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Image segmentation using Mixture Gaussian Model and EM algorithm

1) The images I used for segmentation are depicted below:

2) I assumed that this image has 2 distinct colors.

3) I estimated 3 distinct colors for this image

3)

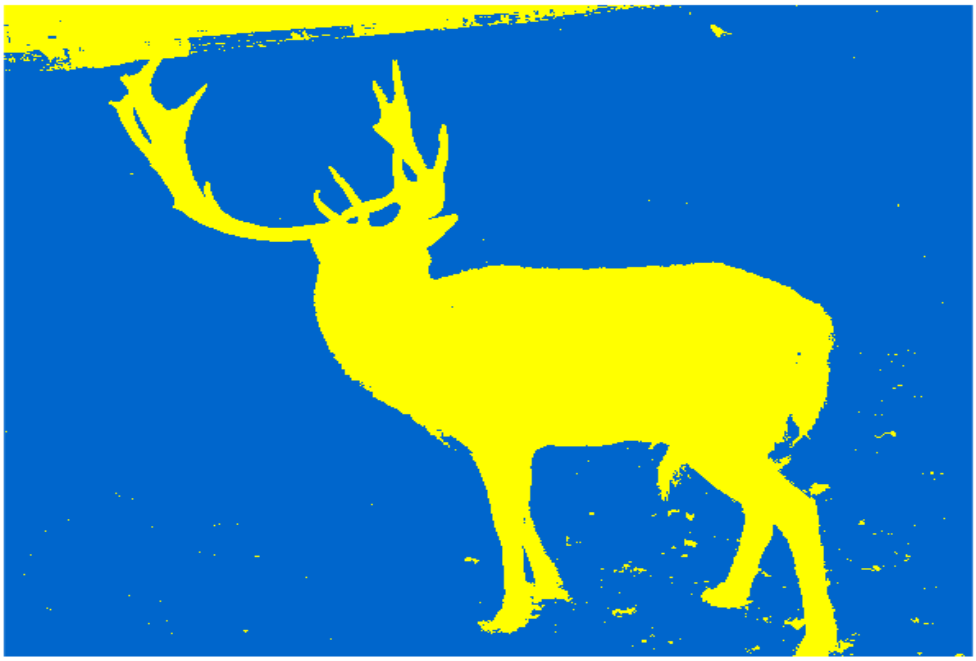
a) For segmenting according to Eq1, first we estimate the mixture of 2 Gaussians along with their channel probability (which is w_i). Then for each pixel we find the probability of pixel in each Gaussian pdf multiplied by the probability of that pdf (which is w_i) and finally assign that pixel to the most probable Gaussian pdf (which represents a class).

Eq1:

$$l_i = \arg\max_{j=1\ldots M} \omega_j \mathcal{N}(x_i; \mu_j, \Sigma_j)$$

The results for segmenting above images according to Eq1 are depicted below:

Segmented image according to I=argmax w*N(xi;μ)

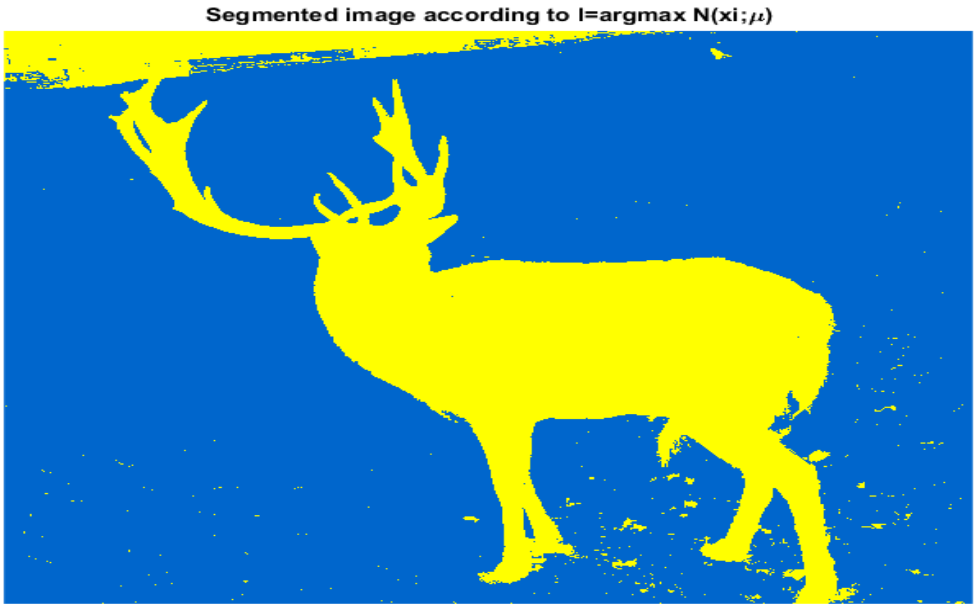


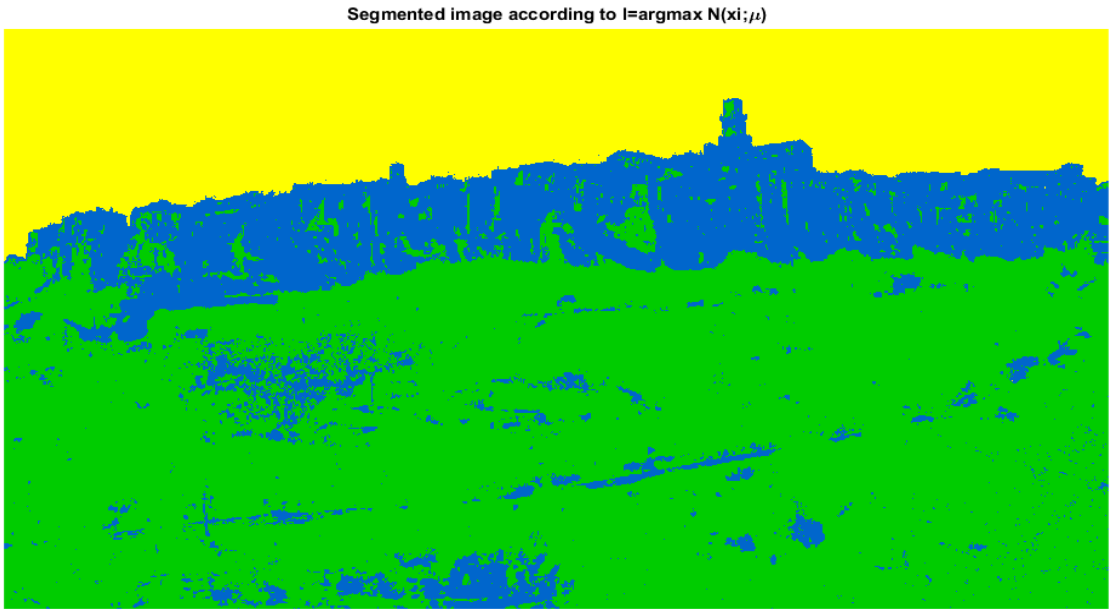
Segmented image according to I=argmax w*N(xi;μ)

a) For segmenting according to Eq2, we just consider Gaussian probabilities estimated using EM algorithm and we neglect channel probabilities (w_i). The results are depicted below:

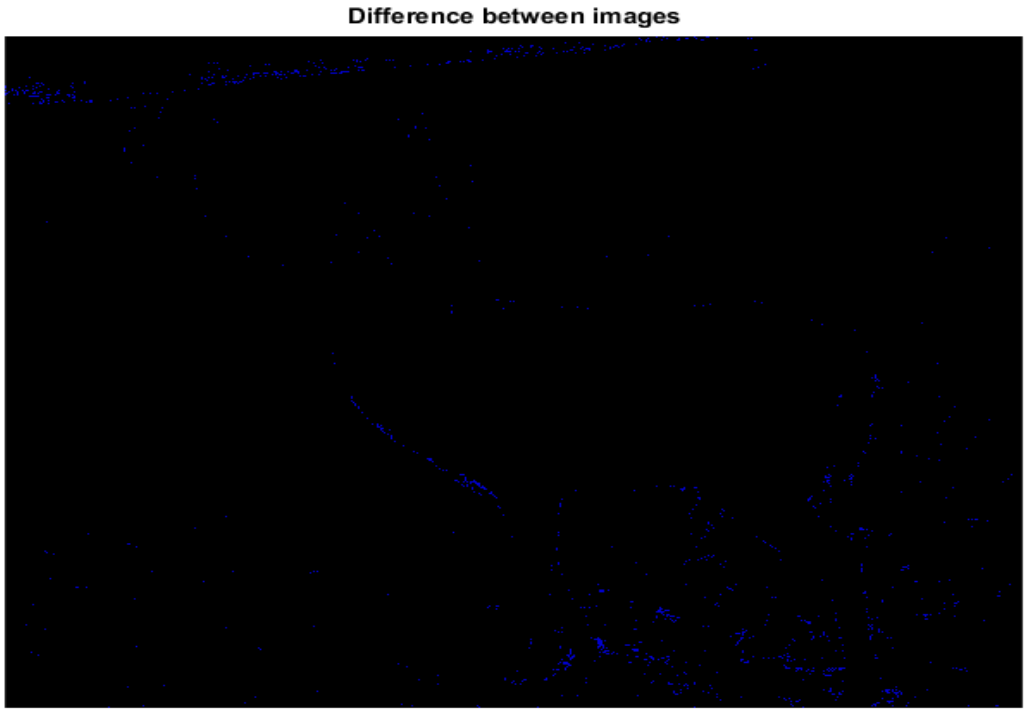
Eq2:

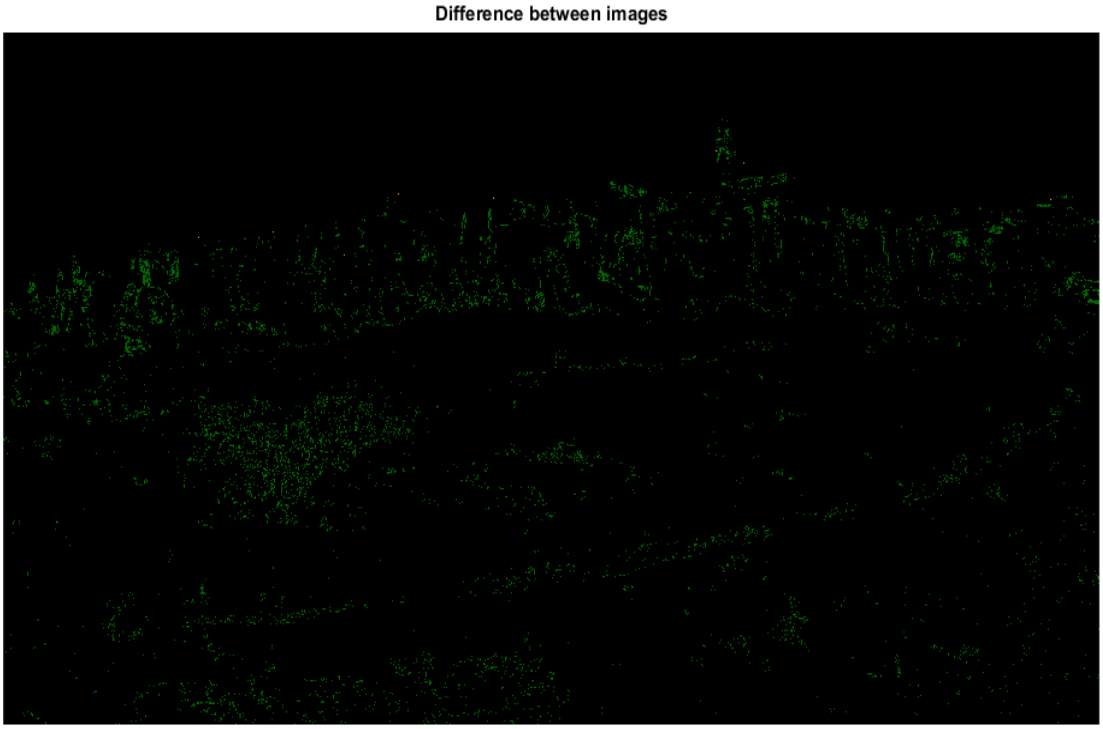
$$l_i = \arg\max_{j=1\ldots M} \mathcal{N}(x_i; \mu_j, \Sigma_j)$$





The difference between a and b cases is depicted below:





Note that difference between a and b cases are the points which are in the border of 2 distinct colors and therefore they will be differently classified in a and b cases.

In reindeer image we see that outer edge of reindeer is differently segmented. These points are the points which lie in intersections between 2 Gaussians and therefore it’s probable that if we neglect channel probabilities they will be differently classified (segmented).