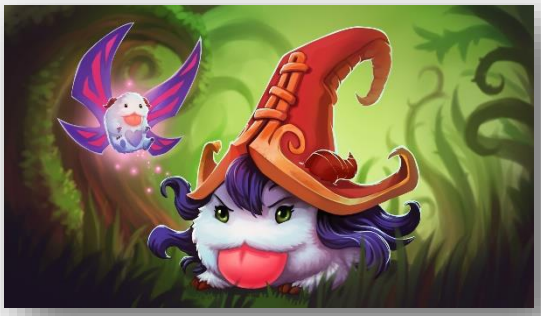
CS6550 Computer Vision

Homework 3 : Segmentation using K-means & Mean-Shift

Due : 23:59 12/07/2015



data/LuluPoro.jpg

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

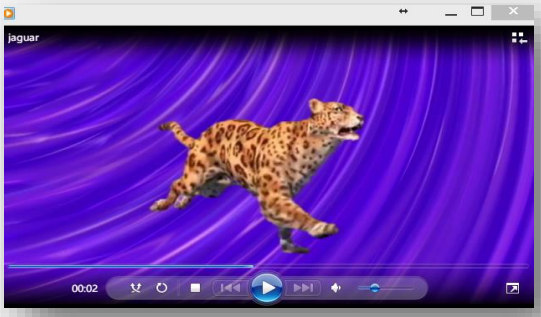
Implement the k-means algorithm to segment “LuluPoro.jpg”

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).

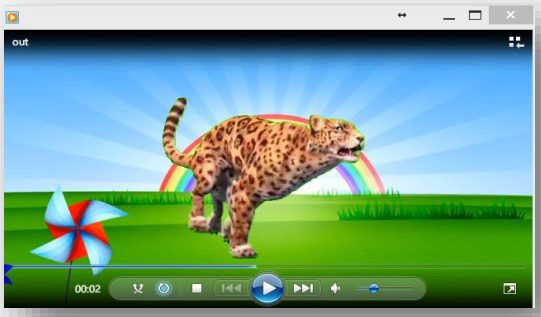
B. Manually select the initial guesses **(K = 3, 7, 11)** for the image in the k-means and apply the k-means algorithm to segment the images. Show the segmentation results and compare them with the results from 1-A. (3 images)

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.



data/jaguar.avi



result

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

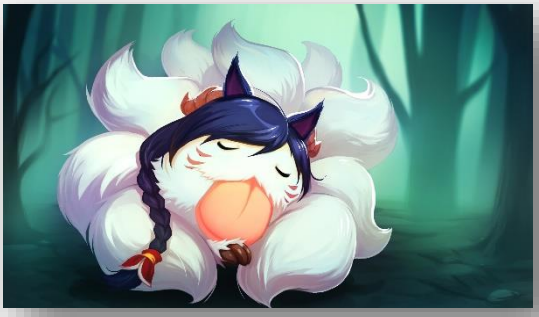
Apply k-means algorithm to segment foreground and background in “jaguar.avi”. You can then replace the background with other scene materials to make the video more interesting.

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.



data/AhriPoro.jpg

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

Implement Mean Shift algorithm to segment “AhriPoro.jpg”

A. Implement the mean-shift algorithm to segment the same color images. Use an appropriate choice for the parameters in the Uniform Kernel on the RGB color space to achieve best image segmentation.

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.

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.

Appendix

- MATLAB functions **kmeans** is not allowed in this homework.
- In part2, please also submit the background materials(image or video) so we can run your code.
- 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.
- Please compress your code, result images and report in the file named HW3_{Student-ID}.zip and upload it to iLMS.
    - Before 12/07(Thu.) 23:59.
- If you encounter any problem, please feel free to contact us, or discuss on iLMS.