

# Are We Ready for Vision-Centric Driving Streaming Perception? The ASAP Benchmark

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<sup>2</sup>UCAS



<sup>3</sup>PhiGent

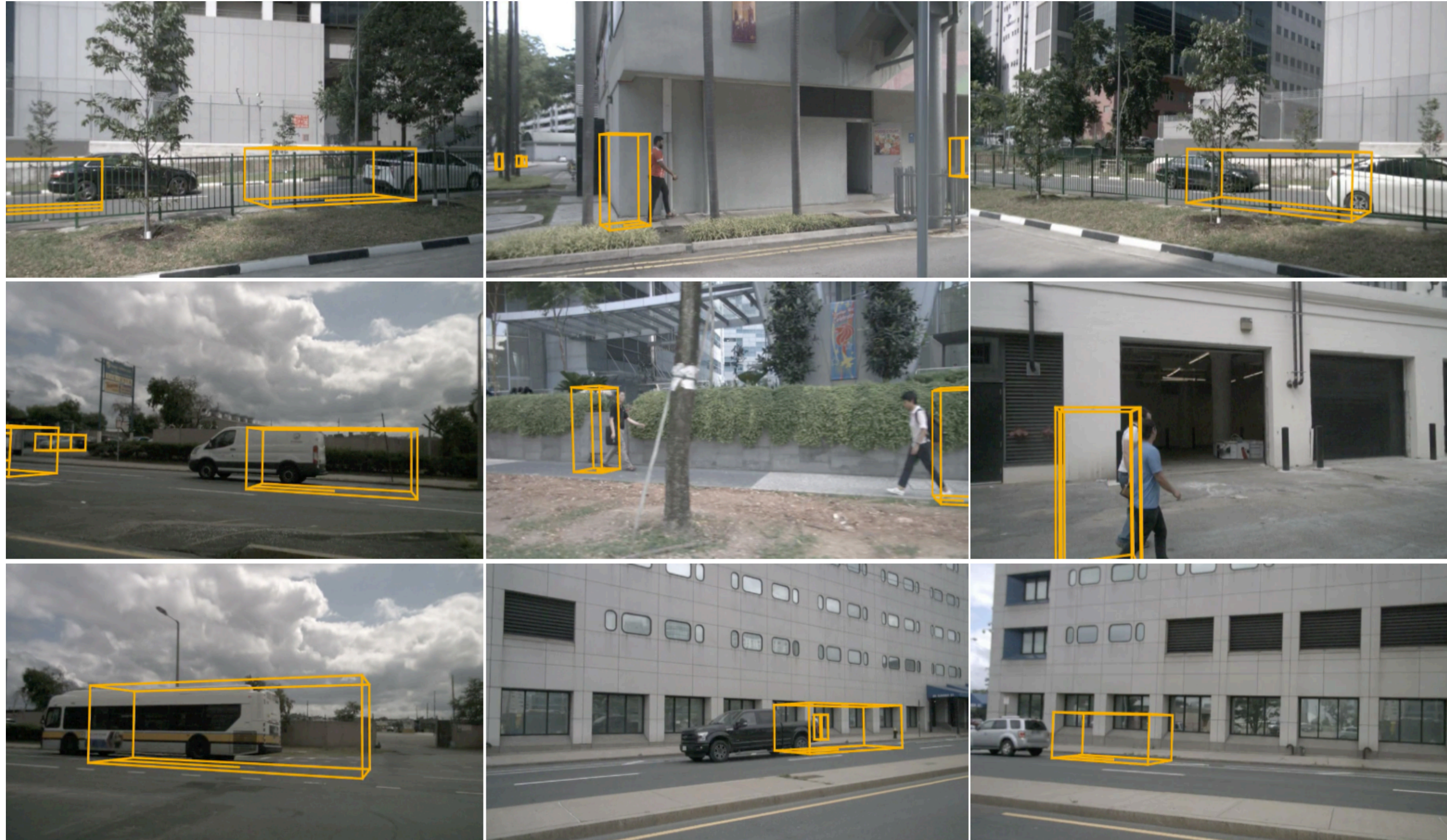


<sup>4</sup>SEU



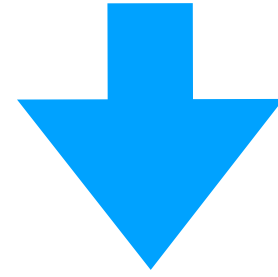


# Prediction delay due to inference latency



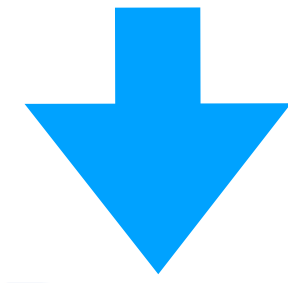


# Streaming Evaluation





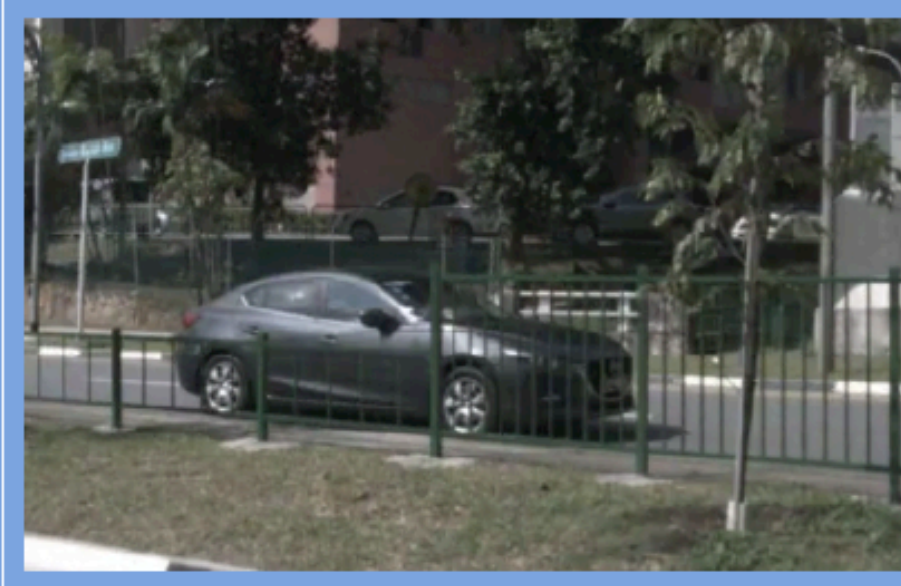
# Streaming Evaluation



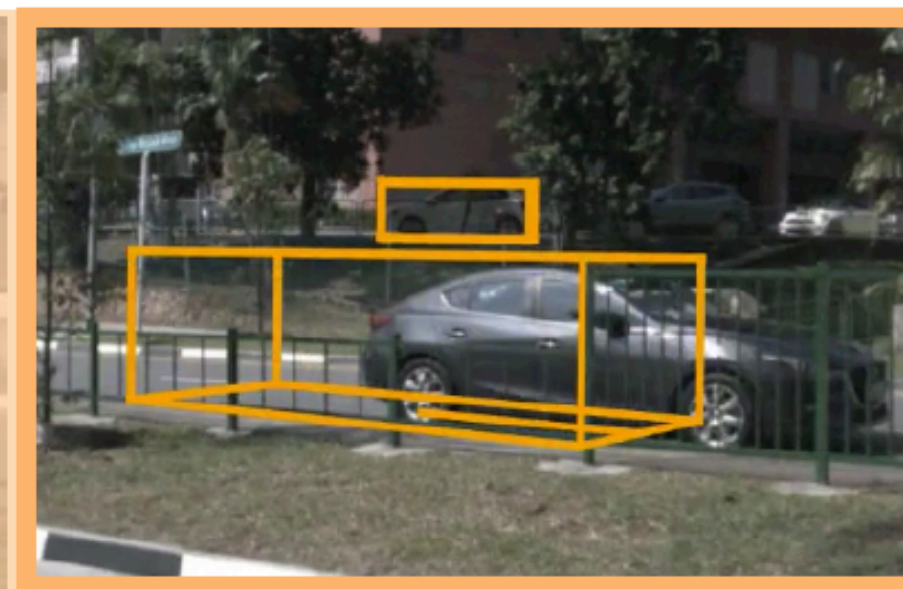
Frame A

Frame B

Frame C



Input  
time

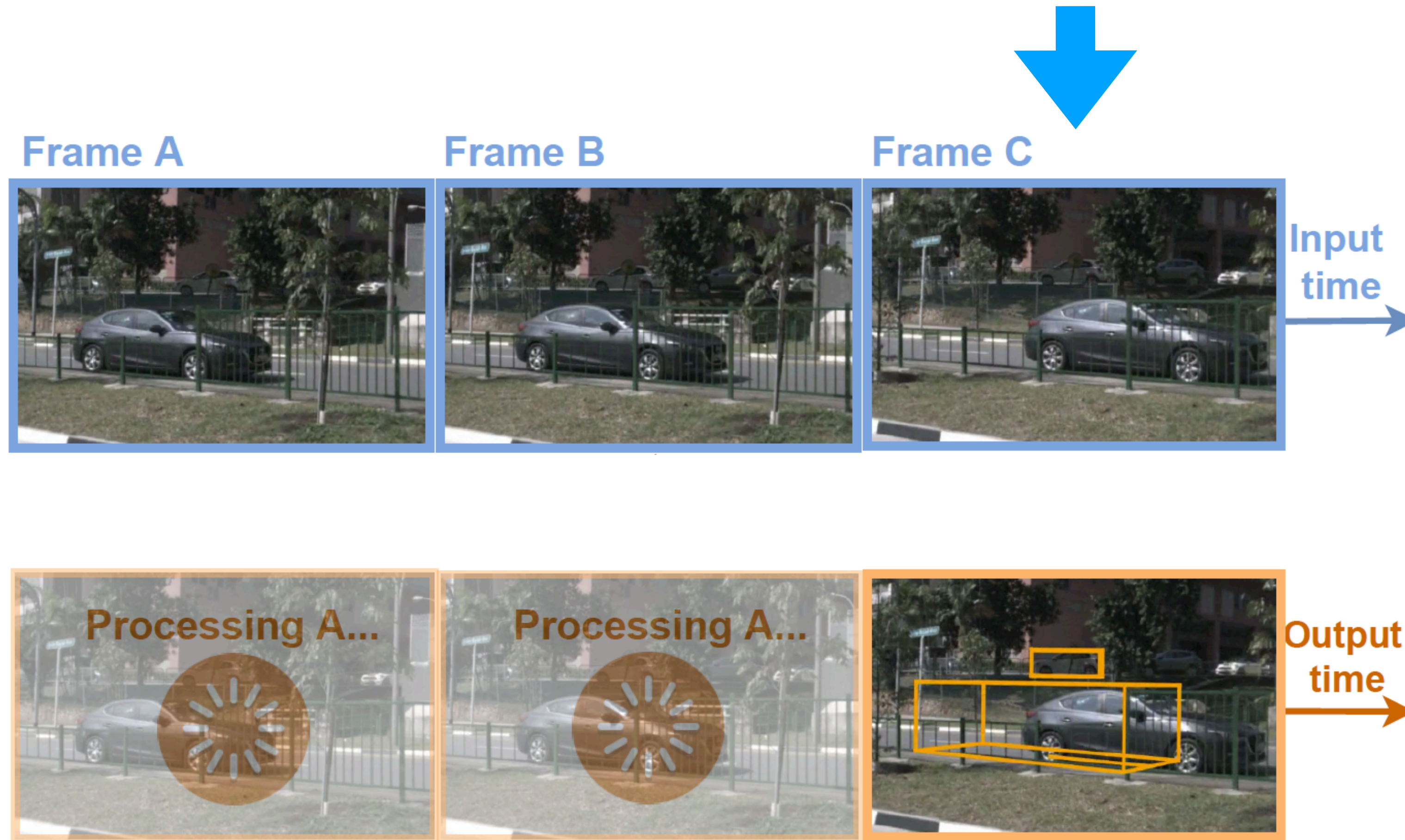


Output  
time



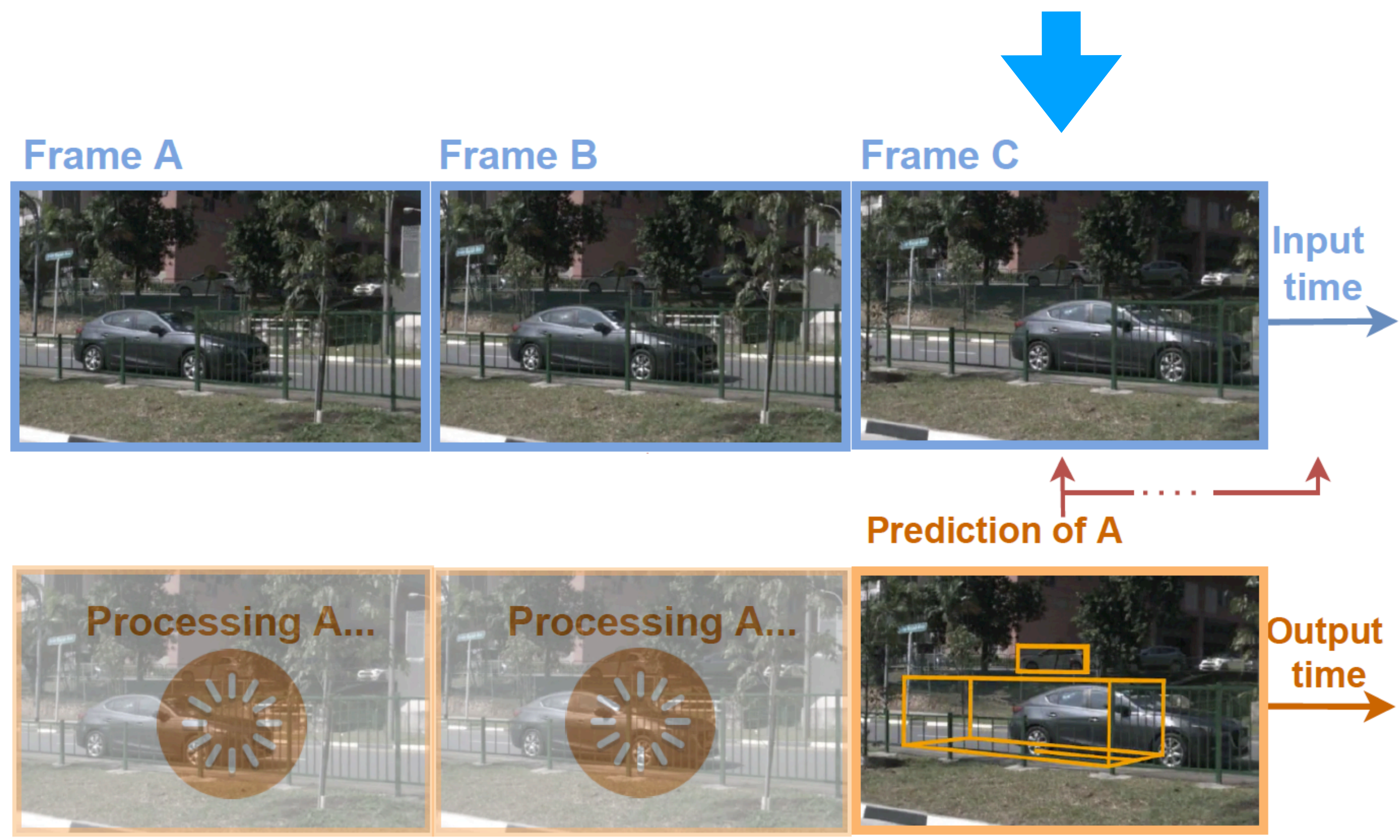


# Streaming Evaluation

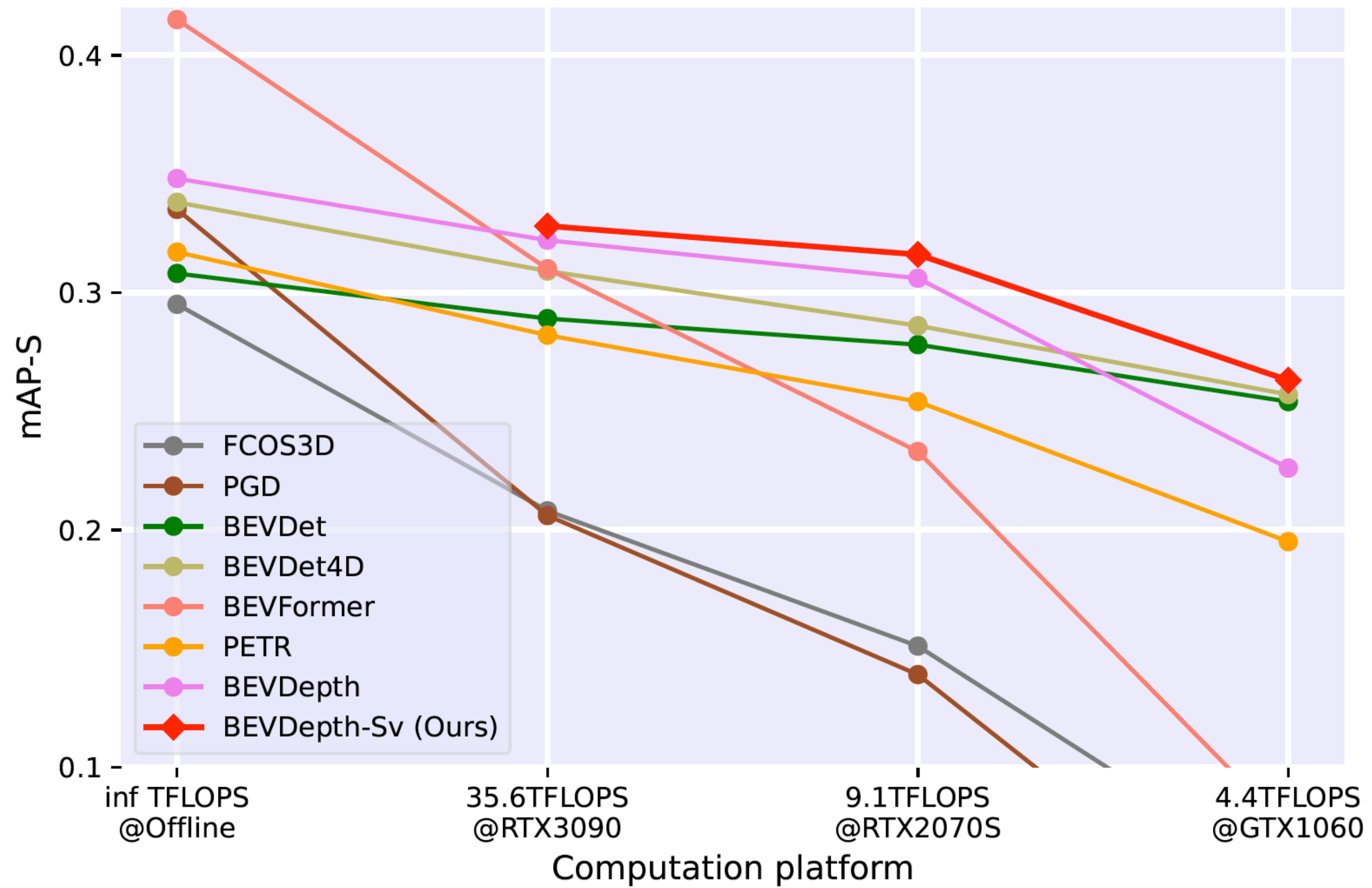




# Streaming Evaluation

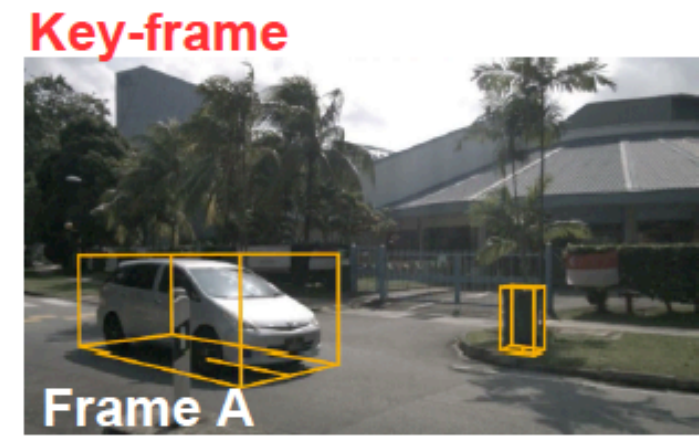


# ASAP benchmark results summary





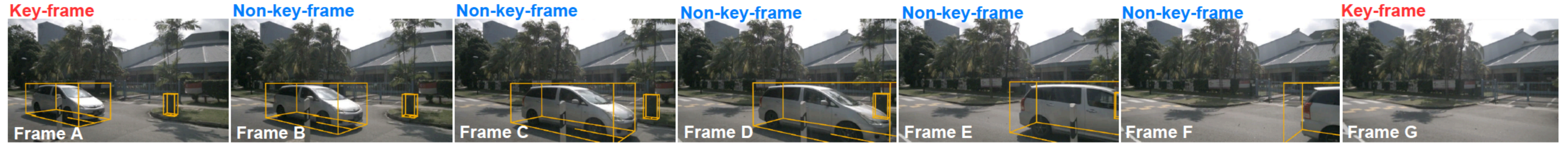
# nuScenes-H: extending annotation for nuScenes



2Hz annotations in nuScenes



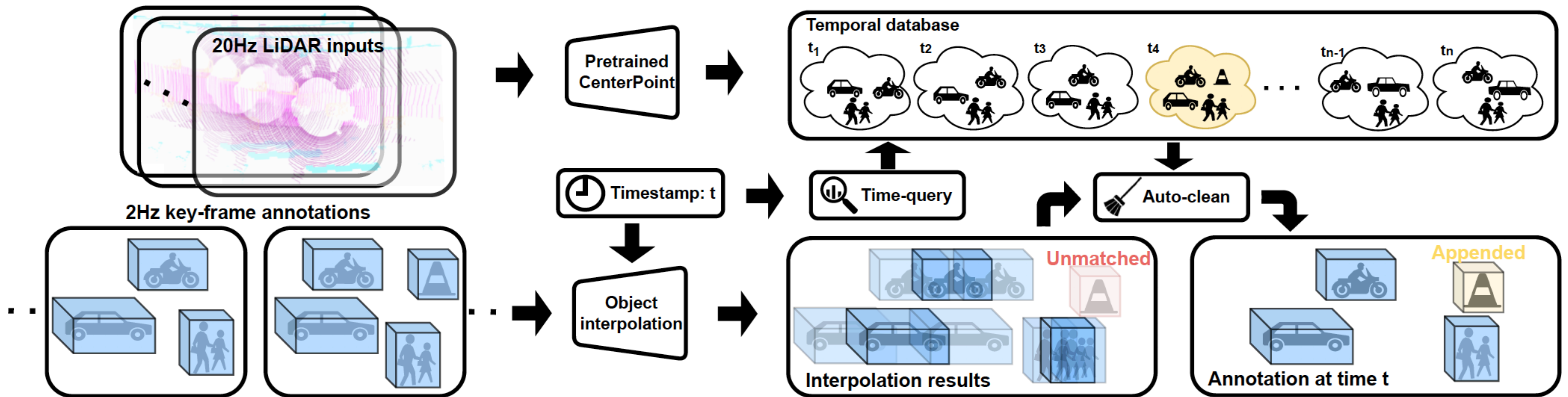
# nuScenes-H: extending annotation for nuScenes



12Hz annotations in nuScenes

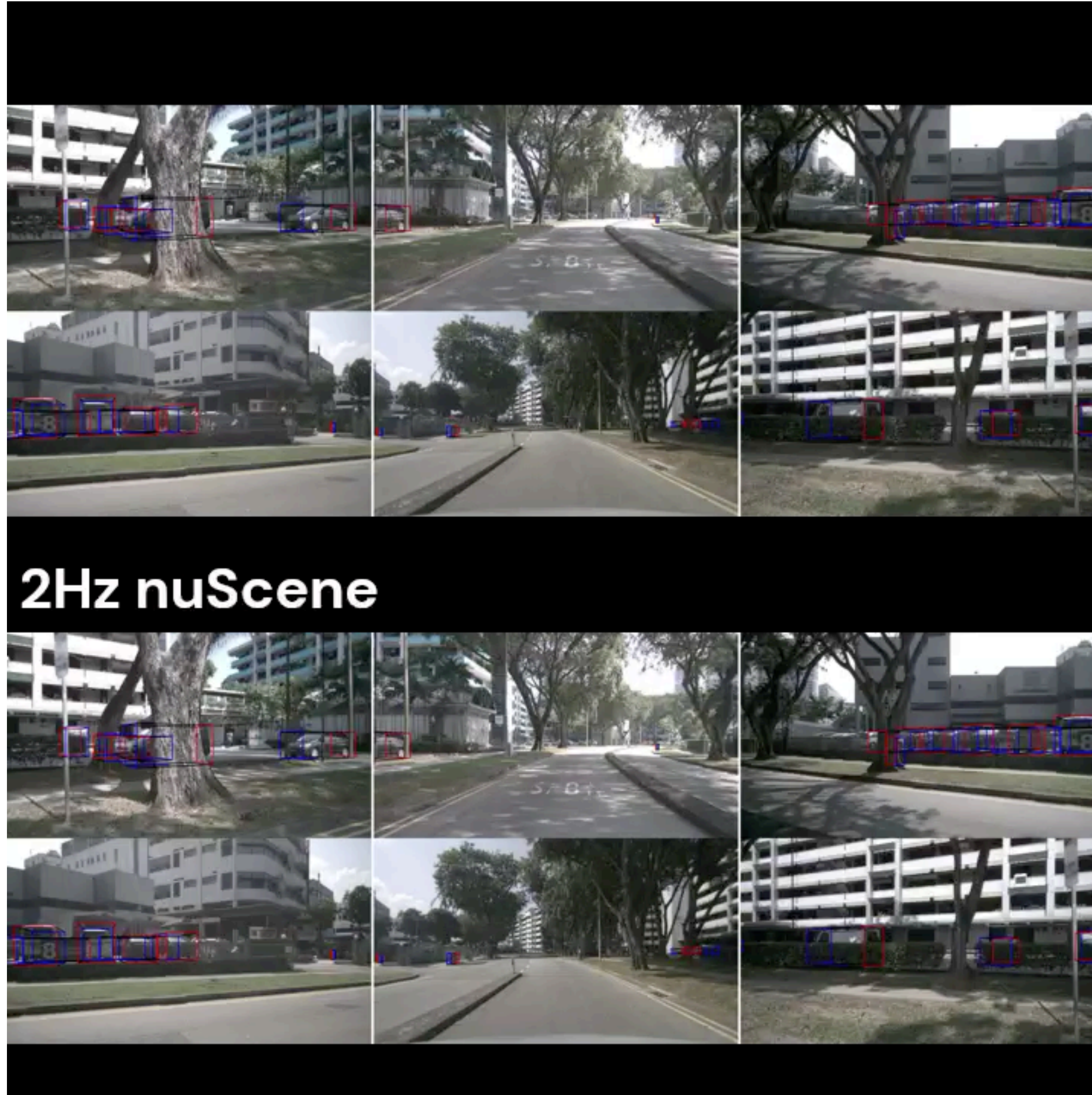


# nuScenes-H: extending annotation for nuScenes



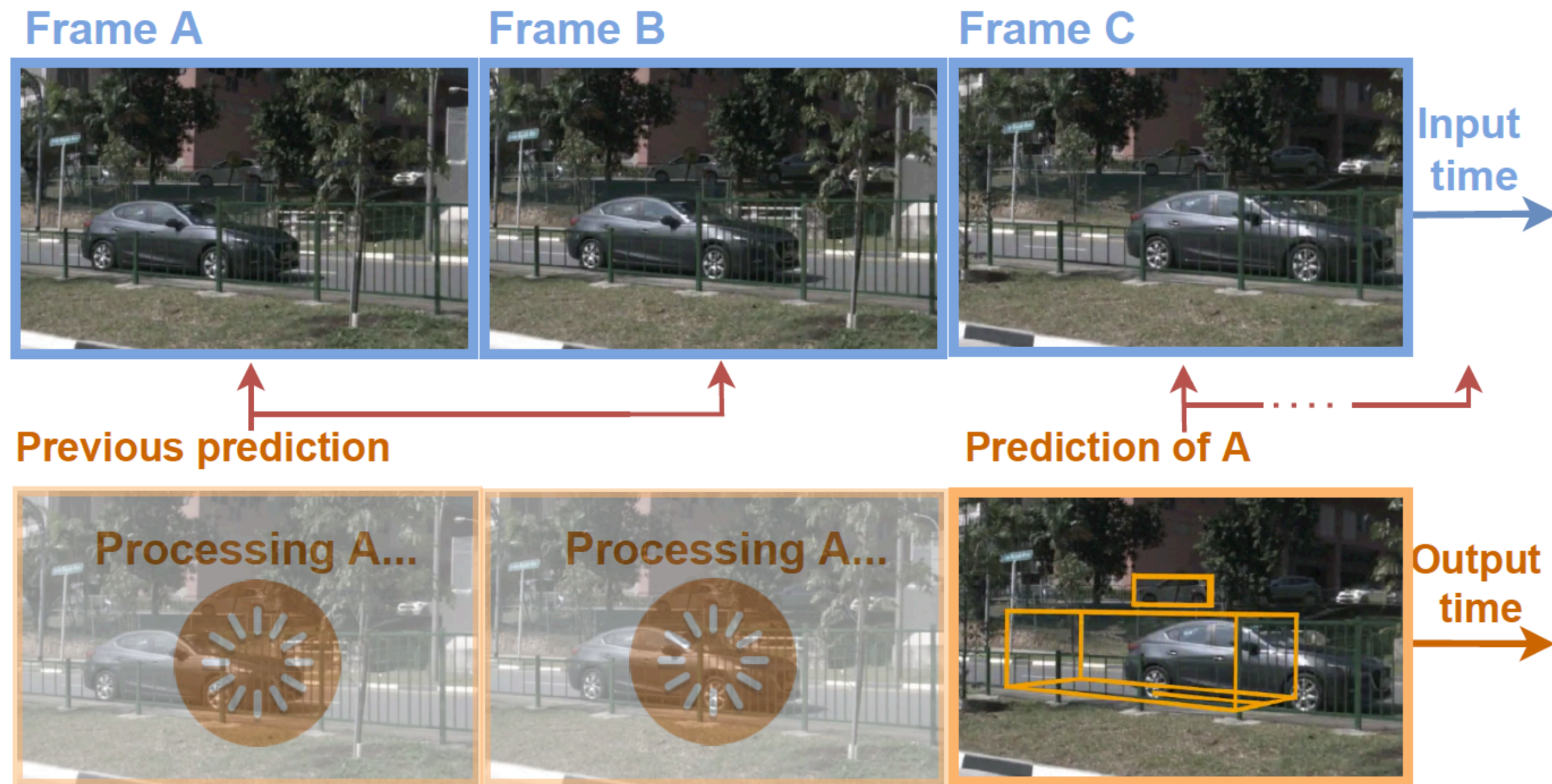


# nuScenes-H: extending annotation for nuScenes





# ASAP Evaluation Protocol

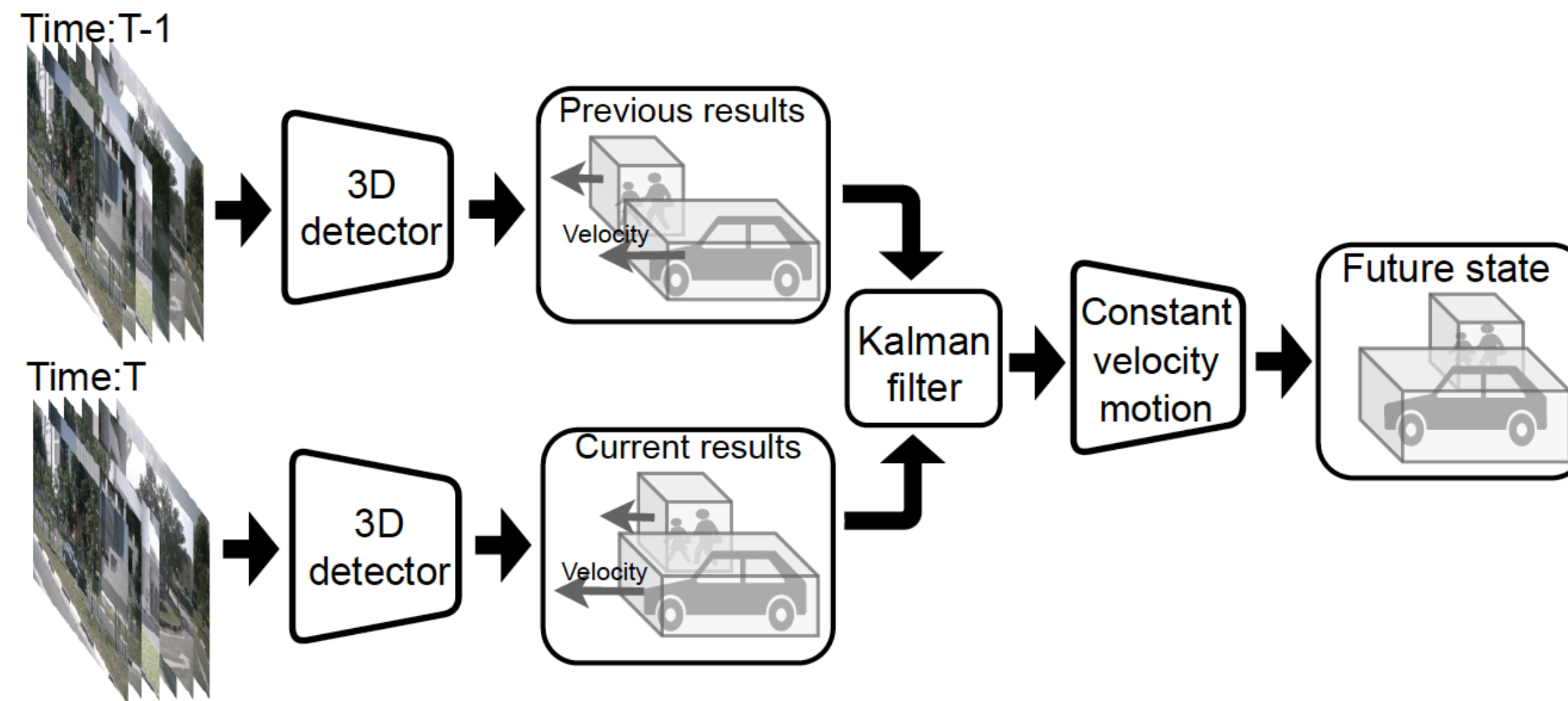


- 1) Evaluate on varying GPUs;
- 2) Evaluate when the GPU is processing other perception tasks;

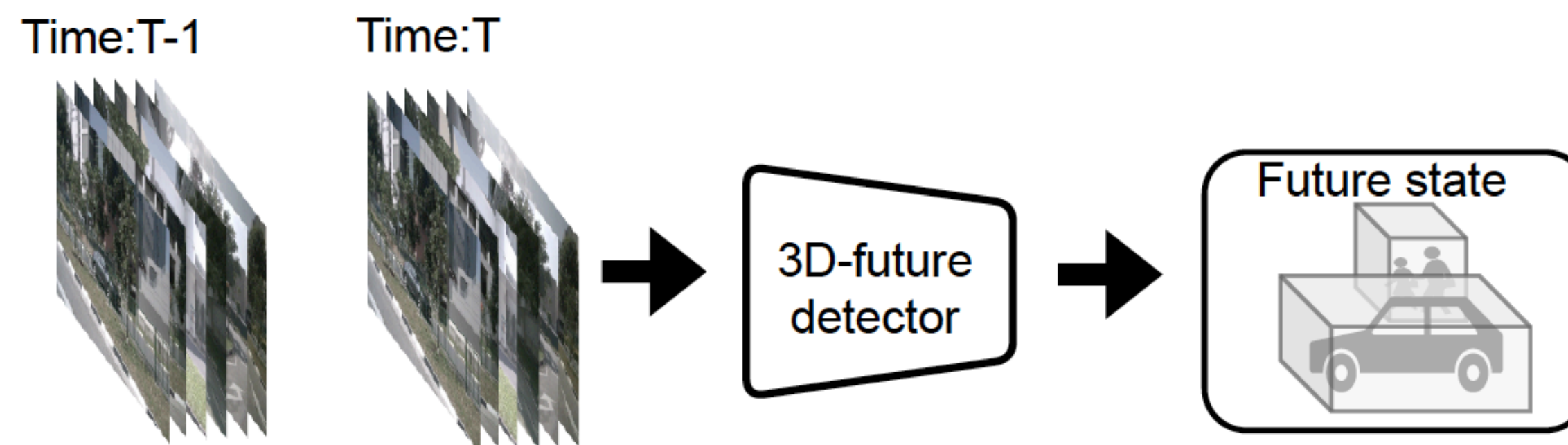


# ASAP Baseline

## 1) Velocity-based updating baseline



## 2) Learning-based forecasting baseline



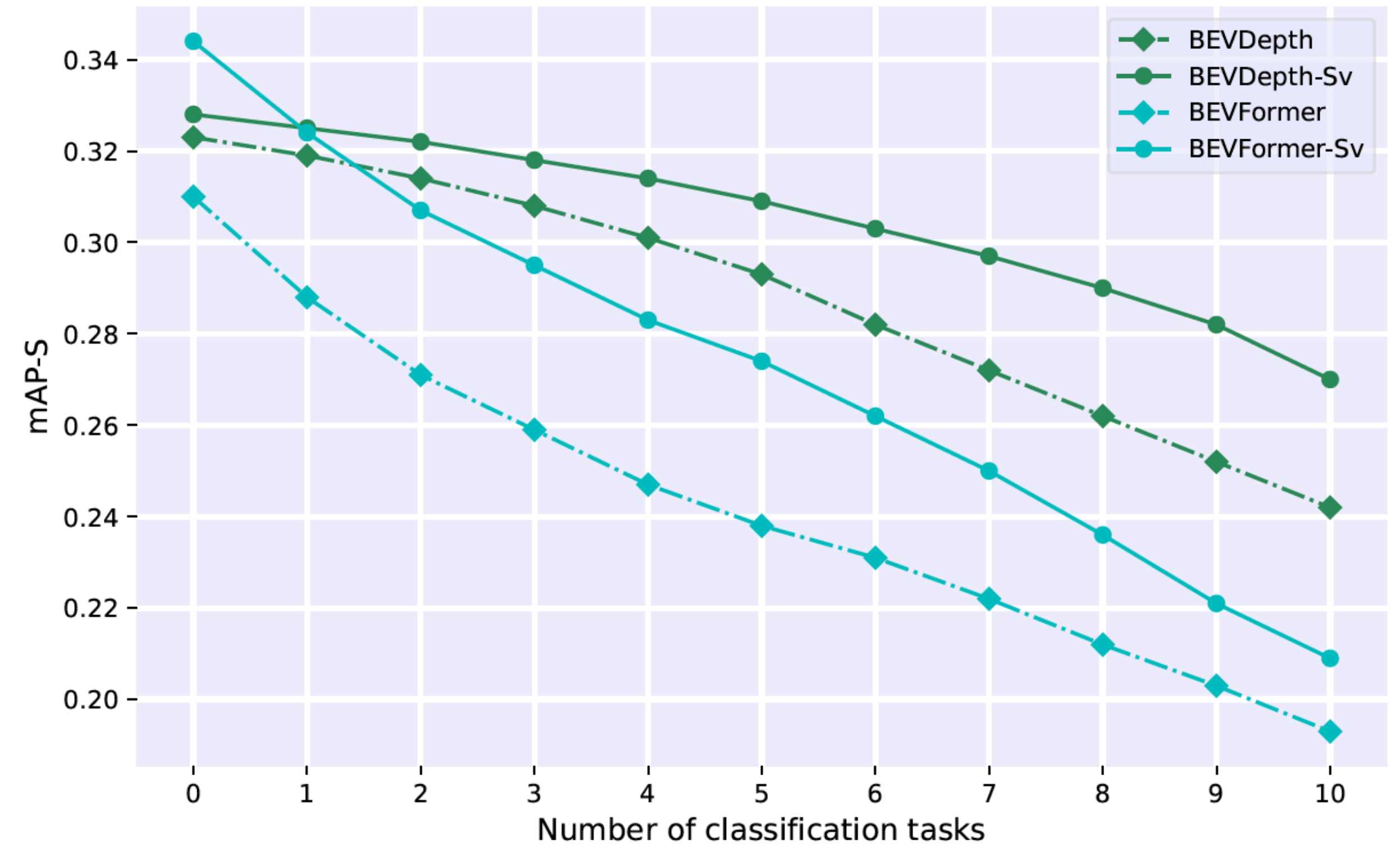
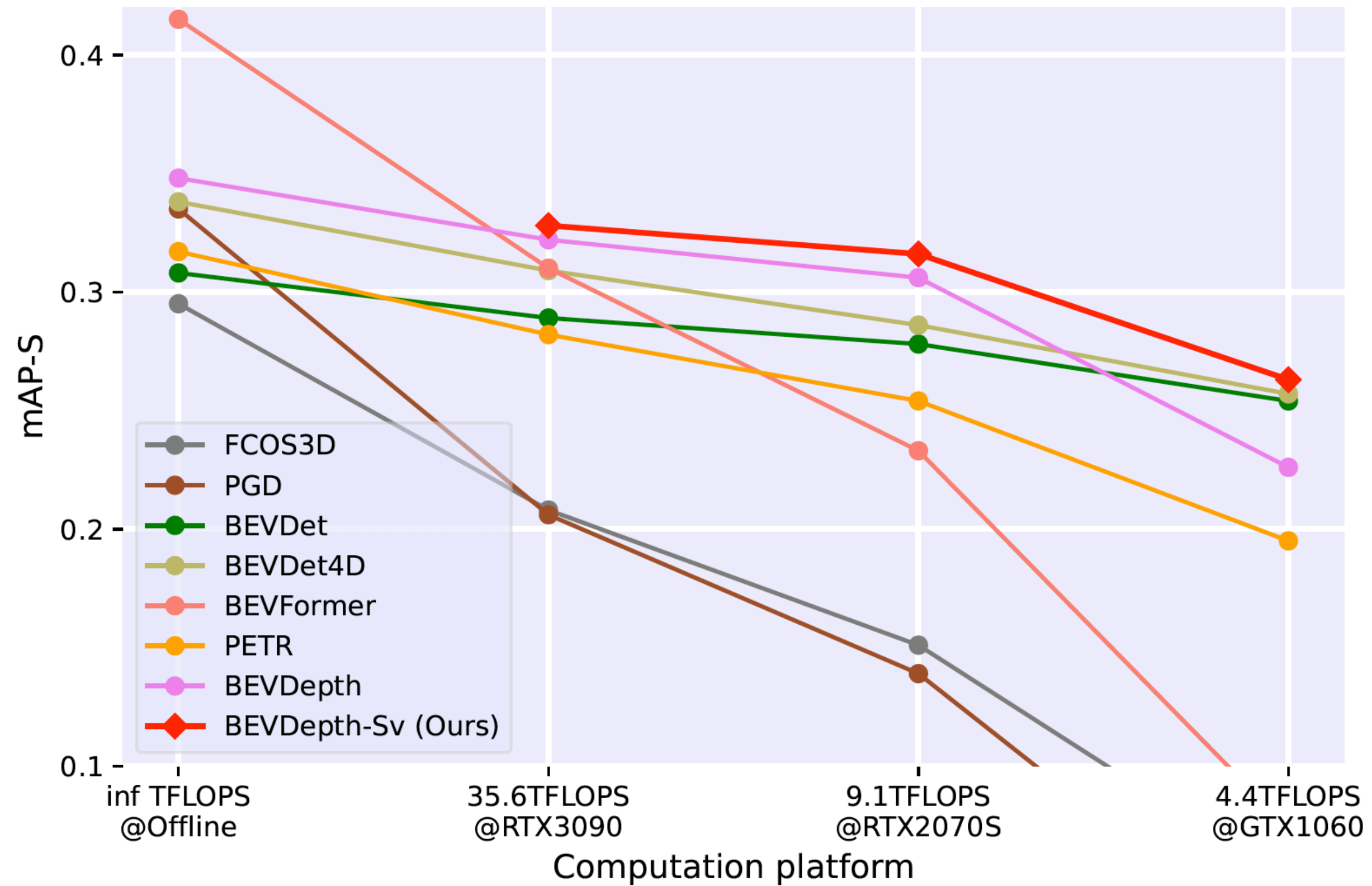


# ASAP Benchmark Experiments

Methods	GPU	FPS	#params.	GFLOPs	Streaming	mAP(-S)↑	NDS(-S)↑	ATE(-S)↓	ASE(-S)↓	AOE(-S)↓	AVE↓	AAE(-S)↓
FCOS3D	-	-	52.5M	2008.2	✗	0.295	0.372	0.806	0.268	0.511	1.315	0.170
FCOS3D	RTX3090	1.7	52.5M	2008.2	✓	0.208	0.326	0.828	0.269	0.512	1.315	0.175
FCOS3D	RTX2070s	0.8	52.5M	2008.2	✓	0.151	0.294	0.836	0.270	0.522	1.315	0.187
FCOS3D	GTX1060	0.3	52.5M	2008.2	✓	0.051	0.234	0.858	0.271	0.585	1.315	0.200
PGD	-	-	51.3M	2223.0	✗	0.335	0.409	0.732	0.263	0.423	1.285	0.172
PGD	RTX3090	1.6	51.3M	2223.0	✓	0.206	0.327	0.817	0.273	0.488	1.285	0.185
PGD	RTX2070s	0.7	51.3M	2223.0	✓	0.139	0.289	0.818	0.276	0.512	1.285	0.195
PGD	GTX1060	0.2	51.3M	2223.0	✓	0.016	0.199	0.909	0.342	0.536	1.285	0.300
BEVDet	-	-	52.6M	215.3	✗	0.308	0.411	0.729	0.265	0.445	1.051	0.175
BEVDet	RTX3090	12.6	52.6M	215.3	✓	0.289	0.370	0.730	0.273	0.533	1.051	0.209
BEVDet	RTX2070s	8.5	52.6M	215.3	✓	0.284	0.367	0.734	0.273	0.536	1.051	0.209
BEVDet	GTX1060	3.3	52.6M	215.3	✓	0.254	0.348	0.751	0.275	0.547	1.051	0.218
BEVDet4D	-	-	53.6M	222.0	✗	0.338	0.476	0.672	0.274	0.460	0.337	0.185
BEVDet4D	RTX3090	11.9	53.6M	222.0	✓	0.309	0.450	0.755	0.275	0.480	0.337	0.200
BEVDet4D	RTX2070s	6.9	53.6M	222.0	✓	0.286	0.438	0.757	0.275	0.481	0.337	0.201
BEVDet4D	GTX1060	3.2	53.6M	222.0	✓	0.257	0.419	0.775	0.276	0.492	0.337	0.211
BEVFormer	-	-	68.7M	1322.2	✗	0.415	0.517	0.672	0.274	0.369	0.397	0.198
BEVFormer	RTX3090	2.4	68.7M	1322.2	✓	0.310	0.452	0.760	0.276	0.385	0.397	0.216
BEVFormer	RTX2070s	1.1	68.7M	1322.2	✓	0.233	0.408	0.774	0.278	0.410	0.397	0.228
BEVFormer	GTX1060	0.3	68.7M	1322.2	✓	0.074	0.311	0.819	0.280	0.516	0.397	0.246
PETR	-	-	36.7M	297.2	✗	0.317	0.367	0.839	0.280	0.614	0.936	0.232
PETR	RTX3090	6.7	36.7M	297.2	✓	0.282	0.341	0.883	0.288	0.639	0.936	0.249
PETR	RTX2070s	3.2	36.7M	297.2	✓	0.254	0.323	0.897	0.289	0.658	0.936	0.258
PETR	GTX1060	1.3	36.7M	297.2	✓	0.195	0.291	0.918	0.291	0.659	0.936	0.266
BEVDepth	-	-	76.6M	662.6	✗	0.348	0.481	0.616	0.272	0.415	0.440	0.196
BEVDepth	RTX3090	8.6	76.6M	662.6	✓	0.323	0.464	0.654	0.272	0.414	0.440	0.198
BEVDepth	RTX2070s	4.4	76.6M	662.6	✓	0.306	0.453	0.664	0.273	0.420	0.440	0.205
BEVDepth	GTX1060	1.4	76.6M	662.6	✓	0.226	0.404	0.686	0.275	0.449	0.440	0.235
BEVDepth-Sv	RTX3090	8.6	76.6M	662.6	✓	0.328	0.466	0.654	0.272	0.416	0.440	0.198
BEVDepth-Sv	RTX2070s	4.4	76.6M	662.6	✓	0.316	0.459	0.662	0.272	0.419	0.440	0.198
BEVDepth-Sv	GTX1060	1.4	76.6M	662.6	✓	0.263	0.428	0.683	0.273	0.436	0.440	0.199
BEVDepth-Sf	RTX3090	8.6	76.6M	662.6	✓	0.329	0.467	0.653	0.272	0.415	0.440	0.197
BEVDepth-Sf	RTX2070s	4.4	76.6M	662.6	✓	0.313	0.457	0.663	0.272	0.420	0.440	0.198
BEVDepth-Sf	GTX1060	1.4	76.6M	662.6	✓	0.235	0.413	0.685	0.274	0.442	0.440	0.205



# ASAP Benchmark Experiments





# Thanks!

Project page: <https://github.com/JeffWang987/ASAP>

