Clustering with the k-Means Algorithm

Laboratory 5, DEDP

Objective

Implement and use the k-Means algorithm for color-based segmentation of images.

Theoretical aspects

The k-Means algorithm

Check the lectures.

Exercises

Pixel-based clustering

1. Load the color image 'Peppers.tiff' using `imread()`. Convert the image to `double` and display it (don't convert to grayscale, leave the colors).
2. Use Matlab's k-Means algorithm to cluster all the pixel values (each pixel = a group of three values R, G, B) into 4 groups.

- Use the `reshape()` function to resize a $M \times N \times 3$ tensor `I` into a $(M * N) \times 3$ matrix `P`, as follows:

  ```
  P = reshape(I, [], 3);
  ```

- Use the `kmeans()` Matlab function to do the clustering. Read the documentation for more details.

3. Replace each pixel of the image with the *centroid* of its class. Display the image. How does it look?
4. Change the number of clusters from 2 to 13 and display them in single window with `subplot()`.

TODO:

- make background of `flower.bmp` image lighter/darker/different color
- replace background of an image with background from another image

Vector quantization

1. Repeat process but cluster now a group of pixels:
    - Convert each 2×2 block of pixels into a single vector with 12 values.
    - Perform clustering on these 12-values data
    - Replace each group of 2×2 pixels with each centroid and plot the result.

Final questions

1. Suppose we do exercises 1 - 3 on a grayscale image. How will it look?