Home Work 3 – Correlation Filter Tracking

Ilija Tavchioski

I. Introduction

The goal of this project was to implement the Correlation Filter tracker and to experiment with the tracker on VOT 2014 sequences.

II. Experiments

A. Task 1

In the following table I are the results of the all sequences from VOT14 dataset with alpha parameter (the forgetting parameter) to be set to 0.1 and the sigma parameter (the standard deviation of the gaussian kernel) to be 2. As we can see the speed of the track is substantially increased in respect to he mean shift tracker, while getting very decent results where except for two sequences all other have less than 10 failuers which can be decreased with better fine-tunning.

Sequence	Average overlap	Total Failuers	Speed
ball	0.33	3	2032.78
basketball	0.41	5	1275.04
bicycle	0.52	4	4299.69
bolt	0.49	1	1499.93
car	0.42	1	3385.79
david	0.66	0	484.92
diving	0.37	4	762.71
drunk	0.21	0	825,18
fernando	0.27	0	458.01
fish1	0.28	12	2636.94
fish2	0.32	7	1697.90
gymnastics	0.53	3	1302.86
hand1	0.38	6	1671.92
hand2	0.37	12	2411.03
jogging	0.66	1	1807.79
mototcross	0.46	1	499.605
polarbear	0.44	0	1311.09
skating	0.45	3	1259.06
sphere	0.34	2	1486.62
sunshade	0.71	4	2583.91
surfing	0.57	0	3854.10
torus	0.51	5	2139.69
trellis	0.44	1	2705.53
tunnel	0.31	0	1540.80
woman	0.62	1	2455.75

Table I
The results of the Correlation Filter tracker on the sequences from VOT2014.

B. Task 2

There several important variables of this tracker, and most important are the forgetting variable α and the standard deviation of the gaussian kernel σ. As we can see in the following table II, if the α parameter is 0, the performance is low since we can conclude that as the environment of the sequence of frames is changing, (ex. the object went to a dark place) the tracker is performing worse. On the other hand if the parameter is 1 we can see that the tracker is losing control and the selected region is getting out of the ground truth step by step. We can conclude that firstly as we increase the parameter we increase the performance and at some point the performance is decreasing. In this case the best is 0.1. On the other hand we can see that generally a little higher standard deviation is helping the tracker since the function covers more of the patch, it is smoother. Also if is too high would be very problem since would almost be like it is a uniform filter.

σ	α	Average overlap	Total Failuers	Speed
1	0.002	0.45	115	2007.77
1	0.1	**0.46**	92	1934.37
1	0.25	**0.46**	77	1962.62
1	0.5	**0.46**	80	1862.60
1	1	0.43	83	2121.54
2	0	0.45	159	2064.32
2	0.02	0.44	119	1939.28
2	0.1	0.44	**76**	1855.55
2	0.25	0.44	84	**2193.63**
2	0.5	0.44	91	2108.05
2	1	0.44	81	1984.01
3	0.02	0.43	111	2128.09
3	0.1	0.45	88	1982.27
3	0.25	0.45	97	2151.77
3	0.5	0.44	85	2039.53
3	1	0.42	95	2040.78

Table II
The performance of the Correlation filter tracker on the VOT2014 dataset.

C. Task 3

In the following table III, we can see the importance of tacking the background in the picture, as the factor is representing the extension of the region of the object. As we can conclude a little increasing is improving the performance of the model.

Factor	Average overlap	Total Failuers	Speed
0.5	0.40	134	4430.5
1	0.44	76	1855.55
1.25	0.46	74	1538.46
1.5	0.48	76	1076.71

Table III
The performance of the Correlation filter tracker related to the increasing factor.

D. Task 4

Also in all results we added the Speed represented in Frames Per Second (FPS). As we can see the larger the region the slower the tracker, also generally almost all of the sequences the tracker is tracking with a speed with larger than 1000 FPS which is a great performance. In addition the process of initialization and the tracking is not different in time consumption.

III. Conclusion

In conclusion we can see that this tracker is much faster in comparison with the mean shift tracker.