भारतीय प्रौद्योगिकी संस्थान तिरुपति
TIRUPATI

Indian Institute of Technology Tirupati

Image Processing Lab

Lab sheet. No: 07

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Data details:

- Brain MRI slices are given for this experiment.
- A training image 'brain_94.png' and a few test images ('brain_86.png', 'brain_99.png', 'brain_105.png') are given along with their ground truth labels.
- Each pixel in the image represents a type of tissue (Background with label-0, Cerebro-Spinal Fluid (CSF) with label-85, Grey Matter with label-170, White Matter with label-255).
- Assume that the intensities of each class follow Gaussian distribution.

Problem :

1. Perform parameter estimation for each of the classes (excluding the background class) from the training image using ML estimation method. Also compute prior probabilities for each class from the training data. Clearly specify the obtained parameters for each class in your report, and draw your inferences.

2. Perform ML-based classification on the testing data. The parameters computed in question 1 can be used for this classification. Visually present your results by displaying them as a labeled image and comparing them with the ground truth labels. Also display misclassified pixels of each class in different colors. Compute the class-wise and overall accuracies for each testing image.

3. Repeat problem-2, but now MAP-based classification.

Aim: To perform the pixel-wise classification using maximum likelihood (ML) and maximum a posteriori (MAP) methods for given data images given.

Output:

maximum likelihood classification:

given image brain 94

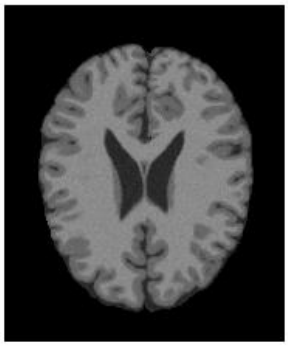


image after classification

given lable image

given image brain 86

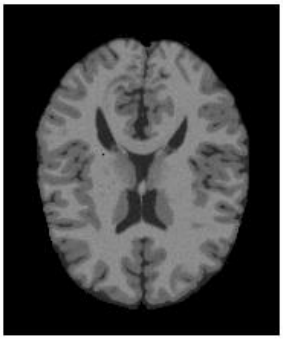
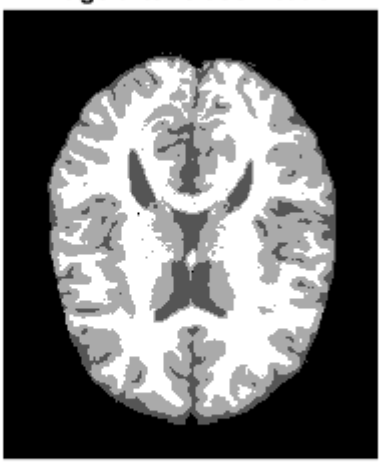
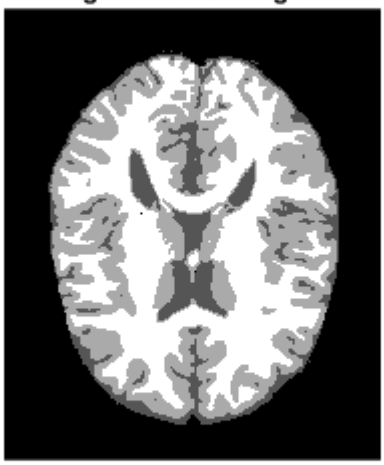


image after classification



given lable image



given image brain 99

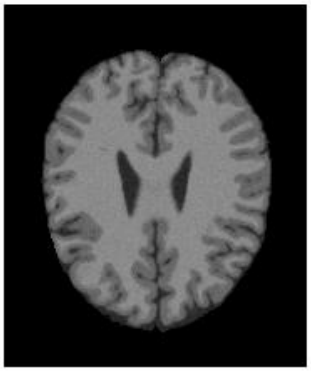
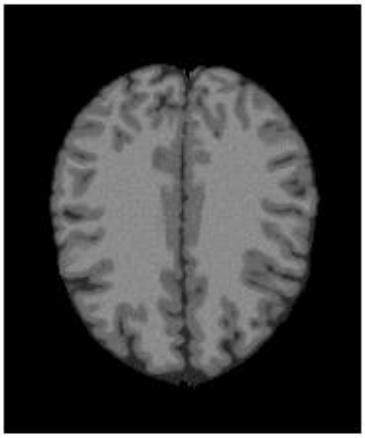


image after classification

given lable image

given image brain 105



Command Window

```
ML_accuracy percentage of img_94: 0.98521
ML_accuracy percentage of img_86: 0.97984
ML_accuracy percentage of img_99: 0.98503
ML_accuracy percentage of img_105: 0.98536
>>
```

maximum a posteriori (MAP) classification:

given image brain 94

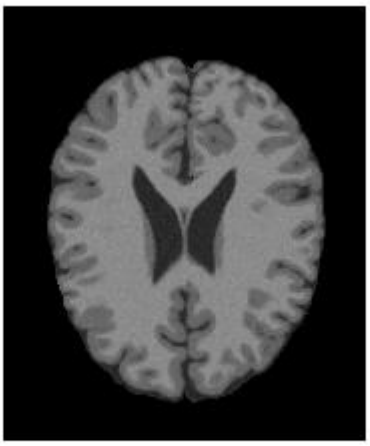
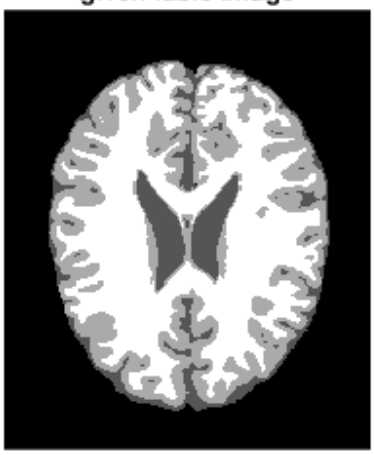


image after classification

given lable image



given image brain 86

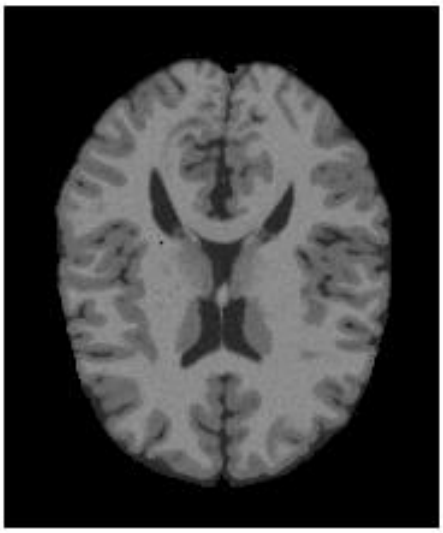
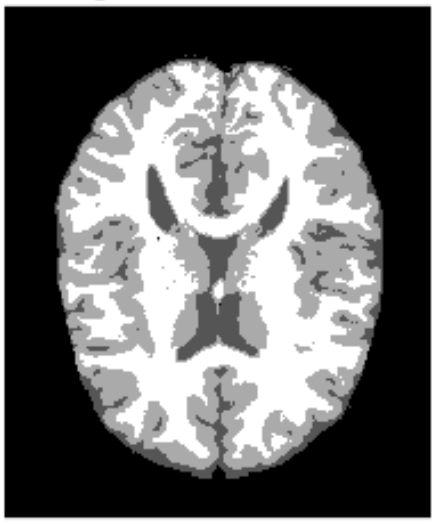
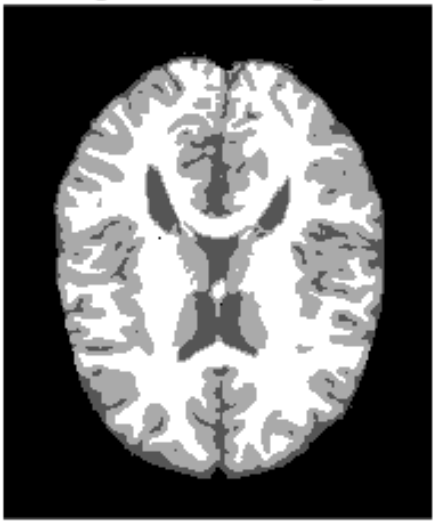


image after classification



given lable image



given image brain 99

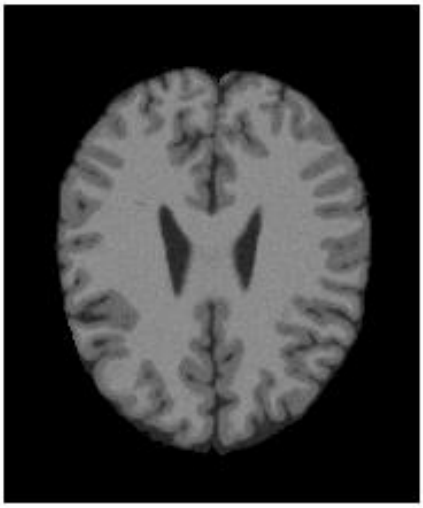
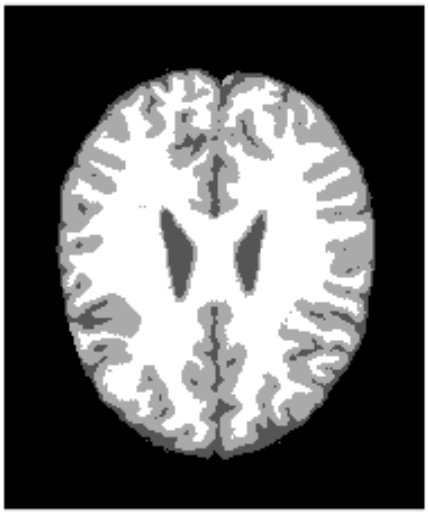
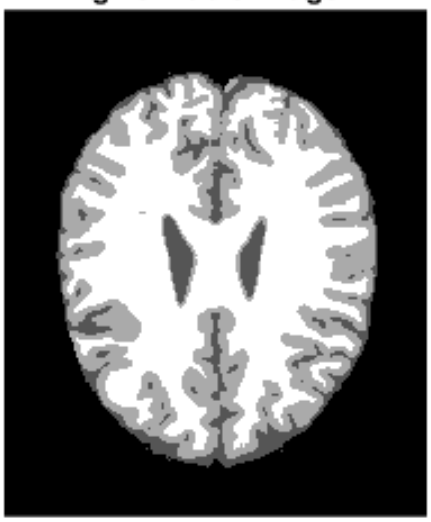


image after classification



given lable image



given image brain 105

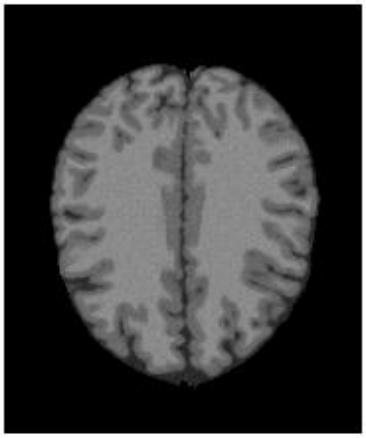


image after classification

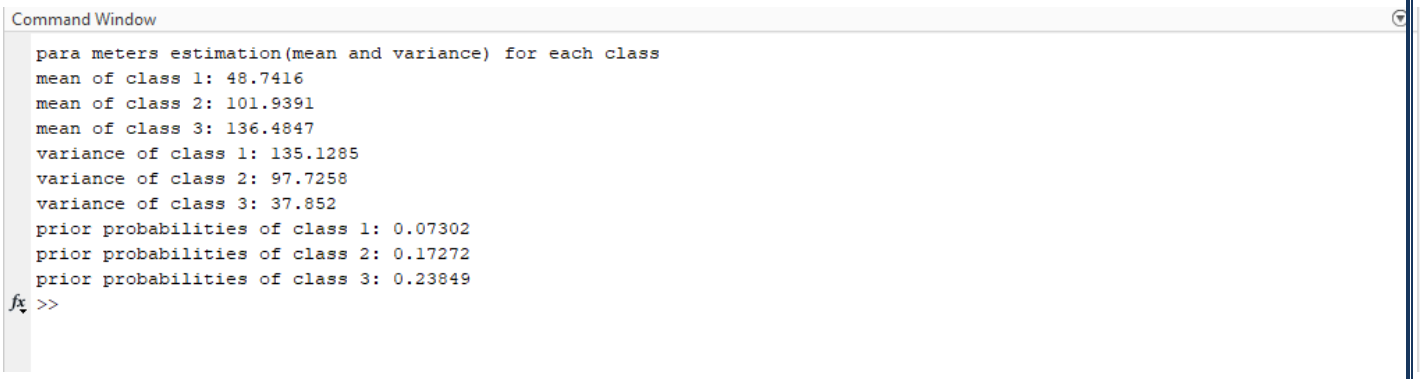
given lable image

Command Window

```
MAP_accuracy percentage of img_94: 0.98658
MAP_accuracy percentage of img_86: 0.98192
MAP_accuracy percentage of img_99: 0.98625
MAP_accuracy percentage of img_105: 0.98658
>>
```

Inferences:

Perform parameter estimation



Accuracy percentage for ML classification

```
accuracy percentage of img_94: 0.98521
accuracy percentage of img_86: 0.97984
accuracy percentage of img_99: 0.98503
accuracy percentage of img_105: 0.98536
```

Accuracy percentage for MAP classification

```
accuracy percentage of img_94: 0.98658
accuracy percentage of img_86: 0.98192
accuracy percentage of img_99: 0.98625
accuracy percentage of img_105: 0.98658
```

we can observe that both the ML and MAP estimates gives the almost equal accuracy percentage.