CVPR 2019

Tracking and Detection Challenge

Overview

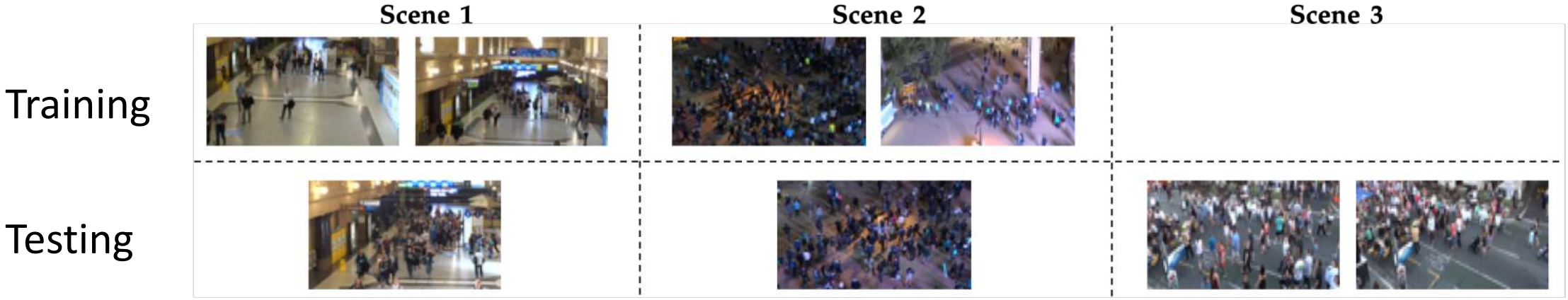
1. Dataset

2. Evaluation
3. Challenge Awards

Dataset

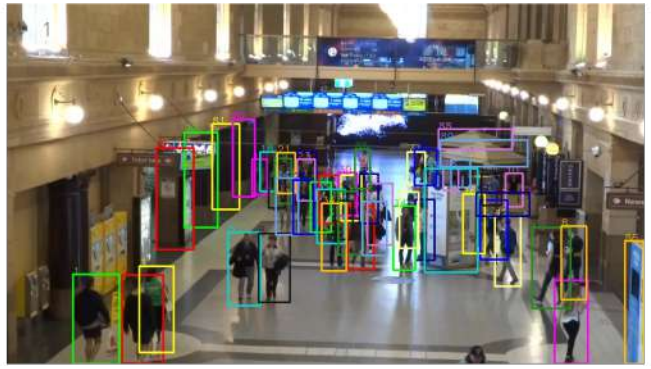
The dataset

- 8 different sequences (4 training + 4 testing) from 3 different scenes
- Scenes are very crowded (up to 246 ped. per frame)
- Scenes are: Indoor and outdoor; Day and night sequences
- Test data contains know and unknown scenes

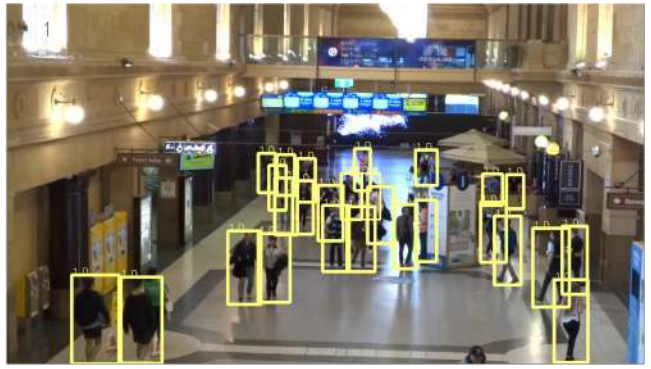


The dataset

Raw videos



Annotated Ground Truth



Public detection

The dataset

1 2 3 4 5 6 7 8

Training sequences								
Name	FPS	Resolution	Length	Tracks	Boxes	Density	Description	Source
CVPR19-01	25	1920x1080	429 (00:17)	90	26,219	61.1	indoor	new
CVPR19-02	25	1920x1080	2,782 (01:51)	295	199,752	71.8	indoor	new
CVPR19-03	25	1920x880	2,405 (01:36)	754	414,734	172.4	outdoor, night	new
CVPR19-05	25	1920x1080	3,315 (02:13)	1251	815,068	245.9	outdoor, night	new
Total training			**8,931 (05:57)**	**2,390**	**1,455,773**	**163.0**		

Testing sequences								
Name	FPS	Resolution	Length	Tracks	Boxes	Density	Description	Source
CVPR19-04	25	1920x1080	2,080 (01:23)	756	425,216	204.4	outdoor, night	new
CVPR19-06	25	1920x734	1,008 (00:40)	340	197,382	195.8	outdoor, day	new
CVPR19-07	25	1920x1080	585 (00:23)	125	40,511	69.2	indoor	new
CVPR19-08	25	1920x734	806 (00:32)	271	140,261	174.0	outdoor, day	new
Total training			**4,479 (02:58)**	**1,492**	**803,370**	**179.4**		

Ground Truth Annotation

Annotation classes						
Sequence	Pedestrian	Non motorized vehicle	Static person	Occluder on the ground	crowd	Total
CVPR19-01	19,870	0	2,574	3,775	0	26,219
CVPR19-02	154,747	4,021	11,128	29,856	0	199,752
CVPR19-03	356,356	5,832	23,415	28,971	160	414,734
CVPR19-04	318,392	3,310	101,434	2,080	0	425,216
CVPR19-05	709,044	8,499	90,895	6,630	0	815,068
CVPR19-06	131,124	1,248	59,324	5,686	0	197,382
CVPR19-07	33,101	800	3,685	2,925	0	40,511
CVPR19-08	77,398	4,237	52,984	5,642	0	140,261
Total	1,800,032	27,947	345,439	85,565	160	2,259,143

Public detection

- Faster R-CNN with ResNet 101 backbone
- 180,000 iterations on training dataset

Training sequences										
Sequence	AP	Rcll	Prcn	FAR	GT	TP	FP	FN	MODA	MODP
CVPR19-01	0.82	85.81	99.57	0.11	13075	11219	49	1856	85.43	91.84
CVPR19-02	0.82	86.56	99.58	0.12	93333	80788	344	12545	86.19	92.31
CVPR19-03	0.64	60.81	98.83	0.94	313684	190749	2265	122935	60.09	86.85
CVPR19-05	0.55	51.87	99.99	0.01	581383	301565	25	279818	51.87	89.14

Testing sequences										
Sequence	AP	Rcll	Prcn	FAR	GT	TP	FP	FN	MODA	MODP
CVPR19-04	0.54	57.44	99.58	0.31	268947	154493	654	114454	57.20	82.45
CVPR19-06	0.51	58.25	73.86	12.83	62725	36539	12931	26186	37.64	72.93
CVPR19-07	0.81	82.87	92.55	1.86	16318	13522	1088	2796	76.20	78.36
CVPR19-08	0.47	54.33	62.59	13.12	32552	17686	10573	14866	21.85	70.98

S. Ren, K. He, R. Girshick, and J. Sun. Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks. *arXiv e-prints*, page arXiv:1506.01497, Jun 2015.
K. He, X. Zhang, S. Ren, and J. Sun. Deep Residual Learning for Image Recognition. *arXiv e-prints*, page arXiv:1512.03385, Dec 2015.

Public detection

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Evaluation Protocol

Evaluation rules procedure for the challenge

- Only pedestrians are considered for the evaluation
- Static persons and persons on vehicles are filtered out and ignored
- Persons which are visible <25% are excluded for detection challenge
- Threshold for IoU = 0.5 for detection ground truth matching

- Main criterium for tracking: MOTA score[1]
- Main criterium for detection: Average Precision (AP)
- Tracking challenge: Only public detections are allowed

[1] Bernardin, K. & Stiefelhagen, R. Evaluating Multiple Object Tracking Performance: The CLEAR MOT Metrics. Image and Video Processing, 2008(1):1-10, 2008.

Challenge Awards

Tracking Challenge

Tracking Challenge

Top 10 out of 36 Submissions

Submission have to be revised. Final decisions will be published soon

Measure	Better	Perfect	Description
MOTA	higher	100 %	Multiple Object Tracking Accuracy [1]. This measure combines three error sources: false positives, missed targets and identity switches.
IDF1	higher	100 %	ID F1 Score [2]. The ratio of correctly identified detections over the average number of ground-truth and computed detections.

[1] Bernardin, K. & Stiefelhagen, R. Evaluating Multiple Object Tracking Performance: The CLEAR MOT Metrics. Image and Video Processing, 2008(1):1-10, 2008.
[2] Ristani, E., Solera, F., Zou, R., Cucchiara, R. & Tomasi, C. Performance Measures and a Data Set for Multi-Target, Multi-Camera Tracking. In ECCV workshop on Benchmarking Multi-Target Tracking, 2016.

Detection Challenge

Detection Challenge

	Detector	AP	First Name	Surname	Affiliation
1	**SRK_ODESA**	0.81107	Viktor	Porokhonskyy	Samsung Ukraine Research & Development Center
2	**CVPR19_det**	0.80484	Xiangbo	Su	Baidu Netcom Science and Technology Co., Ltd
3	**Aaron**	0.7906	Yifan	Chen	HuaZhong University
4	**PSdetect19**	0.74534	Gianni	Franchi	Paris-Sud University
5	**ViPeD_19**	0.73459	Luca	Ciampi	University of Pisa
6	**fpntest19**	0.63311	Feng	Ni	Peking University
7	**FRCN101**	0.53835	Tauka	Kirishima	SenseTime Inc.
8	**mot_rcnn**	0.48635	shoudong	han	Huazhong University of Science & Technology
9	**SSDT**	0.088341	ShiJie	Sun	Chang'an University
10	**Cascade_CH**	0.0274	Huixiang	Luo	Fudan University

What's next?

- Publication of CVPR Challenge

  CVPR19 Tracking and Detection Challenge: How crowded can it get?
  Patrick Dendorfer, Hamid Rezatofighi, Anton Milan, Javen Shi, Daniel Cremers, Ian Reid, Stefan Roth, Konrad Schindler, Laura Leal-Taixe arXiv:1906.04567

- Give us feedback about the challenge
- Join the discussion to improve our benchmark for multi-object tracking (end of the workshop)
- Leader board and presentation will be put online
- Stay tuned for more challenges to come! https://motchallenge.net
- Subscribe to our Newsletter