Detection of Neighbouring Aircrafts in Collision course and General Flight Scenarios

A. Rozantsev, M. Christoudias, V. Lepetit, P. Fua

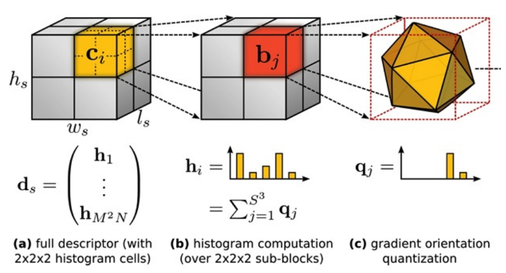
ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Collision Scenarios

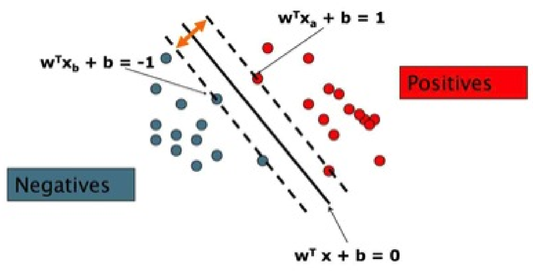
- Object is not moving with respect to the camera
- Size of the object is increasing

Approach

We use SVM linear classifier with 3D HOG feature vector to detect collision-path UAVs.



3Dhistogram of oriented gradients



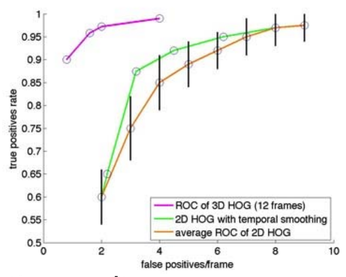
Linear SVM

Experimental setup and results

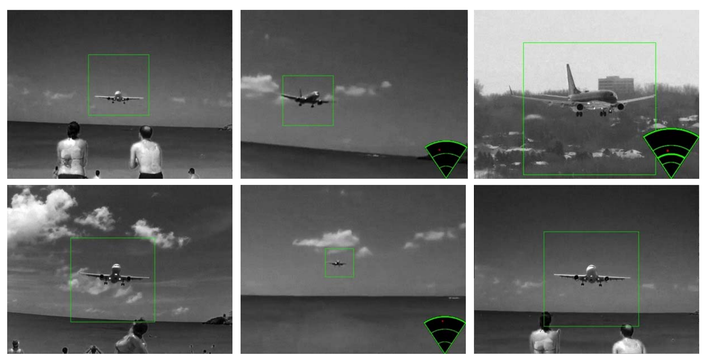
Database of aircrafts on the collision course

Evaluation of the approach

Comparison of the proposed algorithm with the conventional single frame object detection approaches

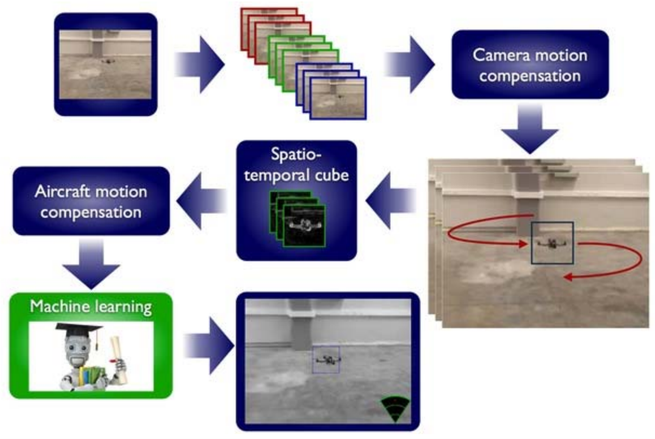


Detection results



General flight scenarios

No preliminary assumptions about the behaviour of the aircraft in the air can be made.



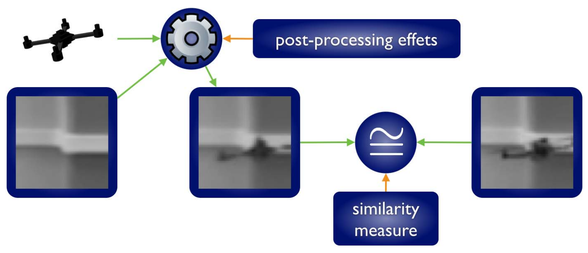
- We aim to use temporal information during the detection process, as it allows to significantly reduce the false positive rate.
- Camera motion compensation is done with the homograpy-based approach.
- Aircraft motion compensation is based on regression and is applied to reduce the in-class variation of the data.

Results

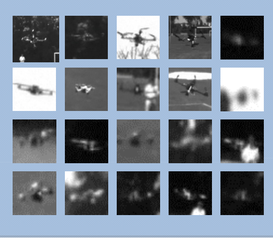
Synthetic Data

Challenges

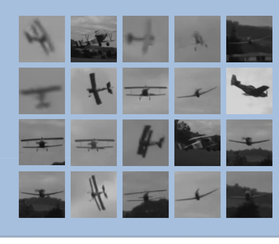
- Lack of available real data to train the detector
- Annotation of real data



UAV dataset

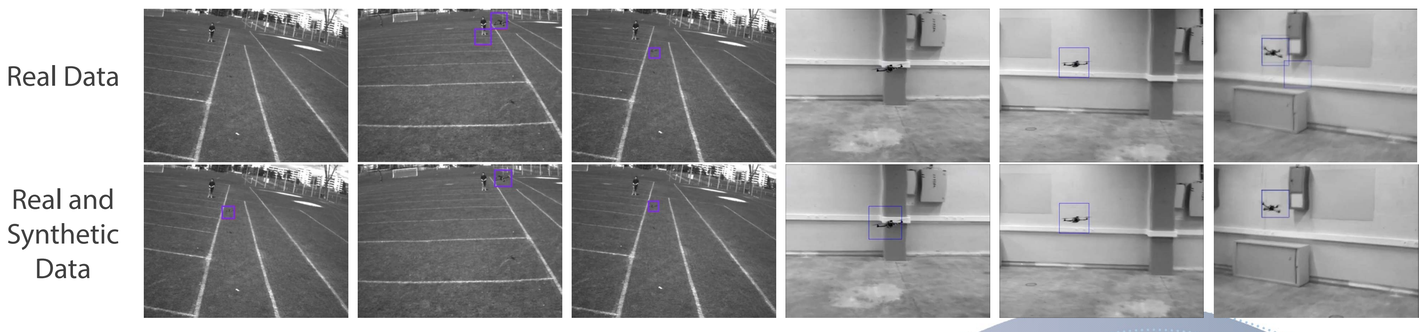


Aircraft dataset



		Real images	Similarity measure: $d_{Eucl}(.,.)$	$d_{HoG}(.,.)$	$d^R_{WL}(.,.)$	$d^L_{WL}(.,.)$	$d_{CNN}(.,.)$
UAVs	Detection method:		Average precision:				
	DPM	0.84	0.78	**0.93**	0.70	0.72	0.67
	AdaBoost	0.80	0.72	0.85	0.89	**0.92**	0.75
	CNN	0.85	0.84	0.84	0.84	0.86	**0.89**
Aircrafts	Detection method:		Average precision:				
	DPM	0.79	0.83	**0.88**	0.85	0.86	0.81
	AdaBoost	0.65	0.75	0.84	0.87	**0.92**	0.73
	CNN	0.72	0.75	0.85	0.70	0.83	**0.88**

Evaluation



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