COMP0026 (Image Processing) Coursework I: *Segmentation*

COMP0026 Team
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You will create a python Jupyter notebook.

The total points for this exercise is **100**.

Please refer to Moodle for the due dates.

You are asked to implement two image segmentation methods: thresholding and clustering.

Package requirement: You are only allowed to use NumPy for the implementation. Other packages include OpenCV, Matplotlib can be used for loading images/visualization.

1 Thresholding **(50 points)**

We provide you a color input image to test with and a reference segmentation.

Convert the image to a gray image (**5 points**).

Implement a function to threshold the image (**20 points**) by a threshold value t.

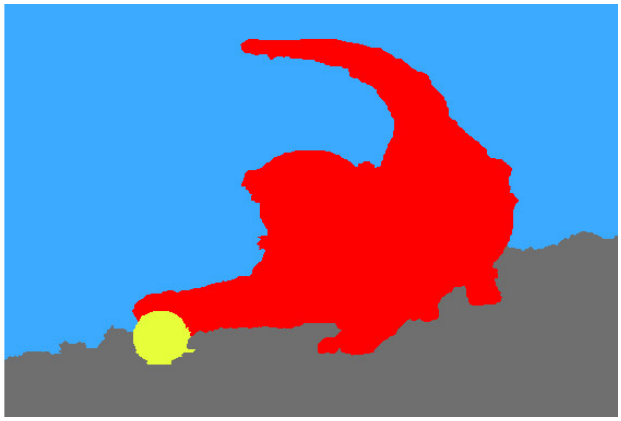
Plot the ROC curve of that method under varying t (**13 points**) and submit this as an image file in sufficient quality (**2 points**).

What is the optimal threshold t (**5 points**), if precision and recall are weighted equally?

Is there a better linear method to convert the RGB into the gray image, so that a sweep results in a better result (**5 points**)?

2 Clustering (50 points)

We provide you another RGB image with a segmentation into 4 regions.

Implement a function to segment the image using k-means using only color (**25 points**) and using color and position (**10 points**) as features.

Implement a method to L_2-compare the input image and its clustered version, i.e., an image where every pixel is replaced by the mean color of its cluster (**10 points**). Let is call this the "error".

The algorithms has free parameters: the number of clusters k for k-means ~~and the weight of the Gaussian kernel σ for mean shift~~. Plot ~~four~~ two error curves for varying k ~~and σ~~ for both the color and color-and-position version of the algorithm (**5 points**). the horizontal axis is k ~~or σ~~, the vertical axis is the image error.