

# ***A tentative plan for the project***

**Week 1** - Understanding the concept of random variables, pdfs, joint pdfs, marginal pdfs, conditional pdfs. A closer look at gaussian distribution function. Understanding Multivariate Gaussian Distribution.

**Week 2** - Remanings of multivariate gaussian distribution. Getting familiarized with K - Means Clustering Algorithm. Assignment on K means clustering ( A bit of coding in python + Theoretical Analysis, You will need to submit a report. Will be quite light )

**Week 3** - Generative Models, Understanding the generative model used for bias field correction, Understanding the cost function. Understanding the updates, Implementing the code in python.

**Week 4** - Mostly completing the assignment given, preparing the report for the first half, if you have time then we will start on next topics.

**Week 5** - Mixture Models, Gaussian Mixture Models, Bayesian Statistics ( Mostly Prior and Posterior things ), Why do we think it will be better than K - Means Clusterin ?, Understanding the optimization problem of GMM.

**Week 6** - Understanding the Expectation Maximization Algorithm, Starting implementing the GMM - EM method.

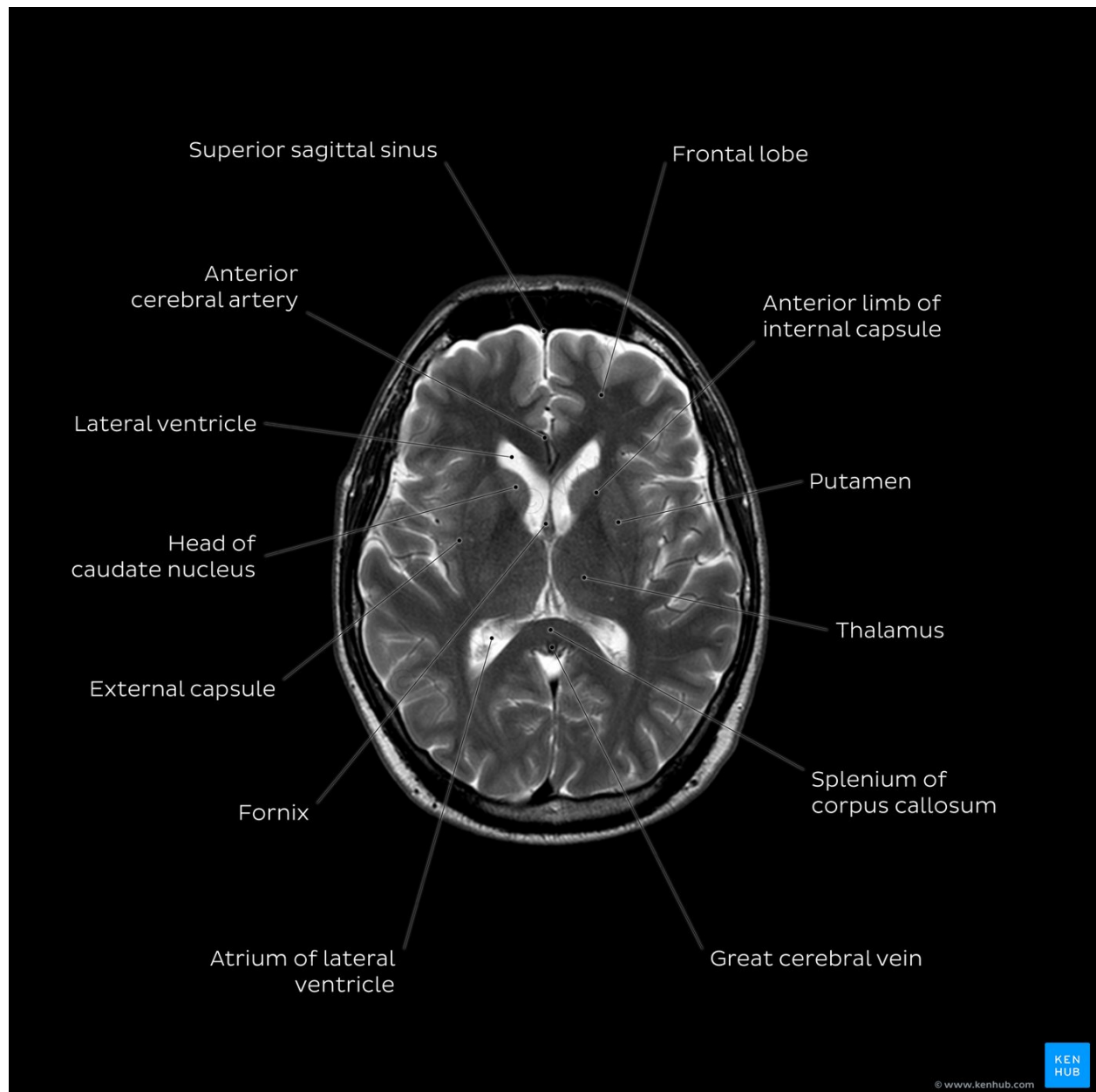
**Week 7** - Understanding the problem of neighbourhood in GMM, Understanding the concept of prior on the GMM, Understanding the update rules, Starting incorporating the HMRF in our original GMM

**Week 8** - Completing any remaining work, Preparing for the end-term report, presentation etc.

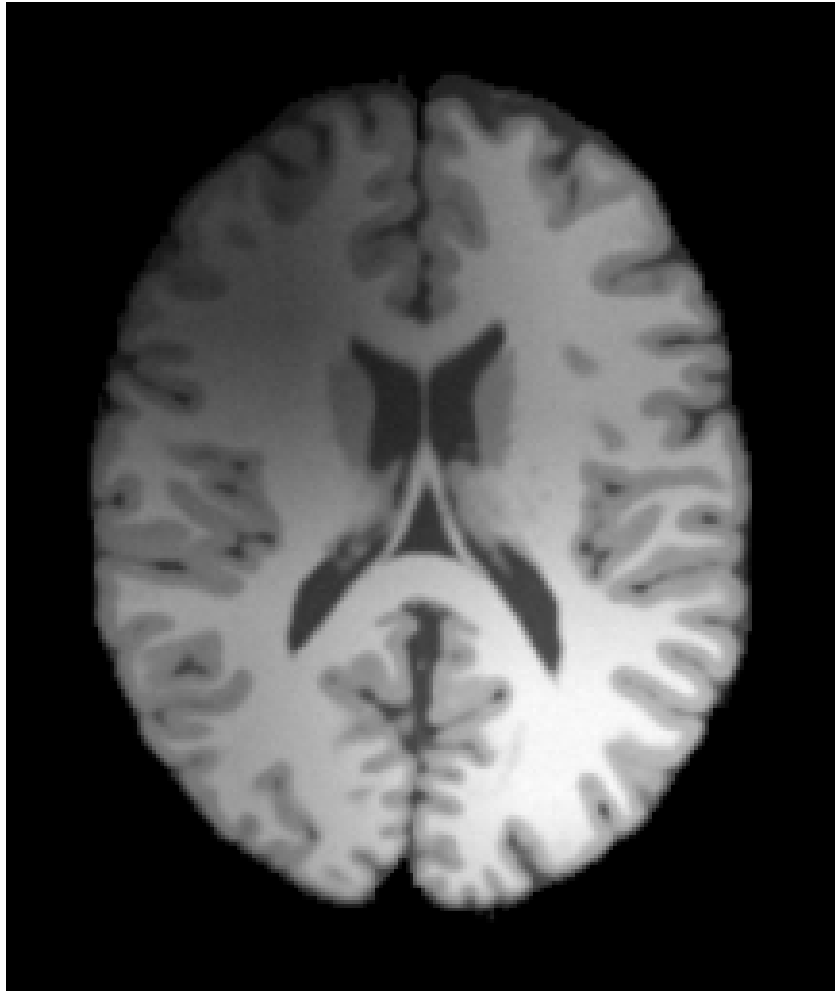
The project as of now is supposed to have four assignments. So don't lack behind. Do ask any doubts if you have in theory or assignments. Once you have understood the theory, the assignments are quite easy.

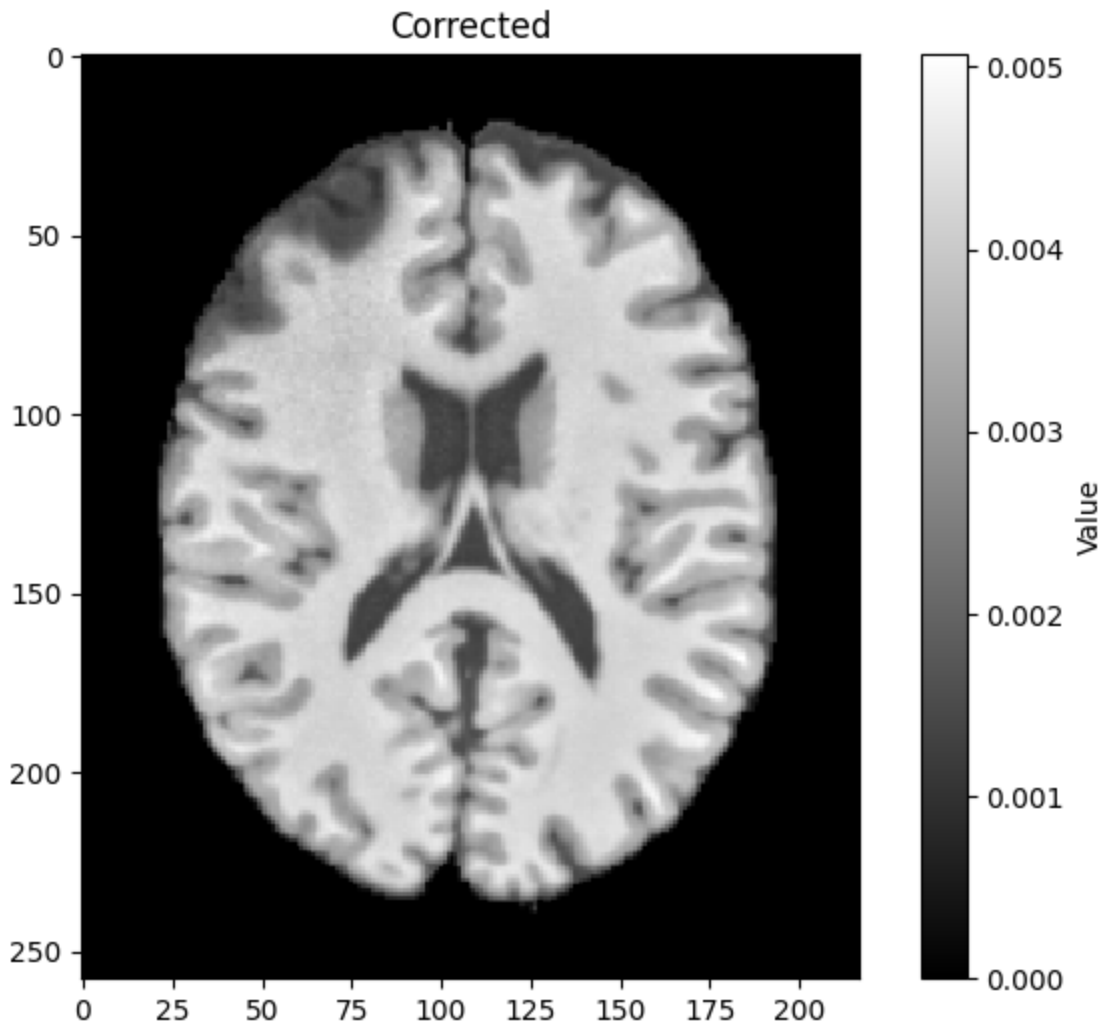
Let's understand what is our goal.

Brain MRI is used for detection of tumor, tissue concentration, Alzheimer disease etc. The obtained image have a lot of problem like noise ( what is noise ? ), bias field etc. Our goal will be to remove the bias field ( we will not deal with noise in this project because of lack of time ). After getting a clear image, we will run our segmentation algorithm on the brain image to get the various tissues properly segmented. The methods learned here can be easily applied to MRI images of other parts or of Brain from different sides.



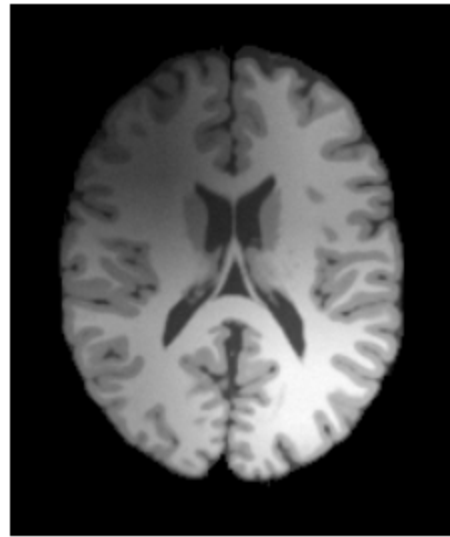
For bias field correction, we will use the below image for test purpose. This image is bit artificially biased ( that's my guess ). We want to remove this bias and get a un-biased image. The image further below is the unbiased image I obtained.



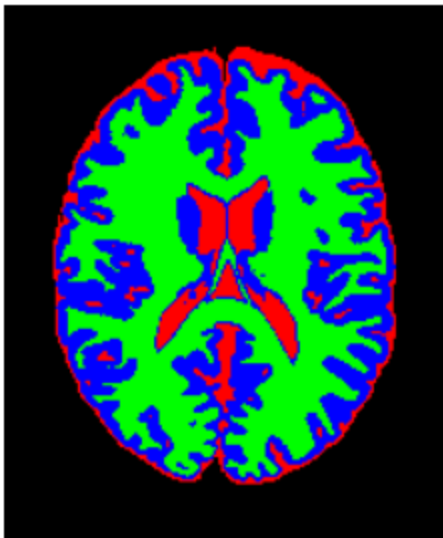


After this, we will segment the image into three clusters mainly fluid, white and grey part. If we have time, then we will implement the HMRF based GMM - EM for making the segmentation better.

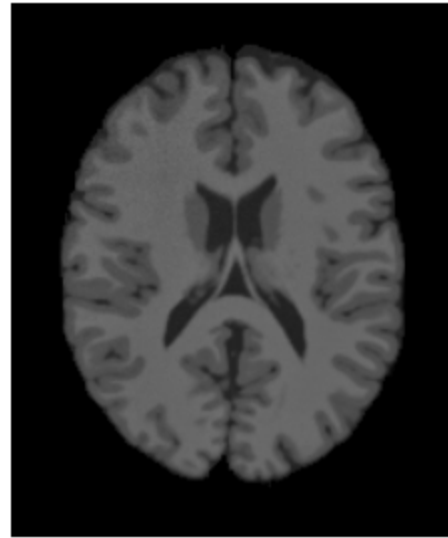
original image



segmentation



bias field correction



Happy Hunting !