
Prof. M. Pollefeys

Assignment 2

October 27, 2021

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By submitting this work, I verify that it is my own. That is, I have written my own solutions to each problem for which I am submitting an answer. I have listed above all others with whom I have discussed these answers.

Task 2 - Mean-Shift Algorithm

2.1 Distance function

In this function, I take the difference from a given point x_i to all points $x_j \in X$. Then I apply the norm function to each of the differences:

$$\text{dist}[i][j] = \|x_j - x_i\| \quad (1)$$

2.2 Gaussian function

I apply the gaussian kernel function to the distance divided by the bandwidth for every entry in dist:

$$k_{i,j} = \exp\left(-\frac{1}{2} \frac{\text{dist}[i][j]^2}{\text{bandwidth}}\right) \quad (2)$$

2.3 Update-Point function

I calculate the mean for point x_i , using the previously calculated weights:

$$\text{mean}(x_i) = \frac{\sum_{j=1}^{\text{Nr. Datapoints}} k_{i,j} * x_j}{\sum_{j=1}^{\text{Nr. Datapoints}} k_{i,j}} \quad (3)$$

2.4 Accelerating the Naive Implementation

Slow implementation: Elapsed time for mean-shift: 8050.739667892456

Fast implementation: Elapsed time for mean-shift: 9.968343496322632

The difference in time it takes is huge. I think one reason is batch processing, but another reason could also be that I implemented the slow implementation only using numpy-arrays and numpy commands and for the batch-processing I used torch. (I first did the batch processing with numpy only too, but this didn't give a significant increase in runtime)

2.5 Result MeanShift

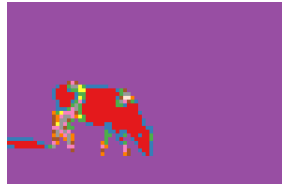


Figure 1: Result of applying mean shift

Task 3 - Implement and Train a Simplified Version of SegNet

Validation-Log:

7:32,715 Namespace(out_dir='out', frequent=10, gpus='', num_workers=1)

2021-10-27 15:27:32,725 = loading model from out/model/_best.pth.tar

2021-10-27 15:27:32,737 = load 200 samples

2021-10-27 15:27:34,103 Test: [0/200] Time 1.364 (1.364) Loss 0.0534 (0.0534)

...

2021-10-27 15:27:43,498 Test: [190/200] Time 0.050 (0.056) Loss 0.0208 (0.0522) 2021-10-27 15:27:45,290

Mean IoU score: **0.875**