TP5
Image Segmentation

The objective of this practical work is to study image segmentation through the K-means method.

1 The method

K-means consists in finding regions in the image that minimize the following energy:

$$F(regions, pixels) = \sum_{i \in regions} \sum_{j \in region\ i} (x_j - c_i)^t (x_j - c_i),$$

where x_j is the value taken into account at pixel j and c_i is the value of the center of region i. Starting from an initial solution, the principle is to iterate 2 steps:

1. Assuming known region centers, associate each pixel to its closest region (i.e. with the minimum distance to the region center).
2. Assuming known associations between pixel and regions, determine new region centers as the mean of pixel values in each region.

2 Implementation

1. Implement K-means with x values being the RGB values in the image.
2. What is the influence of the initial values for region centers ?
3. What is the influence of the number of regions K ?
4. Which stop condition did you use? Propose a second one.
5. Consider now for x values both RGB and location (i,j) in the image:
   (a) How does it change the results ?
   (b) How can we balance the influence of colors and locations in the image ?
6. Use a different image from frog and explain how you chose K, the initial values and the location-color balance to get what you consider a good result.

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