Mean Shift Segmentation Applications

Dhanashree Mohite

04/12/2018

1 Abstract

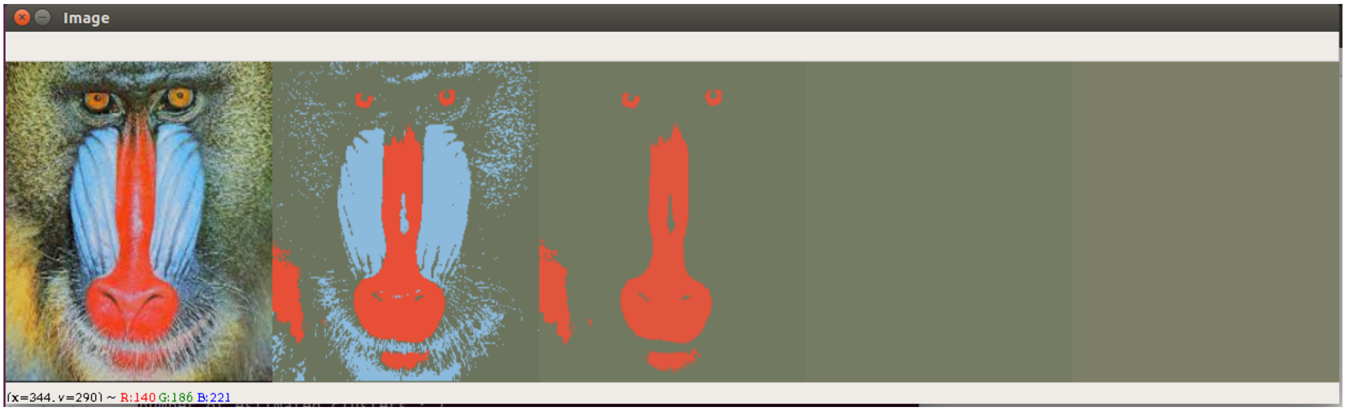
This is a technical report of paper implementation on mean shift segmention applications. Mean shift segmentation applications covered in this paper are listed below:

- Mean shift imgae segmentation using API's
- Object tracking using Mean shift
- Mean shift imgae segmentation using Algorithm implementation

2 Mean shift imgae segmentation using API's

In this implementation, API's from Sklearn Libarary are used. As we know, Meanshift Image segmentation result depends on bandwidth used. Bandwidth required for image segmentation is obtained using estimate_bandwidth API. Two factors that have major impact on bandwidth are no. of samples considering for mean calculation and quantile i.e cut points dividing the range of a probability distribution into continuous intervals with equal probabilities, or dividing the observations in a sample in the same way. Hence, it varies from [0,1].

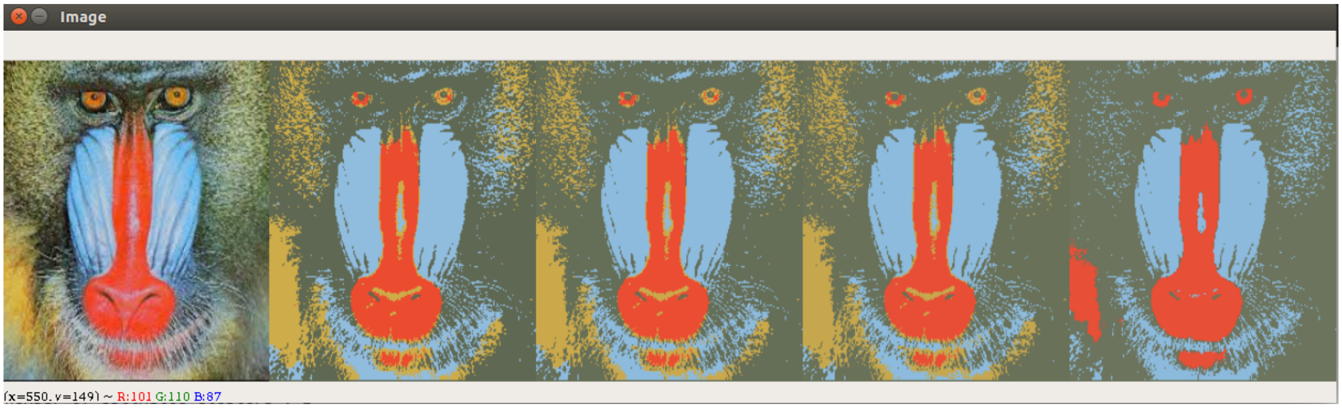
With the help of small variation in quantile value large amount of change bandwidth can be obtained. Below is the result of such case.



(x=344, y=290) ~ R:140 G:186 B:221

Figure 1: Image segmentation with huge difference in Bandwidth values

In order to obtain small ammount of change in bandwidth, no. of samples can be changed with constant quantile value. Below is the result of such case.

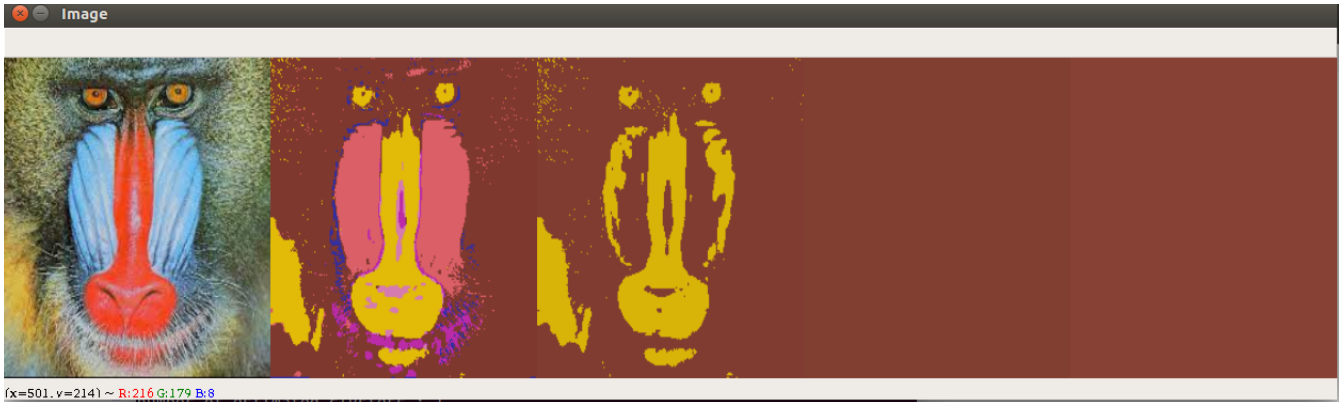


(x=550, y=149) ~ R:101 G:110 B:87

Figure 2: Image segmentation with small difference in Bandwidth values

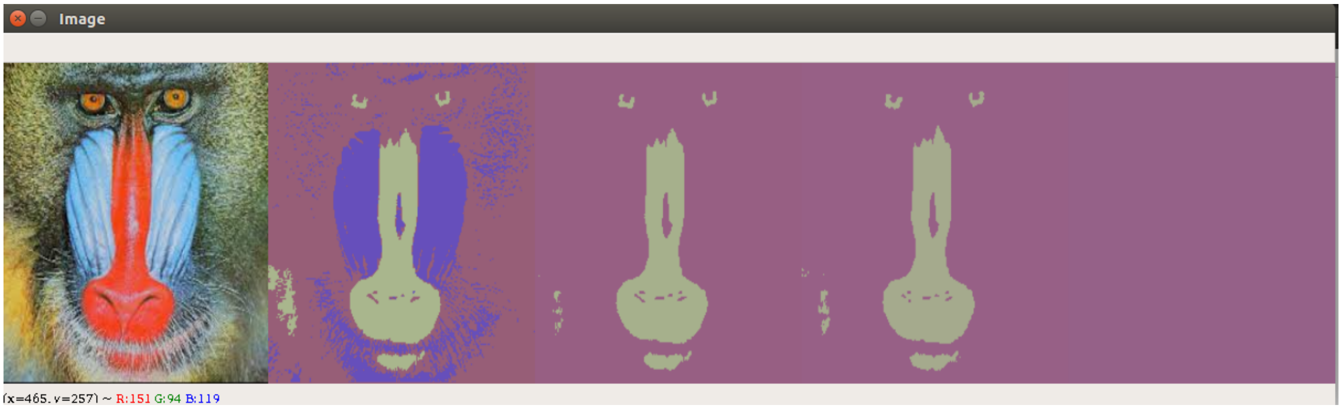
From above two cases, we can see that Bandwidth plays important role in mean shift image segmentation. If bandwidth is too large, two different segments will be merged in to single segment. Whereas, small value of bandwidth gives extra clustes which are actually not required. Thus, Bandwidth requirement varies from image to image.

Along with Bandwith, which colorspace we are using also matters. Results with HSV, LUV and LAB colorspaces are attached below.



```
(x=501, y=214) ~ R:216 G:179 B:8
```

Figure 3: Image segmentation with HSV color space



```
(x=465, y=257) ~ R:151 G:94 B:119
```

Figure 4: Image segmentation with LUV color space

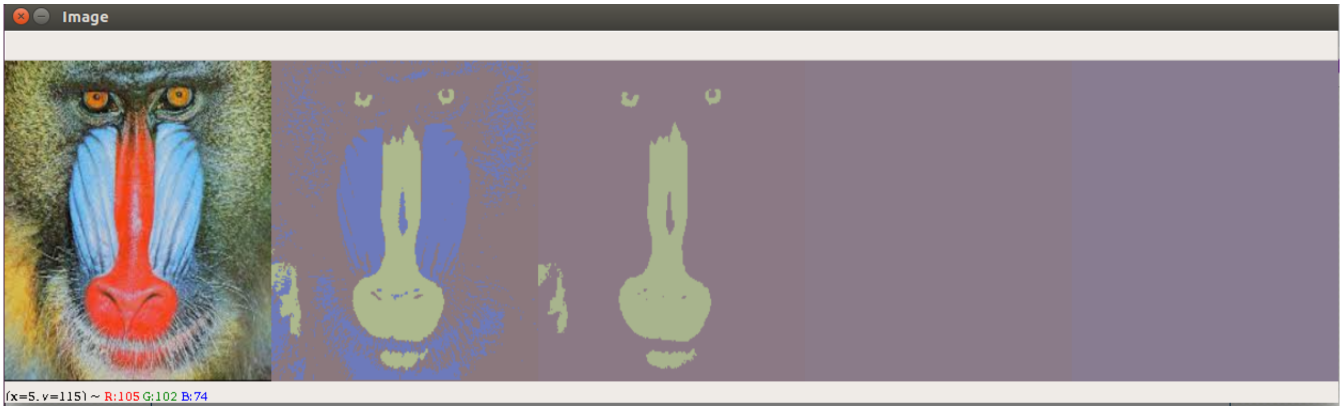


Figure 5: Image segmentation with LAB color space

3 Object tracking using Mean shift

Meanshift with Histogram and Back projection can be used for Object tracking. The backprojection is calculated from the histogram. It basically replace every pixel by its probability to occur in the image. In this example, a rectangle in the upper left corner of the image is selected. It's histogram computed and then a backprojection applied on the whole image to detect others parts of the image which have the same histogram.

Limitation of this implementation is that as initial frame value is hard coded, it mght be possible that object won't come inside frame. Thus, leading to misdetection.

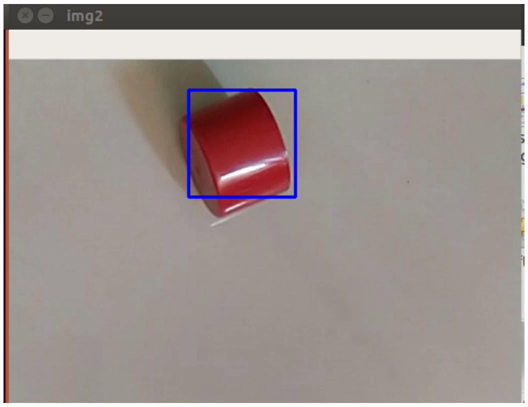


Figure 6: Image caputred during object tracking video

4 Mean shift imgae segmentation using Algorithm implementation

Limitation of using API's for mean shift segmentation is that it takes too much time for image segmentation. It takes around 10sec for 300x300 image. Thus, it's very difficult to work with high quality image.

To achieve faster mean shift segmentation it's algorithm is implemented directly. And due to this huge time reduction is observed for image segmentation. It takes around 1sec for 300x300 image. Result is attached below:

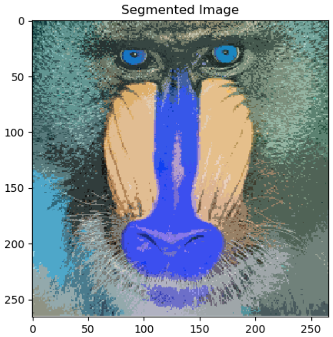


Figure 7: Meanshift Image segmentation using Algorithm

5 Github Link

More Reults and all codes are available on Github:
https://github.com/DhanashreeMohite/DIP/tree/master/MeanshiftSegmentationApplications

6 References

https://scikit-learn.org/stable/auto_examples/cluster/plot_mean_shift.html http://www.cse.psu.edu/ rtc12/CS
https://stackoverflow.com/questions/4831813/image-segmentation-using-mean-shift-explained
http://efavdb.com/mean-shift/ http://www.robindavid.fr/opencv-tutorial/chapter4-histogram-and-backprojection.html https://www.bogotobogo.com/python/OpenCV_Python/python_opencv3_mean_shift