AIP Assignment2

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Segmentation with NCut and k-means

Implemented NCut using laplacian of graph by using degree and weights of the graph constructed. Since it is an NP hard problem the computational complexity shoots up and thus we use a contrained optimization problem.

We created a graph based on similarity of each pixels which depends on spatial and intensity similarity. We later created laplacian of the graph using which we solve the relaxed contrained optimization problem.

We also used the kmeans clustering algorithm to make segmentation map by varying k from 3 to 6.

We noticed that the graph based clustering takes computationally longer time than k-means based clustering. Also graph based clustering results are not close to the original image whereas k means clustering results are more similar to the original image where we can spot the object based on the segmentation map.

Segmentation using ResNet

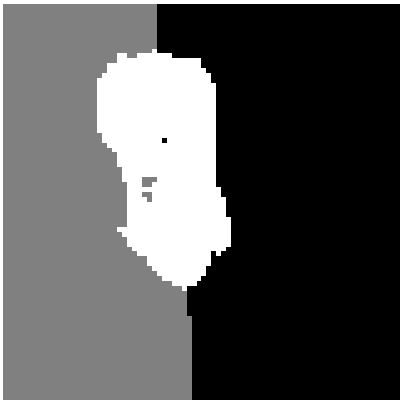
We trained a segmention model using ResNet once without skip connection in upsampling and another time with skip connections.

In fig 5 we can see the training stats for model without skip connections . The model gets saturated very quickly and very little learning takes place. The results we can see are not satisfactory, we get bit better results for class which have much larger region

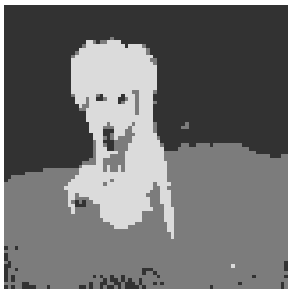
We also trained another segmentation model with skip connection in Resnet 18 upsampling layer and we can see some difference. One is that the iou have a small bump up same as the loss going down a bit. This is because of skip connections which let us use gradients to update the parameters. Although we should fix the issue better by manipulating the loss function since this is similar to class imbalance problem which makes other classes like 'ball', 'umprire' are not learnt (since model cheats by predicting it zero to get less penalised). The training stats can be seen in fig 6. The IOU we get was 68% whereas it was 62% without skip connections. We used jaccard score to compute IOU and we computed mean across all classes and batches to get an idea of progress.

Accuracy is not a good metric to judge the performance here since most of the pixels in all image belongs to one class it becomes easy to get high score.

(a) Original Image



(b) Segmentation using NCut



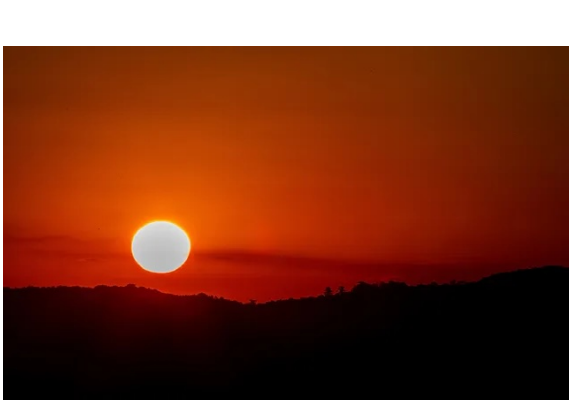
(c) k means for 3 clsuters

(d) k means for 4 clsuters

(e) k means for 5 clsuters

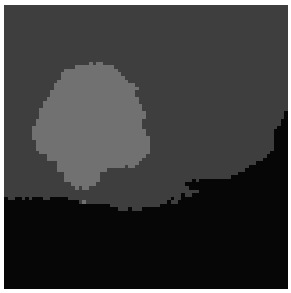
(f) k means for 6 clsuters

Figure 1: Image 1 results

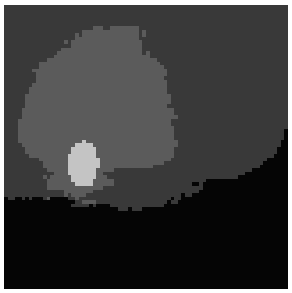


(a) Original Image

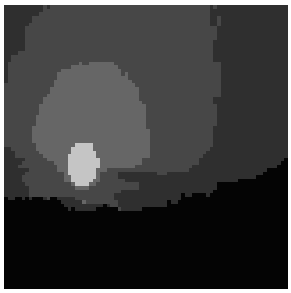
(b) Segmentation using NCut



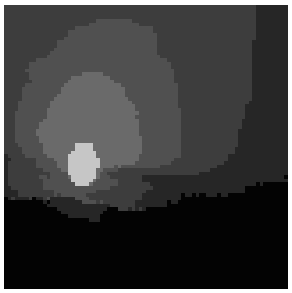
(c) k means for 3 clsuters



(d) k means for 4 clsuters



(e) k means for 5 clsuters



(f) k means for 6 clsuters

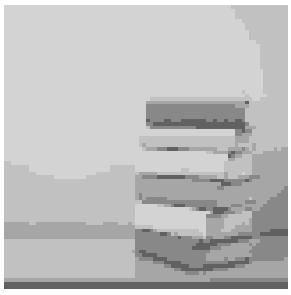
Figure 2: Image 2 results

(a) Original Image

(b) Segmentation using NCut

(c) k means for 3 clsuters

(d) k means for 4 clsuters



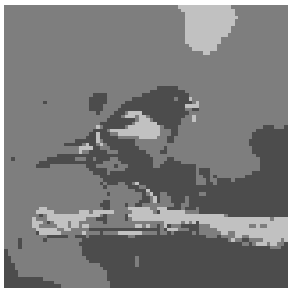
(e) k means for 5 clsuters

(f) k means for 6 clsuters

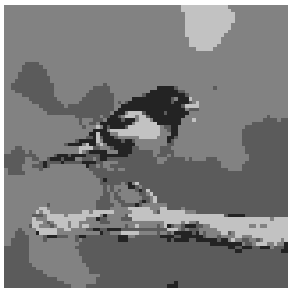
Figure 3: Image 3 results

(a) Original Image

(b) Segmentation using NCut

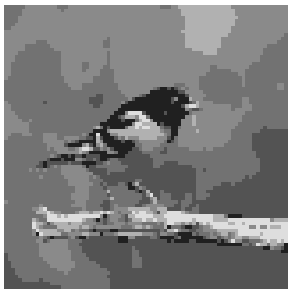


(c) k means for 3 clsuters



(d) k means for 4 clsuters

(e) k means for 5 clsuters



(f) k means for 6 clsuters

Figure 4: Image 4 results

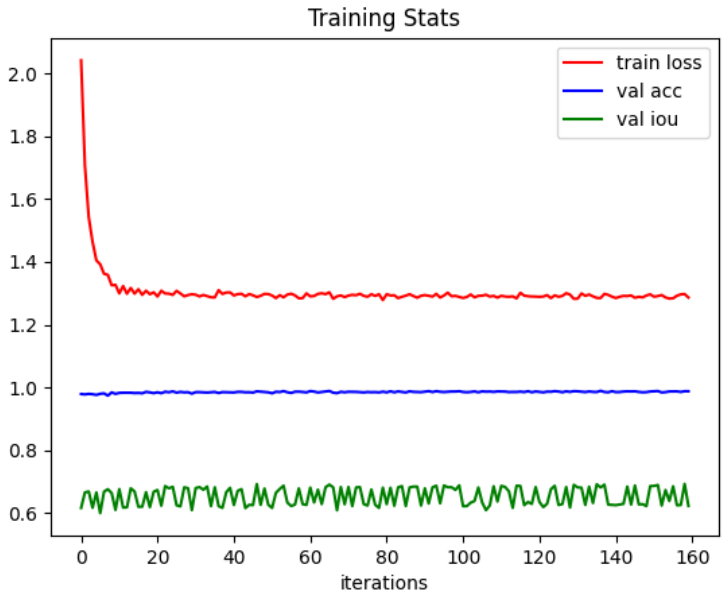


Figure 5: Training stats for ResNet without skip

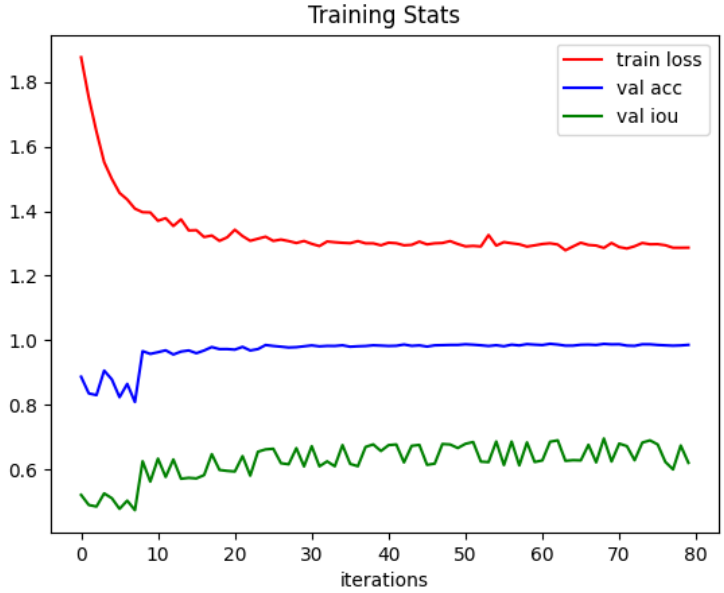


Figure 6: Training stats with skip connections on Resnet