

View Reviews

Paper ID

6543

Paper Title

Automatic Spatio-Temporal Regularization: A General Approach in Correlation Filters for Fast UAV Tracking

Reviewer #1

Questions

1. [Summary] In 3-5 sentences, describe the key ideas, experiments, and their significance.

The paper presents a 2D object tracker that automatically adjusts its parameters to increase robustness as well as efficiency. The presented system shows top accuracy at a large number of commonly used test sequences as well as high execution speed.

2. [Strengths] What are the strengths of the paper? Clearly explain why these aspects of the paper are valuable.

The authors present an improved correlation filter based object tracker that is as good or better than state of the art while it is at the same time faster than most methods it was tested against.

3. [Weaknesses] What are the weaknesses of the paper? Clearly explain why these aspects of the paper are weak. Please make the comments very concrete based on facts (e.g. list relevant citations if you feel the ideas are not novel).

I found the section on 3D tracking by tracking 4 known landmarks trivial and unnecessary for this paper. It is obvious that one can estimate a 6DOF pose from 4 3D points and hence other than claimed not a contribution. I would therefore suggest to remove this section and use the space instead for aspects that are more focused on the new method.

4. [Overall rating] Paper rating (pre-rebuttal)

Weak accept

5. [Justification of rating] Please explain how the strengths and weaknesses aforementioned were weighed in for the rating. Please also mention what you expect to see from the rebuttal that may change your rating.

I really enjoyed reading this paper even though 2D object tracking is not a topic I'm working at. I was pleasantly surprised that a classic method shows strong advantages over the currently hyped machine learning methods.

6. [Detailed comments] Additional comments regarding the paper (e.g. typos, any suggestions to make the submission stronger).

The paper is well written. I did not check the math though.

Since this is a paper on tracking objects in videos it would have been interesting and helpful to see how this tracker performs against its competition in a representative subset of the test sequences.

Reviewer #2

Questions

1. [Summary] In 3-5 sentences, describe the key ideas, experiments, and their significance.

This paper describes improvements to a previously published correlation filter for tracking. The improvements address issues on the learning aspects of the previous filter, related to both the spatial variation of the object appearance and the update rate. Spatial regularization (by means of spatially local response variations) is used to adjust the contribution to learning from certain pixels (pixels where big changes in filter response are penalized). Temporal regularization adjusts the temporal change of the correlation filters in an automatic and

adaptive way. The new filter is applied to localization by tracking of UAVs. Experimental results show improved performance to several competing approaches and filters.

2. [Strengths] What are the strengths of the paper? Clearly explain why these aspects of the paper are valuable.

The use of adaptive and automatic spatial and temporal regularization allows for an increase robustness of this filter. The optimization framework applied to filter training allows for an increase in precision while the the real-time speed performance is the second-best when compared with a set of 12 CPU-based trackers.

3. [Weaknesses] What are the weaknesses of the paper? Clearly explain why these aspects of the paper are weak. Please make the comments very concrete based on facts (e.g. list relevant citations if you feel the ideas are not novel).

The main weakness of the paper results from the experimental evaluation: only UAV data sets were used. The optimization framework used in training is not entirely clear: sub-problems \hat{G} and H are solved by means of an alternate application of ADMM which is not clearly discussed and justified. The effects of changes in hyper-parameter values are not discussed in detail.

4. [Overall rating] Paper rating (pre-rebuttal)

Weak accept

5. [Justification of rating] Please explain how the strengths and weaknesses aforementioned were weighed in for the rating. Please also mention what you expect to see from the rebuttal that may change your rating.

The experimental results show that for the UAV sequences tested, the proposed filter obtained the best results overall, in localization by tracking.

6. [Detailed comments] Additional comments regarding the paper (e.g. typos, any suggestions to make the submission stronger).

In addition to the previous comments it is unclear why the authors decided to evaluate the filter (which is claimed to be general) with UAV image sequences only. The adaptability of the spatial and temporal regularization terms should lead to a more general detection filter.

Reviewer #3

Questions

1. [Summary] In 3-5 sentences, describe the key ideas, experiments, and their significance.

This work studies real-time object tracking for UAV, which needs to additionally consider the computational cost in the mobile device. To avoid the manual parameter tuning problem in discriminative correlation filters, this paper tries to explore a solution to learn to tune the regularization automatically and adaptively. Specifically, the Spatio-temporal regularization is composed of a spatially local response map variation (spatial) and a global response map variation (temporal).

The empirical results on four UAV benchmarks show that the introduced solution outperforms most of the baselines.

2. [Strengths] What are the strengths of the paper? Clearly explain why these aspects of the paper are valuable.

1. This paper introduced both local and global response variations as the spatial-temporal regularization. It is simple but effective.

2. A novel method to automatically and adaptively tune the hyper-parameters. It is well formulated and easy-to-reproduce.

3. The evaluation is comprehensive and convincing. Besides comparing with the state-of-the-art method, the effectiveness of ATR and ASR is also analyzed in an ablation study. The performance of using the tracker to localize the UAV is also evaluated.

3. [Weaknesses] What are the weaknesses of the paper? Clearly explain why these aspects of the paper are weak. Please make the comments very concrete based on facts (e.g. list relevant citations if you feel the ideas are not novel).

1. The notation in Sec4.2 is a little abuse, which would make the reader get lost.
2. The evaluation of the localization system (Sec6.2) only compares against the LED-based method. To show the advantage of the proposed method, It would be better to additionally report the performance of other tracking-based methods as reference.

4. [Overall rating] Paper rating (pre-rebuttal)

Weak accept

5. [Justification of rating] Please explain how the strengths and weaknesses aforementioned were weighed in for the rating. Please also mention what you expect to see from the rebuttal that may change your rating.

Please solve the concerns mentioned in the weakness.

6. [Detailed comments] Additional comments regarding the paper (e.g. typos, any suggestions to make the submission stronger).

Realease the code and UAV localization Dataset could make the work more impactful.