Correlation filter tracking

Matej Kalc

I. Introduction

MOSSE correlation filter is capable of tracking a specific object using a gray template. In this report, we will show how does this tracker perform on the data set VOT14. Additionally, we will describe the influence of the α (update speed) and σ (standard deviation of the gaussian filter). The MOSSE tracker can be improved by using a larger searching patch.

II. Experiments

A. MOSSE performance

The average overlap and number of failures on the data set VOT14 has been calculated using the Pytrack Toolkit Lite. Shown in Table I are the best results of the MOSSE tracker. 70 fails is the least amount of fails achieved with the the MOSSE tracker. The tracker has been ran 240 times. Each time with a different parameters setting (σ, λ, α, enlarge_factor), where $\sigma \in \{1.0, 2.0, 4.0, 6.0, 8.0\}$, $\lambda \in \{0.001, 0.01\}$, $\alpha \in \{0.05, 0.1, 0.15, 0.2\}$ and enlarge_factor $\in \{1.0, 1.2, 1.4, 1.6, 1.8, 2.0\}$.

sigma	lmba	alfa	enlarge	fails	overlap	fps
2.00	0.001	0.15	1.20	70	0.44	386.96
2.00	0.01	0.15	1.20	71	0.44	364.67
1.00	0.001	0.15	1.20	71	0.41	315.98
2.00	0.01	0.20	1.40	72	0.35	308.59
2.00	0.001	0.20	1.40	72	0.35	321.08
1.00	0.01	0.20	1.20	73	0.40	375.08
1.00	0.001	0.20	1.20	73	0.40	334.78
1.00	0.01	0.15	1.20	74	0.40	365.37
2.00	0.001	0.05	1.20	74	0.41	337.98
2.00	0.01	0.05	1.20	74	0.41	368.78

Table I: Top ten best results using different combination of settings

B. Influence of the update speed and standard deviation of the gaussian filter on the tracker performance

Let α be the update speed and σ be the standard deviation of the Gaussian filter of the MOSSE tracker. By running the tracker multiple times, each time with a different set of parameters, we can better understand the influence of those parameters. On Figures 1 and 3 we observe how does each parameter value influence the number of fails. Similarly, on Figures 2 and 4 we observe how does each parameter value influence FPS. For this test, we only considered the number of fails and FPS. We observe that the sigma parameter on average has the least amount of fails at a value of 2. The lowest FPS are achieved with $\sigma = 1$. Using a low value for σ is ideal for the number of fails and FPS. The number of fails is the lowest when using a value of α between 1.0 and 2.0. Setting α to 0, the tracker achieves higher FPS, but at a cost of more fails. An ideal value of α is 0.15 for this data set.

C. Enlarged search patch

Enlarging the searching by an enlarge factor improves the results (see Figure 5). We see that an ideal enlarge factor on average for the data set VOT14 is 1.6. As we increase the search patch, the FPS on average decreases (see Figure 6). Ideally, a larger search patch increases performance, but if we increase it too much, then more background we be contained in the search patch and the tracker will give worse results.

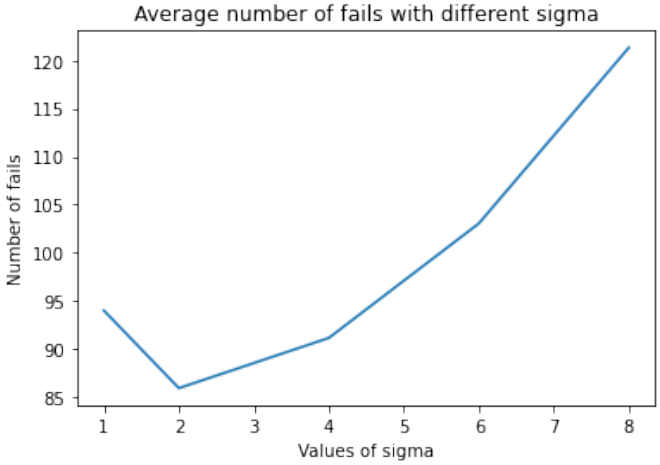

Figure 1: Average number of fails per σ using different settings of parameters

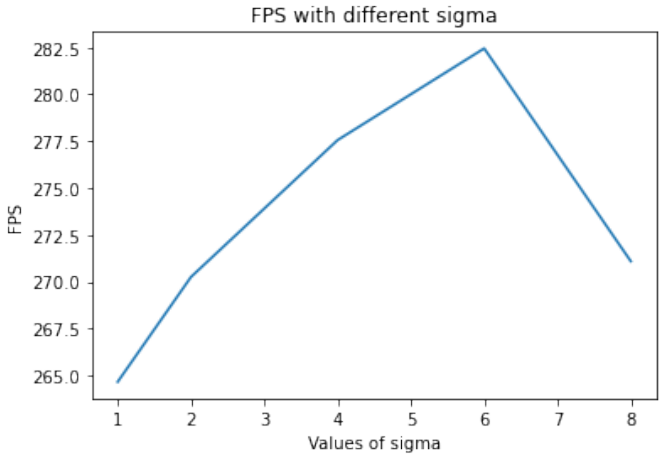

Figure 2: FPS per σ using different settings of parameters.

D. Tracking speed

The tracker has been tested with the following parameters (σ, λ, α, enlarge_factor) = (2.0, 0.001, 0.15, 1.2). On average is the average initialization FPS higher than the average tracking FPS. For some sequences, the average initial is lower than the average tracking FPS.

III. Conclusion

MOSSE tracker is strong when using the appropriate parameters.

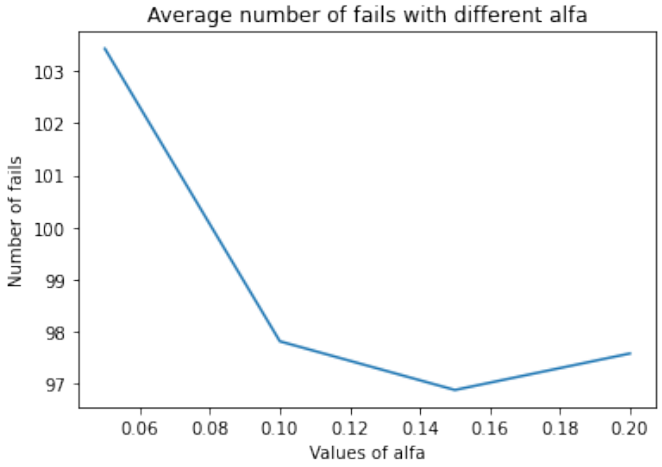

Figure 3: Average number of fails per α using different settings of parameters.

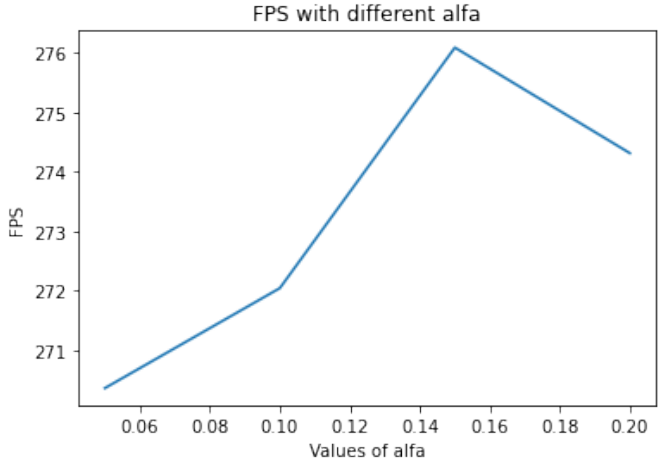

Figure 4: FPS per α using different settings of parameters.

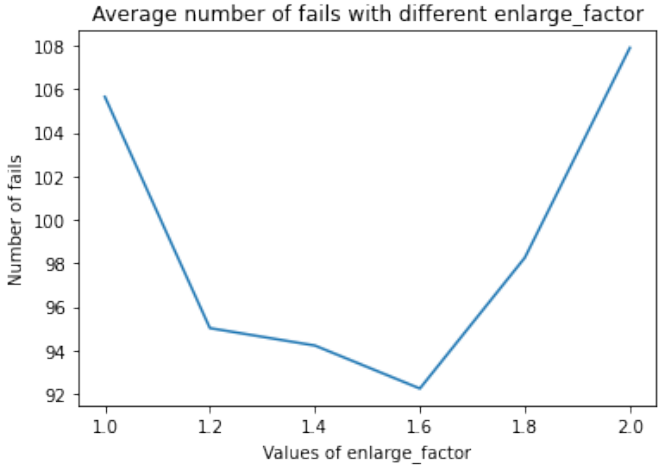

Figure 5: Average number of fails per enlarge factor using different settings of parameters.

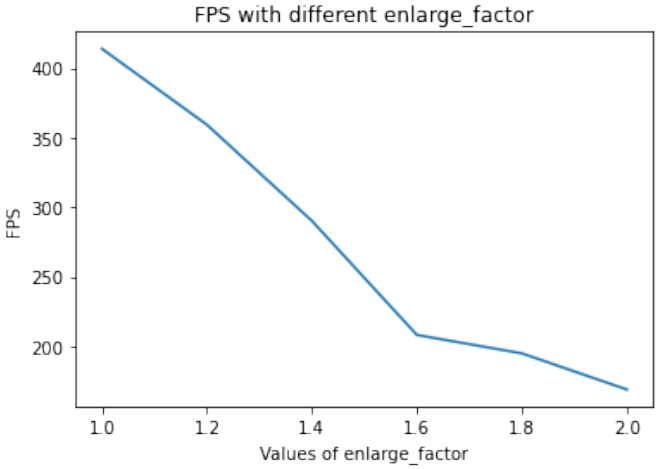

Figure 6: FPS per enlarge factor using different settings of parameters.

Sequence	Avg. Initial FPS	Avg. Tracking FPS
ball	495	637
basketball	290	235
bicycle	771	696
bolt	435	387
car	462	677
david	234	310
diving	262	319
drunk	72	82
fernando	215	147
fish1	498	504
fish2	395	423
gymnastics	345	317
hand1	448	377
hand2	549	439
jogging	464	349
motocross	49	58
polarbear	269	226
skating	310	212
sphere	204	117
sunshade	502	417
surfing	949	1033
torus	556	400
trellis	397	420
tunnel	371	351
woman	525	430

Table II: Table shows the average FPS of initialization frames and the average FPS of tracking frames.