**CM0669 Machine Learning and Computer Vision**

**Lab 10** Image segmentation using machine learning

Open up Matlab and Type in ‘help graythresh. A helpful description will be given on the built-in function ‘graythresh’ for finding a threshold to separate the objects from the background (see segmentation based on thresholding in lecture 10). Download the Matlab codes and the test images in a new folder ‘Week10’.

**1. Greylevel Image segmentation by thresholding**

Run the Matlab codes ‘Greylevel\_segmentation\_local\_thresholding.m’ and ‘Greylevel\_segmentation\_global\_thresholding.m’ on all test images. Analyse and interpret the results. The results show that the global thresholding method performs well when the background is homogeneous and constant. However, as can be seen on image 4, the global thresholding does not correctly separate all the objects from the background especially those located on the bottom side of the image where the background decreases in brightness. This issue can be tackled by using the local thresholding which takes into account the change in brightness of the background. However, for some other images, local thresholding does not seem to perform well due to discontinuities between the processed blocks.

**2. Greylevel Image segmentation by clustering (K-means clustering)**

Run the Matlab codes ‘Greylevel\_segmentation\_clustering.m’ and on all test images for different values of block size and number of clusters (default values are 2 and 3, respectively). Analyse and interpret the results. The results show that greylevel-based segmentation by clustering gives good results on images containing objects with different brightness (or grey-level information) from the background. In contrast to the previous technique of thresholding, clustering can be used to segment more than one type of objects using more clusters (K=3, 4, etc.).

**3. Texture Image segmentation by clustering (K-means clustering)**

1. Run the Matlab codes ‘Texture\_segmentation\_clustering.m’ and on all test images for different values of block size and number of clusters (default values are 4 and 3, respectively). Analyse and interpret the results. The results show that texture-based segmentation by clustering gives good results on images containing objects (or regions) with different texture information from the background. Again, clustering can be used to segment more than one type of objects using more clusters (K=3, 4, etc.).

2. Instead of using high pass filters, write a modified Matlab code which extracts the features in the DWT domain. Use block size=8 (it means 8×8), each block is DWT transformed with two decomposition levels using the Haar wavelet. The feature vector consists of the mean and standard deviation of the resulting sub-bands excluding the approximation one. Execute the code and interpret the results.

The Matlab code has been uploaded on Blackboard. The results show that the wavelet transform provides good features that characterise texture information in different regions. However, the block size of 8x8 does not give the best performance in terms of precision on the current images. It will probably be useful to reduce the block size or use images of higher resolution (larger image size) so that the block discontinuities will be unnoticeable.