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Dynamic Objectness for Adaptive Tracking

Abstract

A fundamental problem of object tracking is to adapt to unseen views of the object while not getting distracted by other objects. We introduce Dynamic Objectness in a discriminative tracking framework to sporadically re-discover the tracked object based on motion. In doing so, drifting is effectively limited since tracking becomes more aware of objects as independently moving entities in the scene. The approach not only follows the object, but also the background to not easily adapt to other distracting objects. Finally, an appearance model of the object is incrementally built for an eventual re-detection after a partial or full occlusion.

We evaluated it on several well-known tracking sequences and demonstrate results with superior accuracy, especially in difficult sequences with changing aspect ratios, varying scale, partial occlusion and non-rigid objects.

Introduction

Adaptive Object Tracking Usefulness
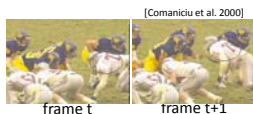• Tracking some unknown object

Challenges
• Unknown object
• Unknown camera
• Scale, illumination changes
• Appearance changes
• Partial and full occlusion

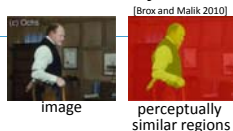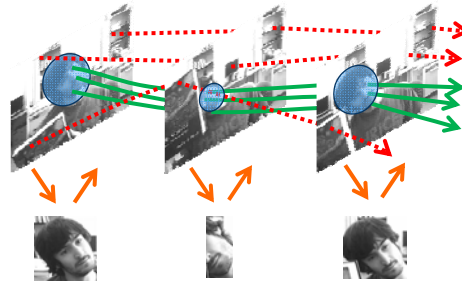### Paradigm of Visual Object Tracking
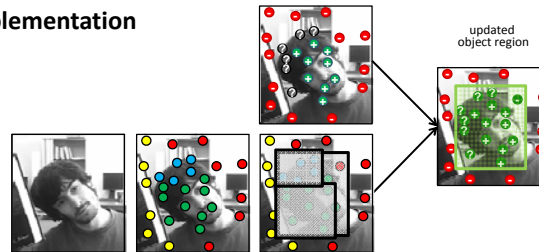
fixed model

incremental model

[Özuysal et al. 2006]

training phase   testing phase

[Comaniciu et al. 2000]

frame t   frame t+1

scene model

salient objects

[Heikkilä and Pietikäinen 2006]

[Brox and Malik 2010]

background   foreground

image   perceptually similar regions

Dynamic Objectness

Principle

Implementation

updated object region

Examples

Object Tracking Results

Sequence	MIL	IFSART	SPT	HTT	TLD	ours
David	0.54	(0.64)	0.12	0.61	0.59	**0.74**
FaceOcc	0.45	(0.55)	0.13	0.56	0.49	**0.58**
FaceOcc2	0.49	(0.49)	0.37	0.39	0.34	**0.57**
Dollar	0.69	(1.00)	0.37	0.66	**0.79**	0.63
Tiger	**0.33**	(0.47)	0.26	0.11	0.29	0.28
Sylvester	0.62	(0.72)	0.65	0.69	**0.71**	0.69
Board	0.32	(0.65)	0.21	0.19	0.16	**0.64**
Fist	-	-	-	0.34	0.39	**0.56**

Pascal overlap: $\dfrac{1}{T}\sum_{t=1}^{T}\dfrac{A_{gt}(t) \cap A_{tr}(t)}{A_{gt}(t) \cup A_{tr}(t)}$

MIL: Visual Tracking with Online Multiple Instance Learning, CVPR 2009
SPT: Superpixel Tracking, ICCV 2011
HTT: Hough-based Tracking of Non-Rigid Objects, ICCV 2011
TLD: Tracking-Learning-Detection, PAMI 2012