

CS6550 Computer Vision
Homework 3: Segmentation using K-means & Mean-Shift
Due: 11:59pm, Dec. 8, 2016

Part 1: K-means image segmentation(40%)

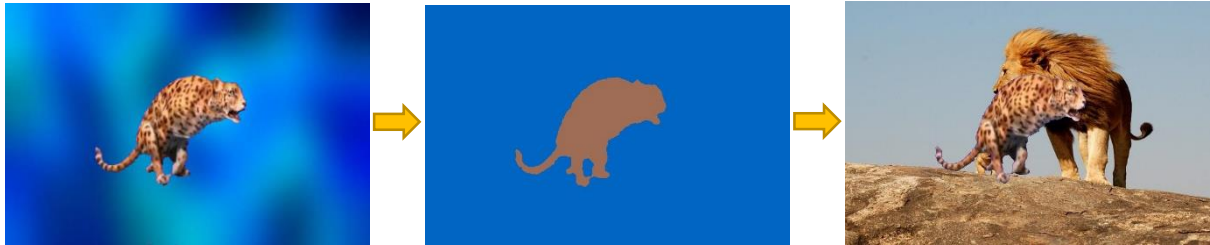
Implement the k-means algorithm to segment "CaitlinPoro.jpg"



- A. Apply k-means on the RGB color space and try it with different k values (3, 7, 11) and show the results. You should use 50 random initial guesses to select the best result based on the objective function for each K. (3 images)
- B. Manually select the initial guesses (K = 3, 7, 11) for the image in the k-means and apply the k-means algorithm to segment the images. Show the segmentation results and compare them with the results from 1-A. (3 images)
- C. Repeat 1-A and 1-B by using the Luv color space. (6 images)
- D. Compare and discuss your segmentation results with the above two different color spaces and the different k selections.

Part 2. Background Replacement using k-means(20%+5%)

Apply k-means algorithm to segment foreground and background in “jaguar.avi”. You can then replace the background with other scene materials to make the video more interesting.



A. The main steps to do background replacement:

- Using k-means to split the input frames into several clusters
- Replace the data labeled as background with new materials. Please describe how you finish the task.

B. [Bonus] Develop better strategies to accelerate the process. (Try to reduce the computation times of k-means) Describe your strategy in the report.

Part 3. Mean-Shift image segmentation(40%)

Implement Mean Shift algorithm to segment “AmumuPoro.jpg”



- A. Implement the mean-shift algorithm to segment the same color images. Select an appropriate choice for the parameters in the Uniform Kernel on the RGB color space to achieve optimal image segmentation (show the clustering result), and then show the pixel distributions in the R*G*B feature space before and after applying mean-shift (Unit5 p.32). (3 images)
- B. In addition, combine the color and spatial information into the kernel for mean shift segmentation and find the optimal parameters for the best segmentation result. (1 images)
- C. Repeat 3-A and 3-B by replacing the RGB color space by the Luv color space. Note the kernel parameters also need to be changed.
- D. Show the mean-shift segmentation results in 3-B with three different sets of bandwidth parameters. Discuss the segmentation results for different bandwidth parameters.

Reminder

- MATLAB functions **kmeans** is not allowed in this homework.
- MATLAB functions **repmat**, **reshape**, **unique** and **min** are allowed in this homework. You can look for RGB to LUV and LUV to RGB functions on the Internet.
- Your package should contain a **README** file about your execution instruction.
- Your code should display and output your results so that we can judge if your code works correctly.
- Your report should depict how you implement methods and display **result images**.
- Please compress your **code**, **result images** and **report** in the file named HW3_{Student-ID}.zip and upload it to iLMS.