Resources in Visual Tracking

宫延河 2015 年 5 月 17 日

Tracking 是计算机视觉非常活跃的研究领域，每年在 CVPR、ICCV、ECCV 和 PAMI 等国际会议和期刊上都有大量相关的文章发表。它的分类有很多，根据追踪目标数量的不同，可分为单目标追踪和多目标追踪，根据是否在线更新模板可分为离线追踪和在线追踪。早期的研究多关注于离线追踪，代表性方法有 Kalman 滤波和粒子滤波，甚至 meanshift 在大行其道时也曾登上 PAMI 的大堂。不过由于近年来 tracking 发展很快，这些方法都已经濒临淘汰，对他们的总结见下面列出的 Tutorials-Advances in Visual Tracking，由于精力有限，本文只关注在线单目标追踪方法。多目标追踪见 Reference Guide: *Multiple Object Tracking*、Multi-Object Tracking 和 Multi_Object Tracking Framework，他们总结的很好，我就不班门弄斧了。

上次在 CSDN 发布的只是单纯的连接，并不能节省大家宝贵的时间，这次相比来说就要全面的多。提醒大家一句 CDSN 上基本都是初学者的总结，断章取义、望文生义等屡见不鲜，还是自己真读过才会领会作者的真实意图。

先来几篇我认为比较写好的吧：

视频讲座

VALSE 曾做过几期有关 tracking 的讲座，包括专题 tracking，张开华老师的 FCT，贾奎 ROML，视频下载链接 http://vision.ouc.edu.cn/valse/。

Techtalks 上录制的 CVPR tracking 相关的视频：

CVPR2014：Adaptive Color Attributes for Real-Time Visual Tracking

CVPR2012：Robust Visual Tracking via Multi-Task Sparse Learning

其他的我相信搞计算机的应该有相应的搜索能力了。

值得看的中文博客

首推 Correlation Filter in Visual Tracking，它给出了算法的直觉，逻辑推理的过程值得深究。

目标跟踪学习系列共 13 篇，基本总结了 online-tracker 所有要看的东西。

各大牛人的主页

一定要经常看，不时就会有新的东西：

Ming-Hsuan Yang's Home Page

KyoungMuLee
Arnold Smeulders
Haibin Ling
Lei Zhang
Horst Possegger
Sinisa Todorovic
Dr. Zdenek Kalal
Charles Bibby | Research Interest: Active Vision and SLAM
Kevin Cannons, Mitacs Elevate Postdoctoral Fellow

卢湖川

Jo ão F. Henriques
Shai Avidan
www.eng.tau.ac.il/~oron/
Helmut Grabner
Anton Milan
Tomáš Vojíř
Naiyan Wang - Home

西北大学吴郢

信息与控制学院--吴 毅

张开华

Sam Hare
Bohyung Han's homepage
vision.cse.psu.edu/home/home.shtml

张天柱

Welcome to Jianming Zhang's Home Page
Charles Bibby | Research Interest: Active Vision and SLAM
Deva Ramanan - UC Irvine - Computer Vision
Georg Nebehay
文珑银

下表是 CVPR 2013 benchmark 比较的 tracker，以后大家基本上都要在这个库上跑了，所以一定不要错过。

NAME	CODE	REFERENCE
CPF	CPF	P. Pe 藿 rez, C. Hue, J. Vermaak, and M. Gangnet. Color-Based Probabilistic Tracking. In ECCV, 2002.
KMS	KMS	D. Comaniciu, V. Ramesh, and P. Meer. Kernel-Based Object Tracking. PAMI, 25(5):564 鈥�577, 2003.
SMS	SMS	R. Collins. Mean-shift Blob Tracking through Scale Space. In CVPR, 2003.
VR-V	VIVID/VR	R. T. Collins, Y. Liu, and M. Leordeanu. Online Selection of

		Discriminative Tracking Features. PAMI, 27(10):1631 鈥斺1643, 2005.[www] * We also evaluated four other trackers included in the VIVID tracker suite. (**PD-V**,聽 **RS-V**,聽 **MS-V**, and 聽 **TM-V**).
Frag	Frag	A. Adam, E. Rivlin, and I. Shimshoni. Robust Fragments-based Tracking using the Integral Histogram. In CVPR, 2006.[www]
OAB	OAB	H. Grabner, M. Grabner, and H. Bischof. Real-Time Tracking via On-line Boosting. In BMVC, 2006.[www]
IVT	IVT	D. Ross, J. Lim, R.-S. Lin, and M.-H. Yang. Incremental Learning for Robust Visual Tracking. IJCV, 77(1):125 鈥斺141, 2008.[www]
SemiT	SBT	H. Grabner, C. Leistner, and H. Bischof. Semi-supervised On-Line Boosting for Robust Tracking. In ECCV, 2008.[www]
MIL	MIL	B. Babenko, M.-H. Yang, and S. Belongie. Visual Tracking with Online Multiple Instance Learning. In CVPR, 2009.[www]
BSBT	BSBT	S. Stalder, H. Grabner, and L. van Gool. Beyond Semi-Supervised Tracking: Tracking Should Be as Simple as Detection, but not Simpler than Recognition. In ICCV Workshop, 2009.[www]
TLD	TLD	Z. Kalal, J. Matas, and K. Mikolajczyk. P-N Learning: Bootstrapping Binary Classifiers by Structural Constraints. In CVPR, 2010.[www]
VTD	VTD	J. Kwon and K. M. Lee. Visual Tracking Decomposition. In CVPR, 2010.[www]
CXT	CXT	T. B. Dinh, N. Vo, and G. Medioni. Context Tracker: Exploring supporters and distracters in unconstrained environments. In CVPR, 2011.[www]
LSK	LSK	B. Liu, J. Huang, L. Yang, and C. Kulikowsk. Robust Tracking using Local Sparse Appearance Model and K-Selection. In CVPR, 2011.[www]
Struck	Struck	S. Hare, A. Saffari, and P. H. S. Torr. Struck: Structured Output Tracking with Kernels. In ICCV, 2011.[www]
VTS	VTS	J. Kwon and K. M. Lee. Tracking by Sampling Trackers. In ICCV, 2011.[www]
ASLA	ASLA	X. Jia, H. Lu, and M.-H. Yang. Visual Tracking via Adaptive Structural Local Sparse Appearance Model. In CVPR, 2012.[www]
DFT	DFT	L. Sevilla-Lara and E. Learned-Miller. Distribution Fields for Tracking. In CVPR, 2012.[www]
L1APG	L1APG	C. Bao, Y. Wu, H. Ling, and H. Ji. Real Time Robust L1 Tracker Using Accelerated Proximal Gradient Approach. In CVPR, 2012.L1_Tracker">[www]
LOT	LOT	S. Oron, A. Bar-Hillel, D. Levi, and S. Avidan. Locally Orderless

		Tracking. In CVPR, 2012.[www]
MTT	MTT	T.Zhang, B. Ghanem,S. Liu,and N. Ahuja. Robust Visual Tracking via Multi-task Sparse Learning. In CVPR, 2012.[www]
ORIA	ORIA	Y. Wu, B. Shen, and H. Ling. Online Robust Image Alignment via Iterative Convex Optimization. In CVPR, 2012.[www]
SCM	SCM	W. Zhong, H. Lu, and M.-H. Yang. Robust Object Tracking via Sparsity-based Collaborative Model. In CVPR, 2012.[www]
CSK	CSK	F. Henriques, R. Caseiro, P. Martins, and J. Batista. Exploiting the Circulant Structure of Tracking-by-Detection with Kernels. In ECCV, 2012.聽[www]
CT	CT	K. Zhang, L. Zhang, and M.-H. Yang. Real-time Compressive Tracking. In ECCV, 2012.[www]

一、Survey and benchmark：

1. VOT challenge，这个不用说了吧，大名鼎鼎，如雷贯耳，如果连这个都不知道，基本上不用在 tracking 圈混了。
2. PAMI2015,CVPR2013:Online Object Tracking: A Benchmark(需翻墙) ，吴毅老师的库，刚开始是 50 个序列，后扩展到 100 个，为评估初始化对 tracker 的影响，加入了 OPE、TRE、SRE 和 TRER、SRER 等评估指标。
3. PAMI2014：Visual Tracking _ An Experimental Survey，阿姆斯特丹大学建立的包括 300 多个视频序列的库，代码：http://alov300pp.joomlafree.it/trackers-resource.html
4. ICCV2013:Finding the Best from the Second Bests – Inhibiting Subjective Bias inEvaluation of Visual Tracking Algorithms，采用 Rank Aggregation、PageRank、Elo's Rating 和 Glicko's rating 等 4 种方法收集已有论文进行排序。
5. Signal Processing 2011：Video Tracking Theory and Practice
6. ACCV2006：Tutorials-Advances in Visual Tracking：中文：视觉跟踪的进展
7. Evaluation of an online learning approach for robust object tracking

二、研究团体：

1. University of California at Merced：Ming-Hsuan Yang 视觉跟踪当之无愧第一人，后面的人基本上都和气其有合作关系，他引近 9000

Publications PAMI：6，CVPR：26，ECCV：17，BMCV：6，NIPS：6，IJCV：3，ACCV：3

代表作：Robust Visual Tracking via Consistent Low-Rank Sparse Learning

FCT,IJCV2014:Fast Compressive Tracking

RST,PAMI2014:Robust Superpixel Tracking; SPT,ICCV2011, Superpixel tracking

SVD,TIP2014:Learning Structured Visual Dictionary for Object Tracking

ECCV2014: Spatiotemporal Background Subtraction Using Minimum Spanning Tree and Optical Flow

PAMI2011:Robust Object Tracking with Online Multiple Instance Learning

MIT,CVPR2009: Visual tracking with online multiple instance learning

IJCV2008: Incremental Learning for Robust Visual Tracking

2. Seoul National University Professor：KyoungMuLee2013 年在 PAMI 上发表 5 篇，至

今无人能及

文献列表 PAMI:13,CVPR:30,ECCV:12,ICCV:8,PR:4

PAMI2014： A Geometric Particle Filter for Template-Based Visual Tracking

ECCV2014: Robust Visual Tracking with Double Bounding Box Model

PAMI2013:Highly Nonrigid Object Tracking via Patch-based Dynamic Appearance Modeling

CVPR2014: Interval Tracker: Tracking by Interval Analysis

CVPR2013: Minimum Uncertainty Gap for Robust Visual Tracking

CVPR2012:Robust Visual Tracking using Autoregressive Hidden Markov Model

VTS ,ICCV2011:Tracking by Sampling Trackers.

VTD,CVPR2010: Visual Tracking Decomposition

TST,ICCV2011: Tracking by sampling trackers

3. Temple University，凌海滨

Publication List PMAI:4,CVPR:19,ICCV:17,ECCV:5,TIP:9

CVPR2014:Multi-target Tracking with Motion Context in Tenor Power Iteration

ECCV2014:Transfer Learning Based Visual Tracking with Gaussian Process Regression

ICCV2013:Finding the Best from the Second Bests - Inhibiting Subjective Bias in Evaluation of Visual Tracking Algorithms

CVPR2013: Multi-target Tracking by Rank-1 Tensor Approximation

CVPR2012:Real Time Robust L1 Tracker Using Accelerated Proximal Gradient Approach

TIP2012: Real-time Probabilistic Covariance Tracking with Efficient Model Update

ICCV2011: Blurred Target Tracking by Blur-driven Tracker

PAMI2011ICCV2009: Robust Visual Tracking and Vehicle Classification via Sparse Representation

ICCV2011:Robust Visual Tracking using L1 Minimization

L1O,CVPR2011: Minimum error bounded efficient l1 tracker with occlusion detection

L1T, ICCV2009:Robust visual tracking using l1 minimization

4. Hong Kong Polytechnic University Associate Professor: Lei Zhang

PapersPAMI:2,CVPR:18,ICCV:14,ECCV:12,ICPR:6,PR:28,TIP:4

STC,ECCV2014: Fast Tracking via Dense Spatio-Temporal Context Learning

FCT,PAMI2014,ECCV2012:Fast Compressive Tracking, Minghsuan Yang

IET Computer Vision2012:Scale and Orientation Adaptive Mean Shift Tracking

IJPRAI2009:Robust Object Tracking using Joint Color-Texture Histogram

5. 大连理工大学教授 卢湖川国内追踪领域第一人

CVPR2014:Visual Tracking via Probability Continuous Outlier Model

TIP2014:Visual Tracking via Discriminative Sparse Similarity Map

TIP2014: Robust Superpixel Tracking

TIP2014: Robust Object Tracking via Sparse Collaborative Appearance Model

CVPR2013: Least Soft-threshold Squares Tracking, Minghsuan Yang

TIP2013:Online Object Tracking with Sparse Prototypes, Minghsuan Yang

Signal Processing Letters2013: Graph-Regularized Saliency Detection With Convex-Hull-Based Center Prior

Signal Processing2013: On-line Learning Parts-based Representation via Incremental Orthogonal Projective Non-negative Matrix Factorization

CVPR2012:Robust Object Tracking viaSparsity-based Collaborative Model, Minghsuan Yang

CVPR2012:Visual Tracking via Adaptive Structural Local Sparse Appearance Model, Minghsuan Yang

Signal Processing Letters 2012:Object tracking via 2DPCA and L1-regularization

IET Image Processing 2012:Visual Tracking via Bag of Features

ICPR2012: Superpixel Level Object Recognition Under Local Learning Framework

ICPR2012: Fragment-Based Tracking Using Online Multiple Kernel Learning

ICPR2012: Object Tracking Based On Local Learning

ICPR2012: Object Tracking with L2_RLS

ICPR2011:Complementary Visual Tracking

FG2011:Online Multiple Support Instance Tracking

Signal Processing2010: A novel method for gaze tracking by local pattern model and support vector regressor

ACCV2010: On Feature Combination and Multiple Kernel Learning for Object Tracking

ACCV: Robust Tracking Based on Pixel-wise Spatial Pyramid and Biased Fusion

ACCV2010: Human Tracking by Multiple Kernel Boosting with Locality Affinity Constraints

ICCV2011:Superpixel Tracking, Minghsuan Yang

ICPR2010: Robust Tracking Based on Boosted Color Soft Segmentation and ICA-R

ICPR2010: Incremental MPCA for Color Object Tracking

ICPR2010: Bag of Features Tracking

ICPR2008: Gaze Tracking By Binocular Vision and LBP Features

6. 中科院自动化所 NLPR 文珑银博士，李子青老师的关门弟子，和 yang 合作发的 CVPR，VOT2014 有问题的就找文牛吧。
   cvpr2014 年多目标跟踪，基于超图密集子图搜索的单视角多目标跟踪，考虑跨时域检测之间的高阶关系，能够在密集场景中更好的处理多行人跟踪。我 CVPR 2 篇，ECCV 1 篇，TIP 1 篇

PAMI2015：Exploiting Hierarchical Dense Structures on Hypergraphs for Multi-Target Tracking

CVPR2015:JOTS: Joint Online Tracking and Segmentation

WACV2015:Online Visual Tracking Using Temporally Coherent Part Cluster

TIP2014: Robust Deformable and Occluded Object Tracking with Dynamic Graph

TIP2014:Robust Online Learned Spatio-Temporal Context Model for Visual Tracking

CVPR2014:Multiple Target Tracking Based on Undirected Hierarchical Relation Hypergraph

CVPR2014: A Probabilistic Framework for Multitarget Tracking with Mutual Occlusions

ACCV2014: Learning Discriminative Hidden Structural Parts for Visual Tracking

ECCV2012: Online Spatio-Temporal Structural Context Learning for Visual Tracking

7. 南京信息工程大学教授,KaiHua Zhang

FCT,PAMI2014:Fast Compressive Tracking, L. Zhang, and M-H. Yang

Trans. Circuits and Systems for Video Technology2013:Robust Object Tracking via Active Feature Selection, L. Zhang, M-H. Yang

TIP2013:Real-Time Object Tracking via Online Discriminative Feature Selection, L. Zhang, and M-H. Yang

8. Oregonstate Professor,Sinisa Todorovic 由视频分割转向 Tracking

CSL,CVPR2014: Multi-Object Tracking via Constrained Sequential Labeling

CVPR2011:Multiobject Tracking as Maximum Weight Independent Set

9. Graz University of Technology, Austria，Horst Possegger 博士
CVPR2014:Occlusion Geodesics for Online Multi-Object Tracking
CVPR2013: Robust Real-Time Tracking of Multiple Objects by Volumetric Mass Densities
10. 马里兰大学 Zdenek Kalal 博士
TLD,PAMI2011: Tracking-Learning-Detection
TIP2010: Face-TLD: Tracking-Learning-Detection Applied to Faces
ICPR2010:Forward-Backward Error: Automatic Detection of Tracking Failures
CVPR2010: P-N Learning: Bootstrapping Binary Classifiers by Structural Constraints
BMVC2008: Weighted Sampling for Large-Scale Boosting
中文讲解：
TLD 视觉跟踪算法
TLD 源码深度分析
庖丁解牛 TLD
TLD（Tracking-Learning-Detection）学习与源码理解

三、其他早期工作：
Tracking of a Non-Rigid Objectvia Patch-based Dynamic Appearance Modeling and Adaptive Basin Hopping Monte Carlo Sampling

tracking-by-detection

粒子滤波 演示与 opencv 代码

opencv 学习笔记-入门（6）-camshift

Camshift 算法原理及其 Opencv 实现

Camshift 算法

CamShift 算法，OpenCV 实现 1--Back Projection

目标跟踪学习笔记_2(particle filter 初探 1)
目标跟踪学习笔记_3(particle filter 初探 2)
目标跟踪学习笔记_4(particle filter 初探 3)

目标跟踪学习系列一:on-line boosting and vision 阅读