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Lab 8 Report

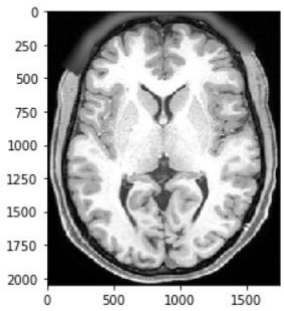
Application of Gaussian Models

Accurate segmentation of MRI images using EM algorithm with the mixed Gaussian models for provided data sets – you need to determine the number of Gaussian models, mean, and variance for each Gaussian model, also use color for different categories.

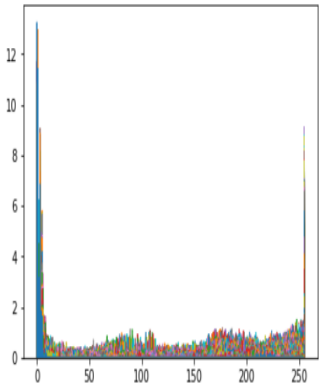
We first read the MRI image in grayscale and plot the histogram of the grayscale image.

```
In [5]:
1 MRI1 = cv2.imread("MRI1.jpg",0)
2 plt.imshow(MRI1, cmap="gray")
3 MRI1.shape
```

```
Out[5]: (2048, 1749)
```

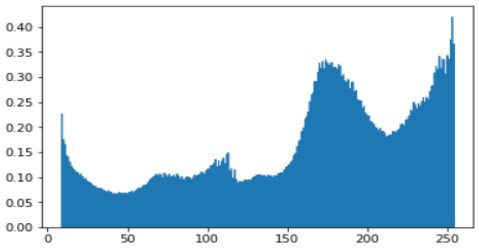



```
1 n, bins, _ = plt.hist(MRI1, density=True,bins=10000,histtype='step')
```



As we can see from the histogram, it is necessary to remove background voxels and high intensity to apply GMM.

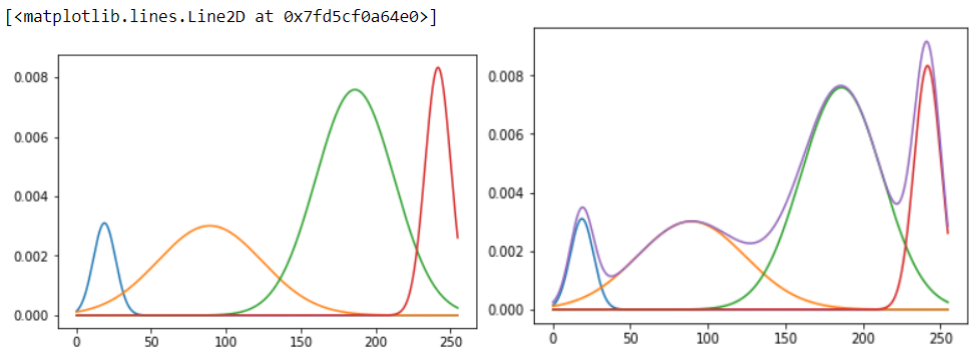
```
1 n, bins, _ = plt.hist(test, density=True,bins=10000,histtype='step')
```



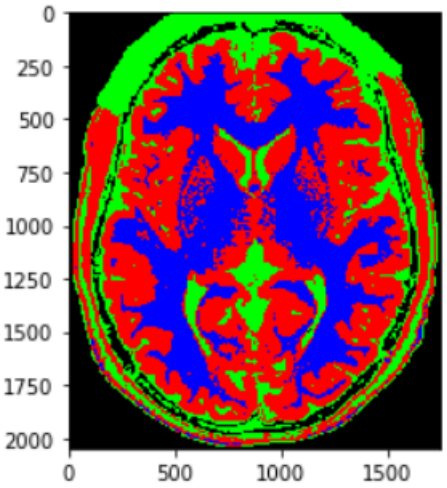
We define the GMM_EM model and apply expectation maximization to get corresponding Gaussian pdf parameters. The detail implementation can be found in the ipynb file.

```
1 mu, sigma, alpha
```

```
(array([ 18.75782298,  89.23167494, 186.2750395 , 241.75461283]),
 array([ 7.49500011, 34.80297015, 26.22839251,  8.62798893]),
 array([0.05825748, 0.26267816, 0.49884746, 0.18021691]))
```

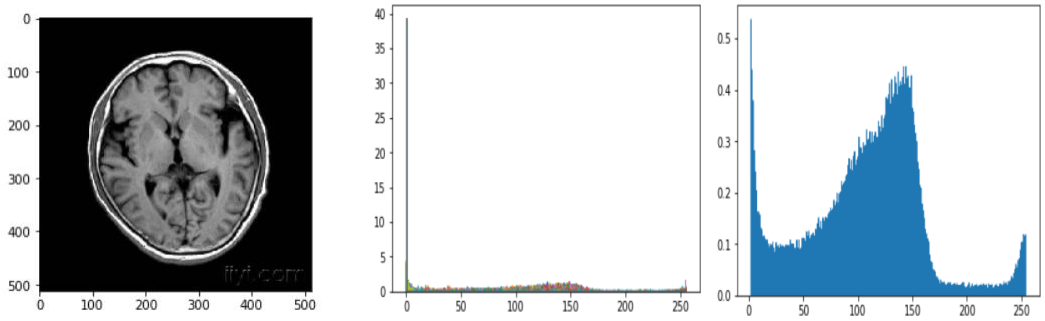


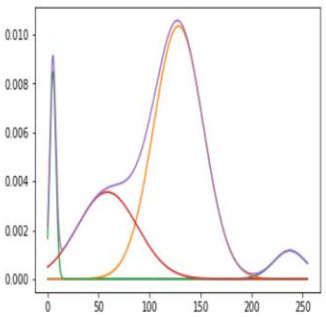
We could solve equation according to Gaussian Mixture Model's parameters to get the threshold points (31, 136, 227) to apply segmentation. The segmentation result is shown below:

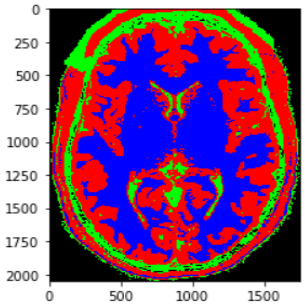


As we can see, the GM（grey matter）, WM（white matter） and CSF（Cerebrospinal Fluid） can be observed clearly.

The same procedure could be applied to MRI2 image. The corresponding result images are shown below.




0.010
0.008
0.006
0.004
0.002
0.000
0
50
100
150
200
250


0
250
500
750
1000
1250
1500
1750
2000
0
500
1000
1500