E9 246 Advanced Image Processing

Assignment 02

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Course: **MTech AI**

SR No.: 23112

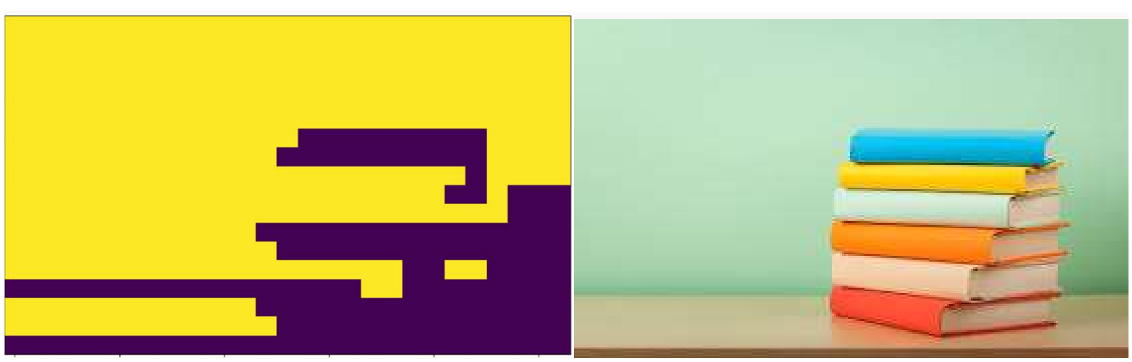
1. Classical methods: N-Cut, K-means

Results:

N-Cut

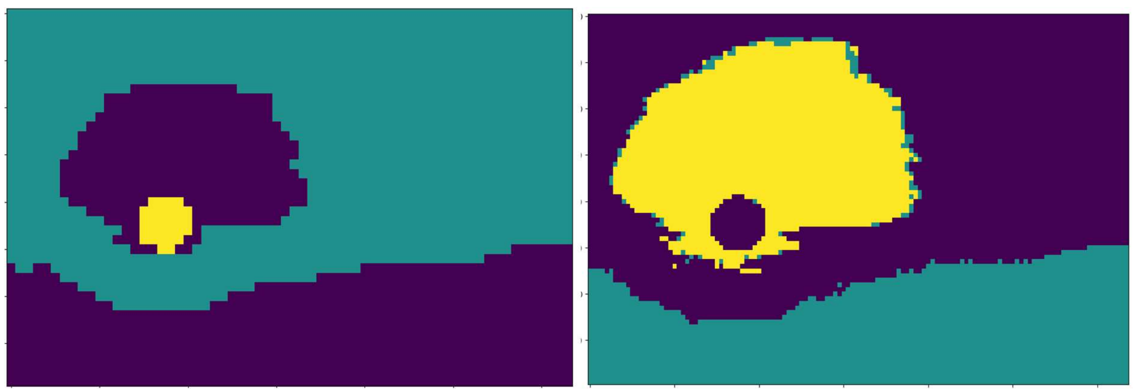
(Image 1)

(Image2)



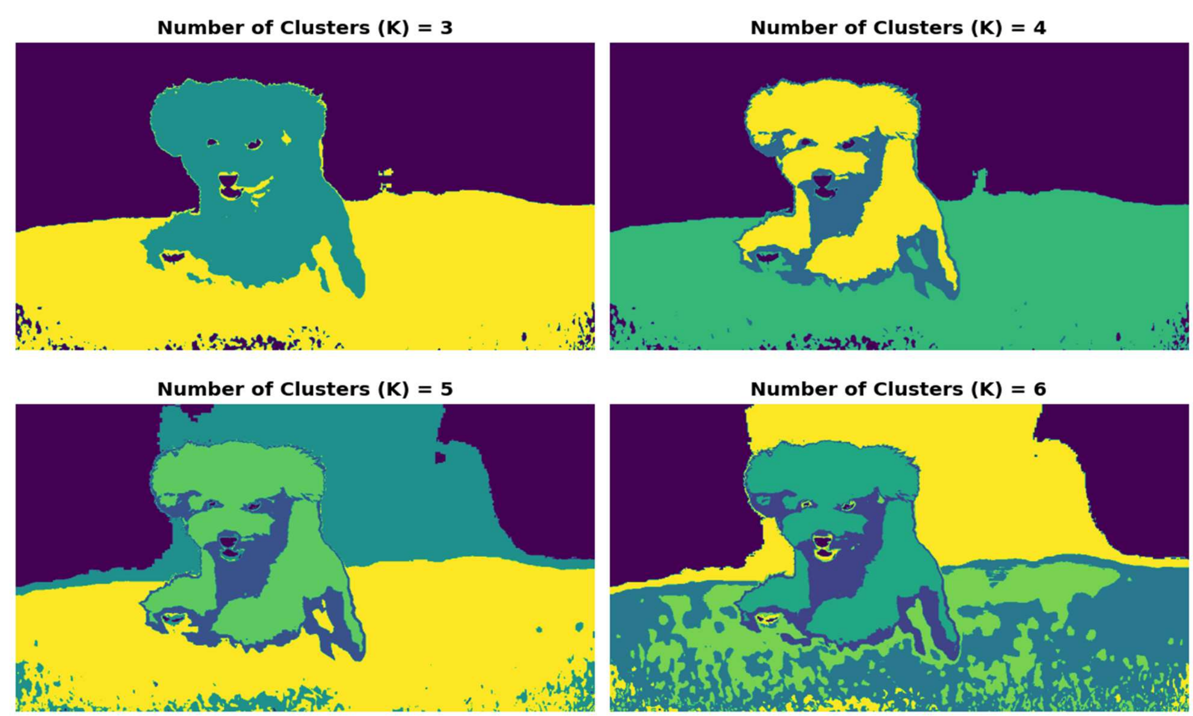
(Image 3)

(Image 4)

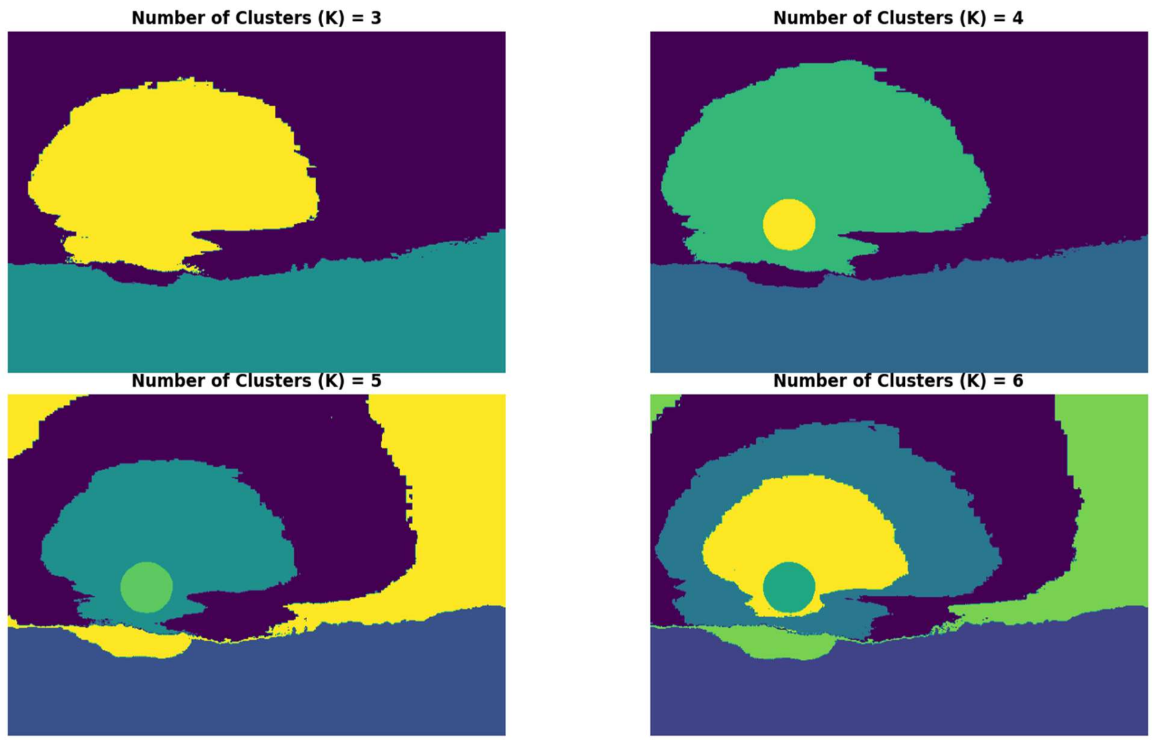


(3 segments on Image 2: Scaled down by 10 times, 5 times respectively, lt. to rt.)

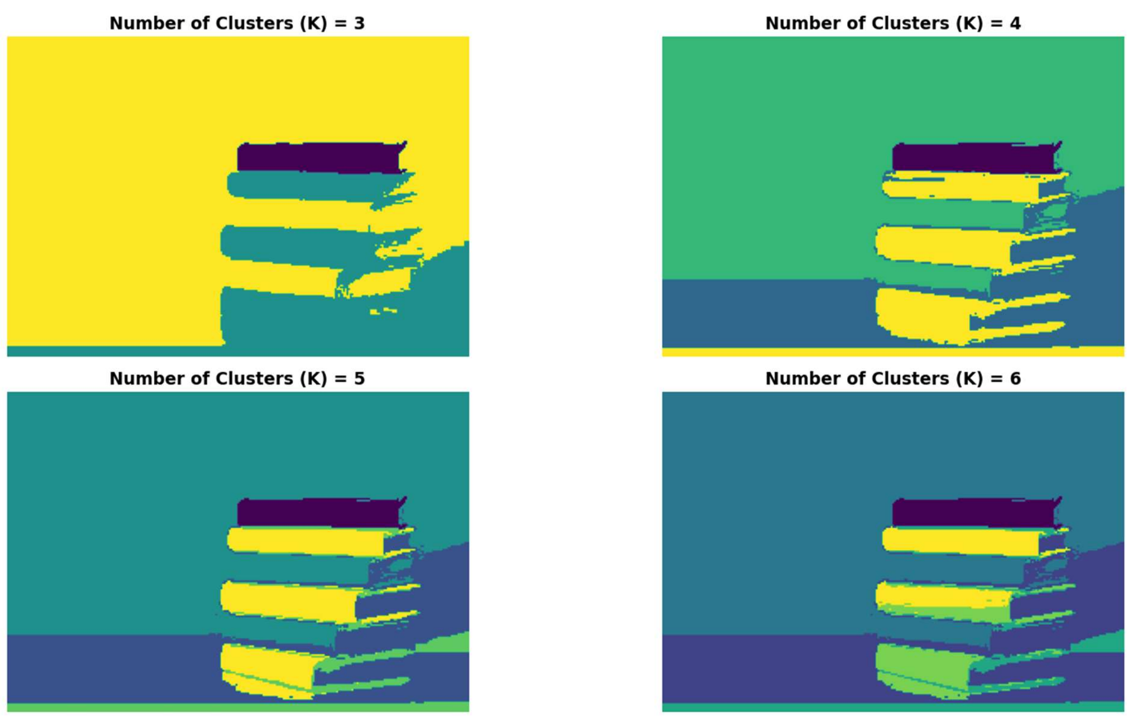
<u>K-means:</u>



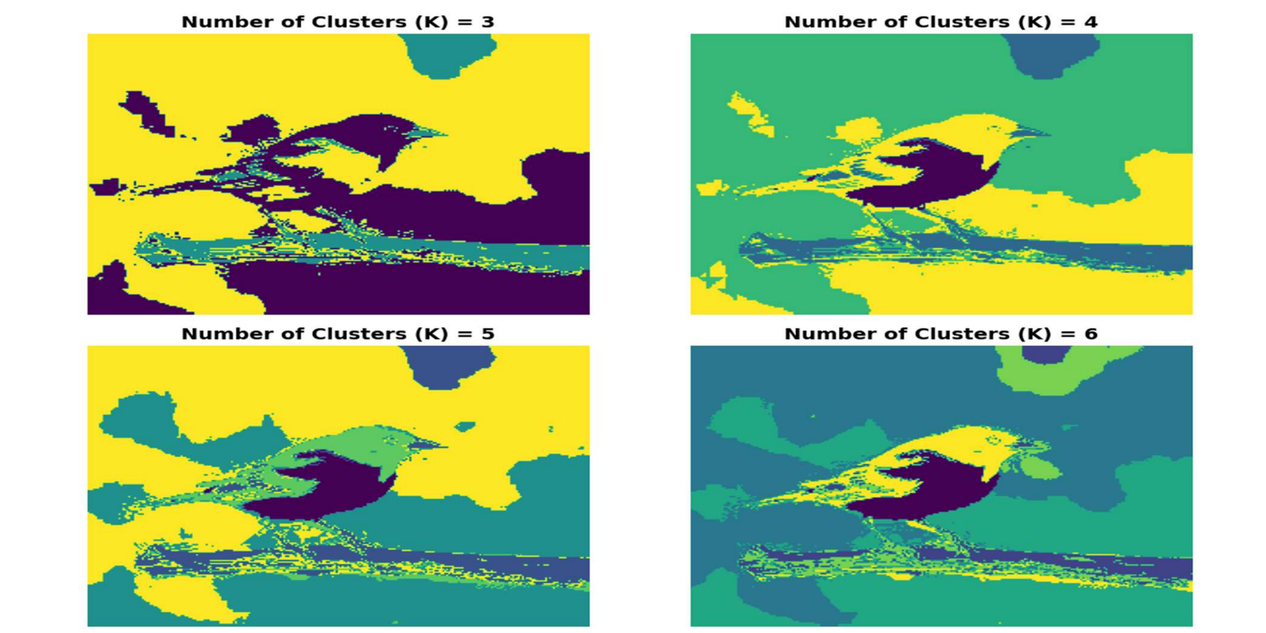
(Image1)



(Image2)



(Image3)



(Image4)

Observations and Implementation:

1. K-Means produces a lot better result than that of N-Cut algorithm, this is due to the already available package used for implementing K-Means while N-cut was implemented from scratch and had to be tuned for achieving the presented results.

2. For K-Means, the value of K decides the number of clusters formed and hence higher value of K gives finer segmentation results.

3. For N-cut, the segmentation results are very coarse because the number of segments is just two and images were scaled down (5 to 10) times due to computational issues which can cause loss of precision too. Along with that the parameters for similarity measures (σ_x, σ_I) had to be tuned manually which is empirical as well as in general suboptimal.

4. The two similarity measures considered in this implementation are taken from the paper itself, i.e. proximity of intensity and distance of the pixels in the image. However, σ_x was taken higher than σ_I to account for the higher weightage that had to be given to intensity similarity which intuitively makes sense too.

5. I had taken the neighbourhood to be a small area around every pixel as given in the paper, but that couldn't generate satisfactory results at all and hence I had to compare a given pixel with every other pixel for given implementation.

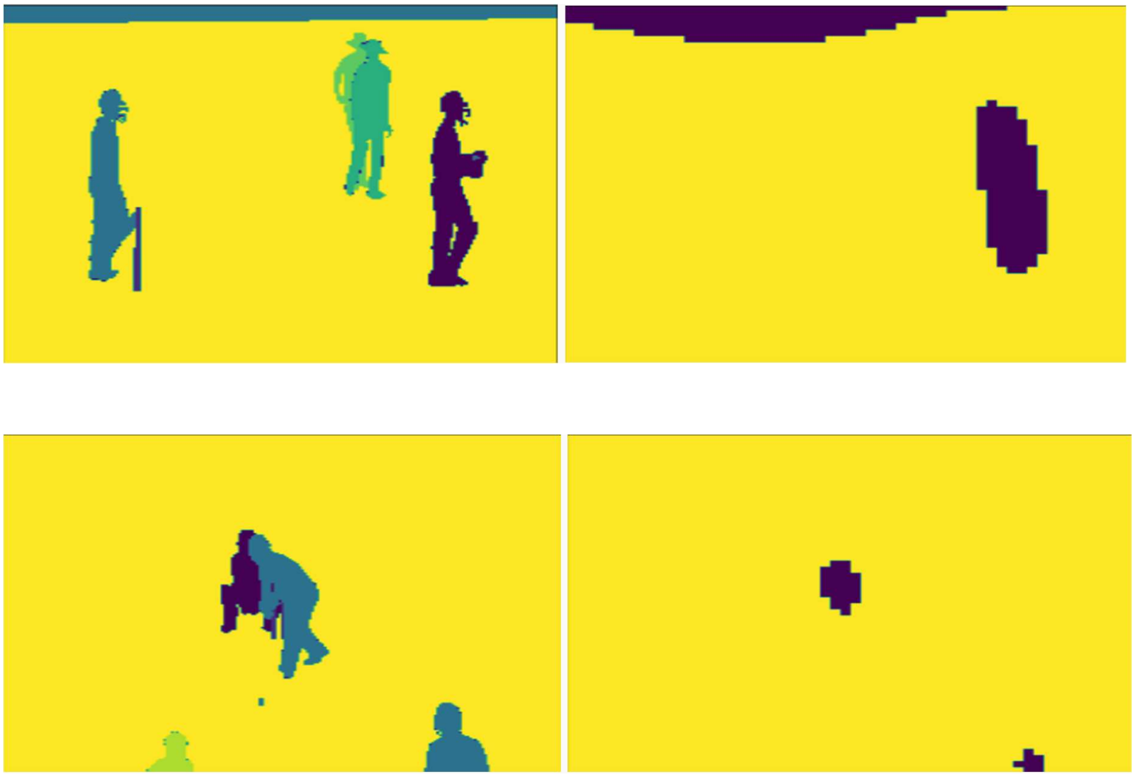
6. I have also changed the final step by taking the eigenvector and producing the image directly from by splitting the positive and negative values in the vector instead of taking median splitting or minimum Ncut splitting point.

7. After this, a three-segment problem was solved on image-2 by taking third smallest eigenvector and dividing it into three regions based on two thresholds which were tuned manually to get the following segmentation output.

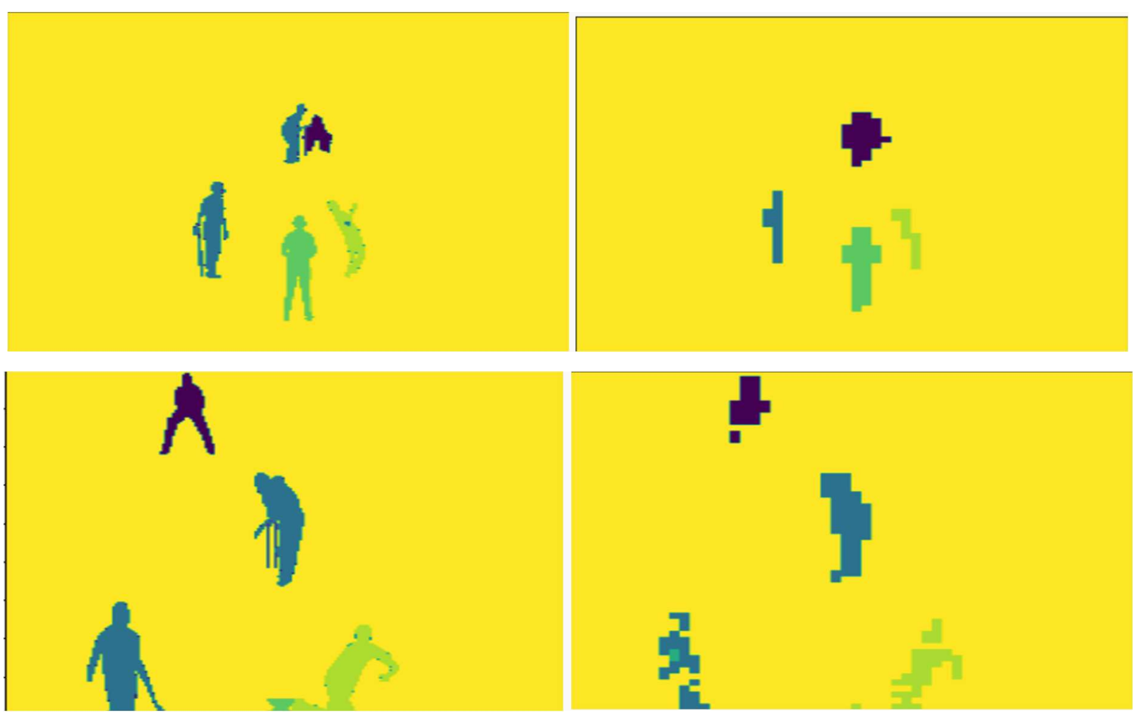
8. The three-way segmentation could have been done by taking one of the segments from the previous step and again performing a two-way segmentation on that but I used this method due to ease of computation.

2. Fully Convolutional Networks

Results:



Target masks and predicted mask output for network without skip connection.



Target masks and predicted mask output for network with skip connection.

Observations and Implementation:

1.Just by seeing the results, it is apparent that the model with skip connections is far better in predicting the output target mask and is a more reliable architecture for semantic segmentation.

2. The skip connections made at the additional convolutional layers combine the global as well as local, finer details to give a overall better semantic information.

3. The results obtained were as follows:

Model/ Metric	Pixelwise accuracy	IOU
With skip	86%	0.12
Without skip	38%	0.11

4. Thus, the results are clearly in favour of the model with skip connection included for doing semantic segmentation.

5. Parameters: Batch size=32, Epochs=50, Optimizer=Adam (learning rate=0.001)