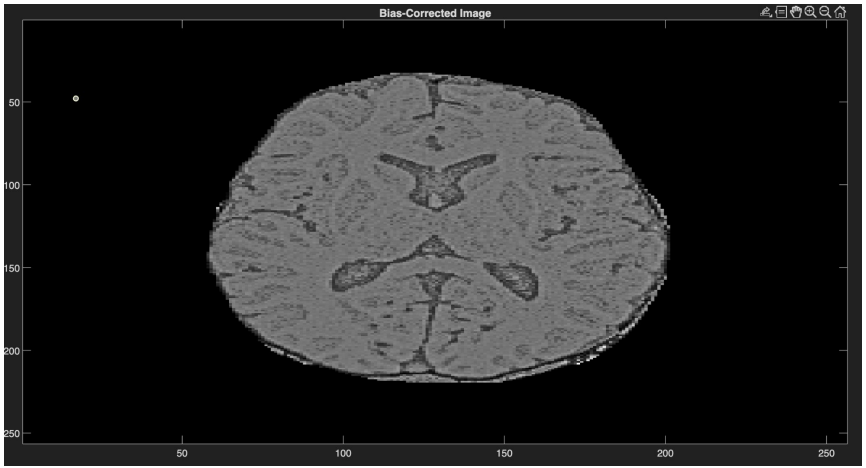


Part (f)

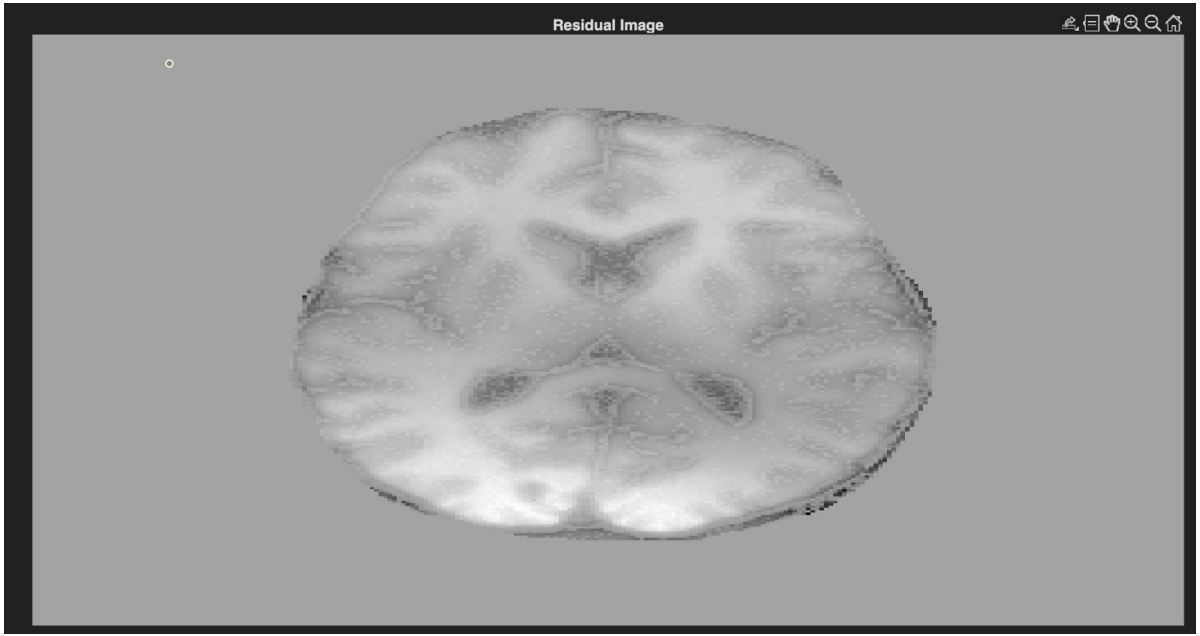

Corrupted Image


Optimal Bias Field Estimate


Class 1
Class 2
Class 3


Bias-Corrected Image
50
100
150
200
250
50
100
150
200
250

Residual Image

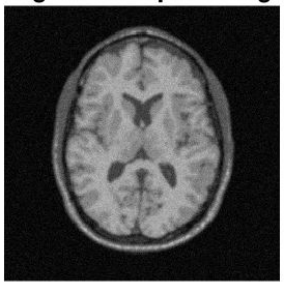


Optimal Class Means

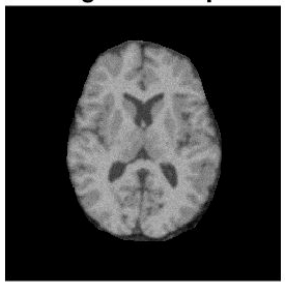
0.2517, 0.3605, 0.4332

Q2 - **Segmenting a Brain MRI Image using EM optimization algorithm**

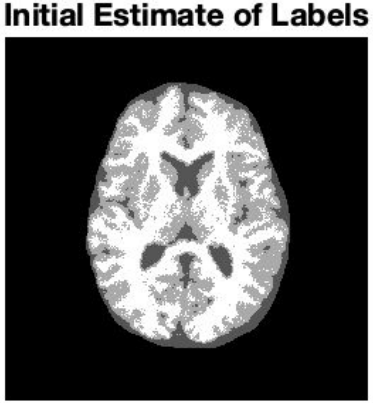
Original Corrupted Image



Masked Original Corrupted Image



Initial Estimate of Labels and Parameters



Label Image -

- Used k-means algorithm to get the initial estimate of labels and parameters (μ_k, σ_k) for k=1,2,3
- Used a random initialization of the means at the first iteration of k-means and assigned clusters
- Updated means, and subsequently clusters until convergence

Motivation to use K-means -

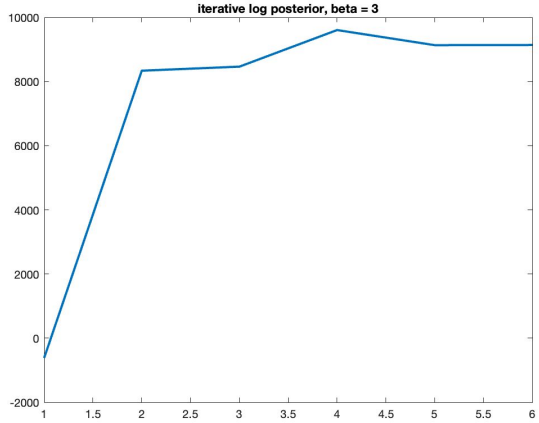
- White matter intensities, gray matter intensities, CSF intensities are usually in separate but overlapping ranges
- K-means gives a reasonable starting point without knowledge of gaussian parameters apriori

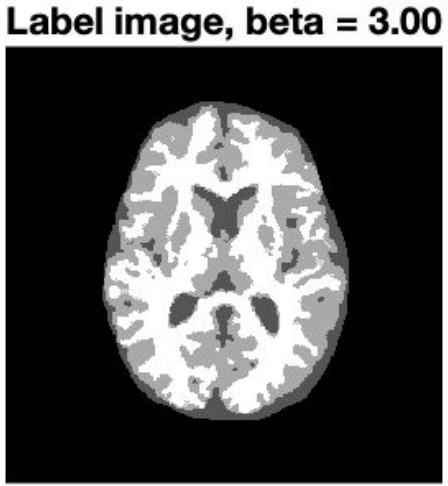
Gaussian parameters - θ :
Initial cluster means: 0.27, 0.51, 0.63
Initial class standard deviations: 0.08, 0.04, 0.04
Motivation:
Once K-means gives us a starting point of means, set the clusters according to the minimum distance of pixel from the cluster centres. On this subset of points, initialize standard deviation definition.

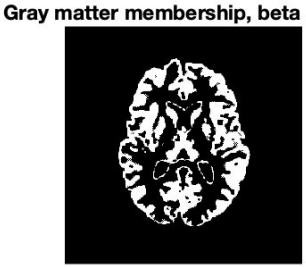
Chosen Beta Value = 3

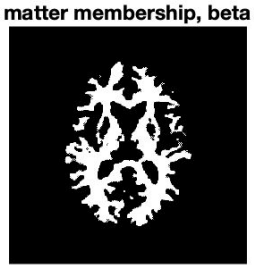
Note: Lower beta values give noisy label images, and higher beta values do not improve the estimate at Beta=3

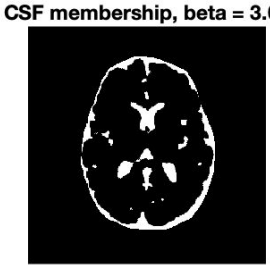
<u>Class means estimate:</u>
Initial cluster means: 0.27011, 0.50532, 0.62874
Final class means: 0.2820, 0.5135, 0.6279



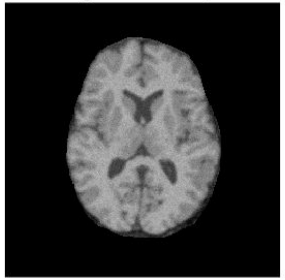








Masked Original Corrupted Image

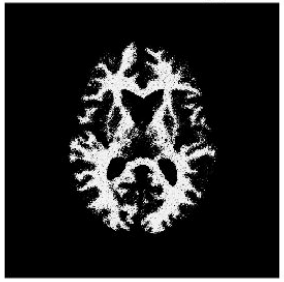


White matter membership, beta = 3.00

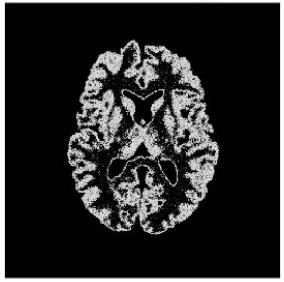
Gray matter membership, beta = 3.00

CSF membership, beta = 3.00

White matter membership, beta = 0.00

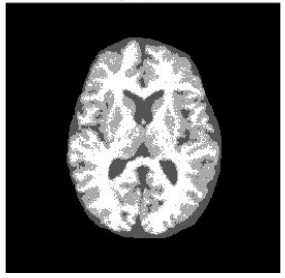


Gray matter membership, beta = 0.00

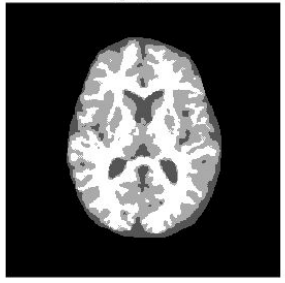


CSF membership, beta = 0.00

Label image, beta = 0.00



Label image, beta = 3.00



Beta = 0 vs 0.5 vs 3