Lab Report 05 - Image Segmentation

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1 1. Image Preprocessing

Figure 1: Smooth Image

Before doing the image segmentation the images have to be gaussian filtered and converted to the $L*a*b$ space. For the smoothing a 5x5 gaussian

Figure 2: Smooth L-a-b Image

filter with $\sigma = 5$ was used. For the Image segmentation the $L * a * b$ space is preferable. This space consists of a lightness value L and the colour values a and b. It can therefore decouple the brithness from the colour space, which gives a better robustness for different lightning conditions. This was done using the matlab functions $makecform$ and $applycform$.

2 Mean-Shift Segmentation

The Mean-Shift Segmentation repeatedly calculates of all the pixels withing a certain radius r around a point. It does this until the nest shift is below a certain threshhold.

It is intuitivly clear and could be validated that increasing the radius is computationally more expensive and takes more time. Therefore, the radius

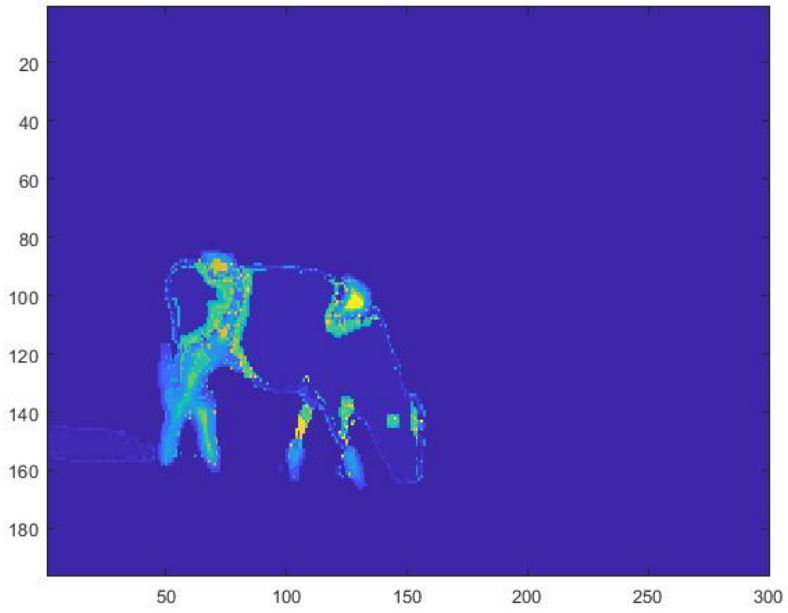

Figure 3: Mean-Shift Image 4: R = 5, thr = 2.5, 163 peaks

should be choosen only large enough to fullfil any time based constraints for the desired application for this computationally expensive algorithm.

3 EM Segmentation

The last part of this exercise is the EM implementation. Here the following parameters are used:

K: Number of clusters

$\alpha = 1/K$: equal weighting

Σ: 3x3 matrix corresponding to the range of $L * a * b$ space

μ: equally spread over the $L * a * b$ space

The implementet fuctions *expectation* and *maximization* evaluate the

Figure 4: Mean-Shift Image 5: R = 5, thr = 2.5, 163 peaks

probability and update the parameters respectivly.

$$mu = \begin{bmatrix} 42.2449 & 137.6082 & 89.1000 \\ 123.5445 & 125.2056 & 114.4193 \\ 137.0442 & 140.5672 & 149.0963 \end{bmatrix} sigma1 = \begin{bmatrix} 819.2520 & -137.2637 & 238.9867 \\ -137.2637 & 33.0107 & -47.3915 \\ 238.9867 & -47.3915 & 79.1724 \end{bmatrix}$$

$$sigma2 = 1.0e{+}03* \begin{bmatrix} 2.3539 & 0.0715 & 0.0406 \\ 0.0715 & 0.0115 & -0.0069 \\ 0.0406 & -0.0069 & 0.0242 \end{bmatrix} sigma3 = \begin{bmatrix} 56.7097 & 0.3528 & 0.4147 \\ 0.3528 & 0.8359 & -0.1712 \\ 0.4147 & -0.1712 & 1.5366 \end{bmatrix}$$

$$sigma3 = \begin{bmatrix} 0.1061 & 0.0377 & 0.8562 \end{bmatrix}$$

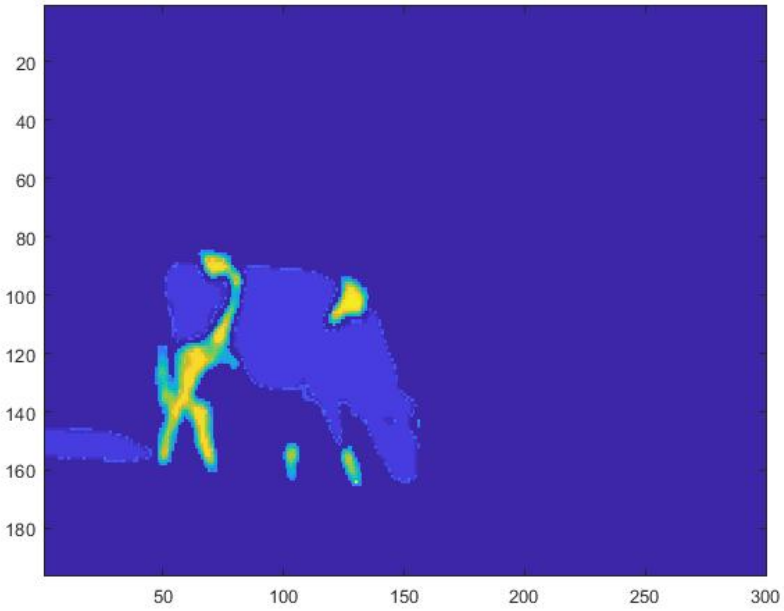

Figure 5: Mean-Shift Image 4: R = 10, thr = 5, 25 peaks

Figure 6: Mean-Shift Image 5: R = 10, thr = 5, 25 peaks

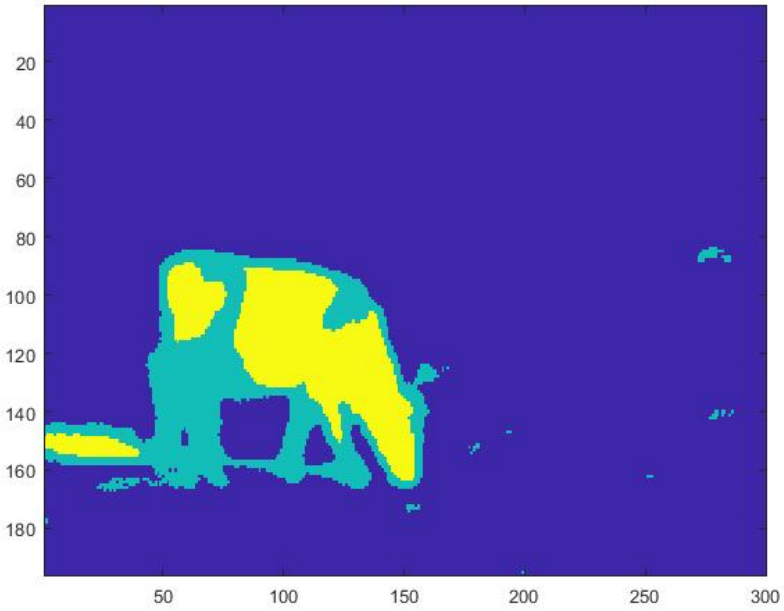

Figure 7: EM Image 4: K = 3

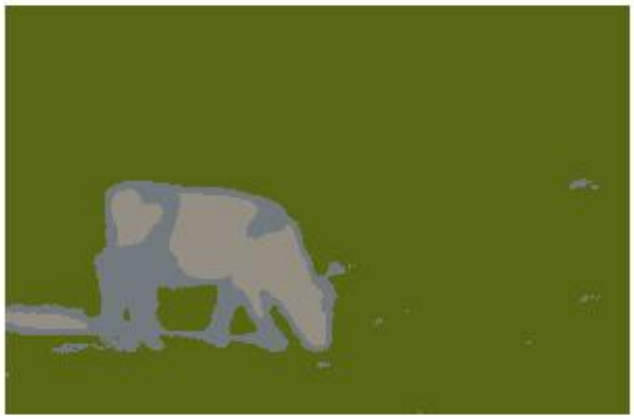

Figure 8: EM Image 5: K = 3