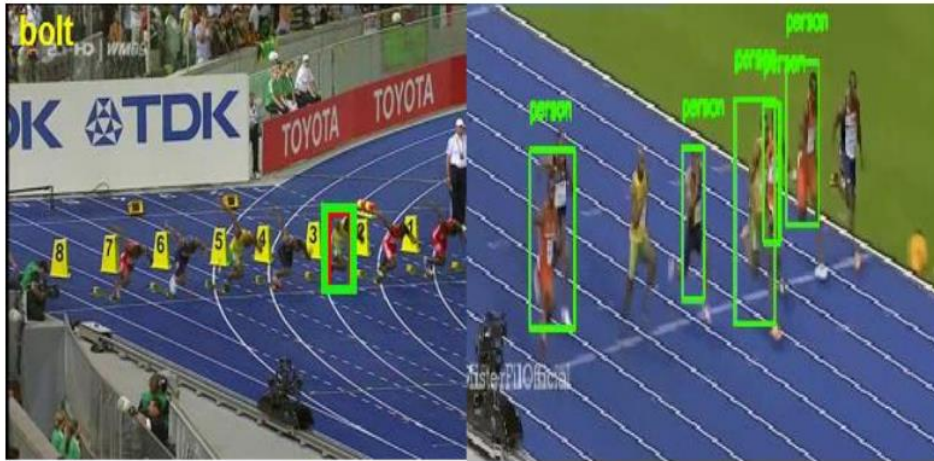# Multi-Object Tracking

Han Wu

We plan to focus on attacking **3D Multi-Object Tracking** (MOT) models for **Vision-Based** vehicle tracking in real time, without using 3D Lidar Data.

❖ Single Object Tracking vs **Multi-Object Tracking**

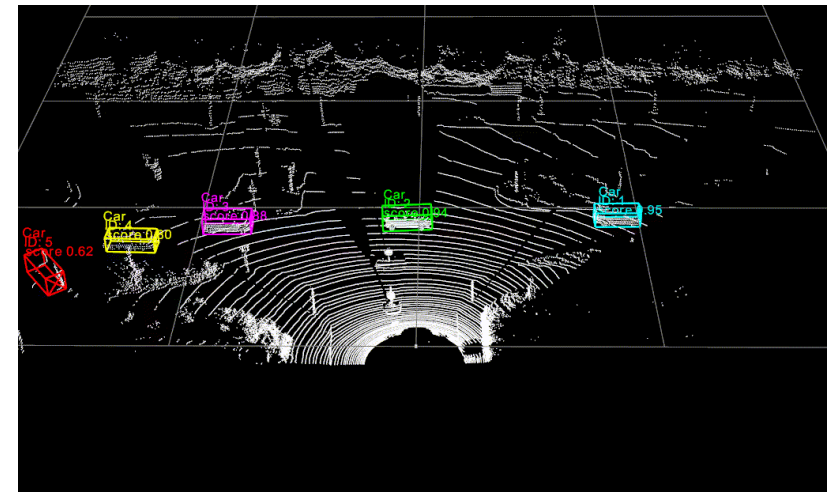Single Object Tracking (SOT) and Multi-Object Tracking (MOT) [1]

❖ Adversarial Attacks

- 2D SOT   (SiamRPN++) x n
- 2D MOT   (FairMOT E2E) x 1

- 3D Lidar   (Point Cloud) x n
- 3D MOT (vision-only)   x 0

❖ 2D Tracking vs **3D Tracking**

Monocular Tracker: vision-only [2]

Multi-Modality Tracker: 3D Lidar

[1] Soleimanitaleb, Zahra, and Mohammad Ali Keyvanrad. "Single Object Tracking: A Survey of Methods, Datasets, and Evaluation Metrics." *arXiv preprint arXiv:2201.13066* (2022).
[2] Wu, Jialian, et al. "Track to detect and segment: An online multi-object tracker." *Proceedings of the IEEE/CVF conference on computer vision and pattern recognition.* 2021.

Traditional Methods (Low-level Features and Statistical Learning)

- The Joint Data Association Filter

- Multi Hypothesis Tracking

- Random Finite Sets

Deep Learning

- Tracking by Detection (TBD): Modular Framework

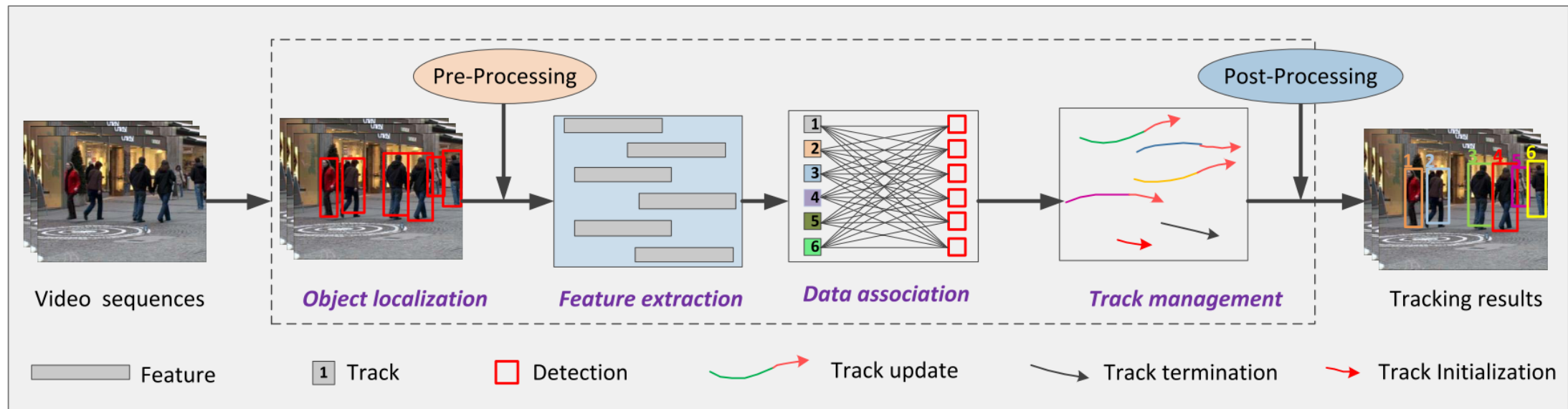- Joint Detection and Tracking (JDT): End-to-End

- Transformer-based Models

Fig. 3. The main procedures of TBD framework, which consists of four core components and two processing techniques. The four core components contain pedestrian localisation, feature extraction, data association and track management. Processing techniques contain pre-processing and post-processing techniques.

❖ Dataset

- KITTI
- MOT Challenge
- nuScenes

❖ Evaluation Metrics

Year and Author	Tracker	MOTA(↑)	MOTP(↑)	IDF1(↑)	MT(↑)	ML(↓)	FP(↓)	FN(↓)	IDS (↓)	Frag(↓)	Hz(↑)
2019 Feng et al.	SAC [50]	**54.7**	75.9	**62.3**	20.4	40.1	26091	**228434**	**1243**	3726	1.5
2019 Bergmann et al.	TWBW [100]	53.5	**78.0**	52.3	19.5	36.6	**12201**	248047	2072	4611	1.5
2019 Henschel et al.	BJD [28]	52.6	77.1	50.8	19.7	35.8	31572	232659	3050	3792	5.4
2019 Chu et al.	FAMA [49]	52.0	76.5	48.7	19.1	**33.4**	14138	253616	3072	5318	0.0
2019 Wang et al.	ETC [105]	51.9	76.3	58.1	23.1	35.5	36164	232783	2288	3071	0.7
2019 Sheng et al.	HAGF [135]	51.8	77.0	54.7	**23.4**	37.9	33212	236772	1834	2739	0.7
2018 Shen et al.	AFN [32]	51.5	77.6	46.9	20.6	35.5	22391	248420	2593	4308	1.8
2018 Henschel et al.	FHFB [136]	51.3	77	47.6	21.4	5.2	24101	247921	2648	4279	0.2
2019 Chen et al.	ATA [130]	51.3	76.7	54.5	17.1	35.4	20148	252531	2285	5798	17.8
2018 Keuper et al.	MSA [83]	51.2	75.9	54.5	20.9	37.0	25937	247822	1802	2984	1.8
2019 Xu et al.	STRN [103]	50.9	75.6	56.0	18.9	33.8	25295	249365	2397	9363	13.8
2018 Long et al.	MOTDT [56]	50.9	76.6	52.7	17.5	35.7	24069	250768	2474	5317	**18.3**
2018 Sheng et al.	IMHT [113]	50.6	77.6	56.5	17.6	43.4	22213	255030	1407	**2079**	2.6
2019 Yoon et al.	DTAMA [8]	50.3	76.7	53.5	19.2	37.5	25479	25296	2192	3978	1.5
2017 Chen et al.	EDM [137]	50.0	77.3	51.3	21.6	36.3	32279	247297	2264	3260	0.6