

Real-Time Scene-Adaptive Tone Mapping for High-Dynamic Range Object Detection

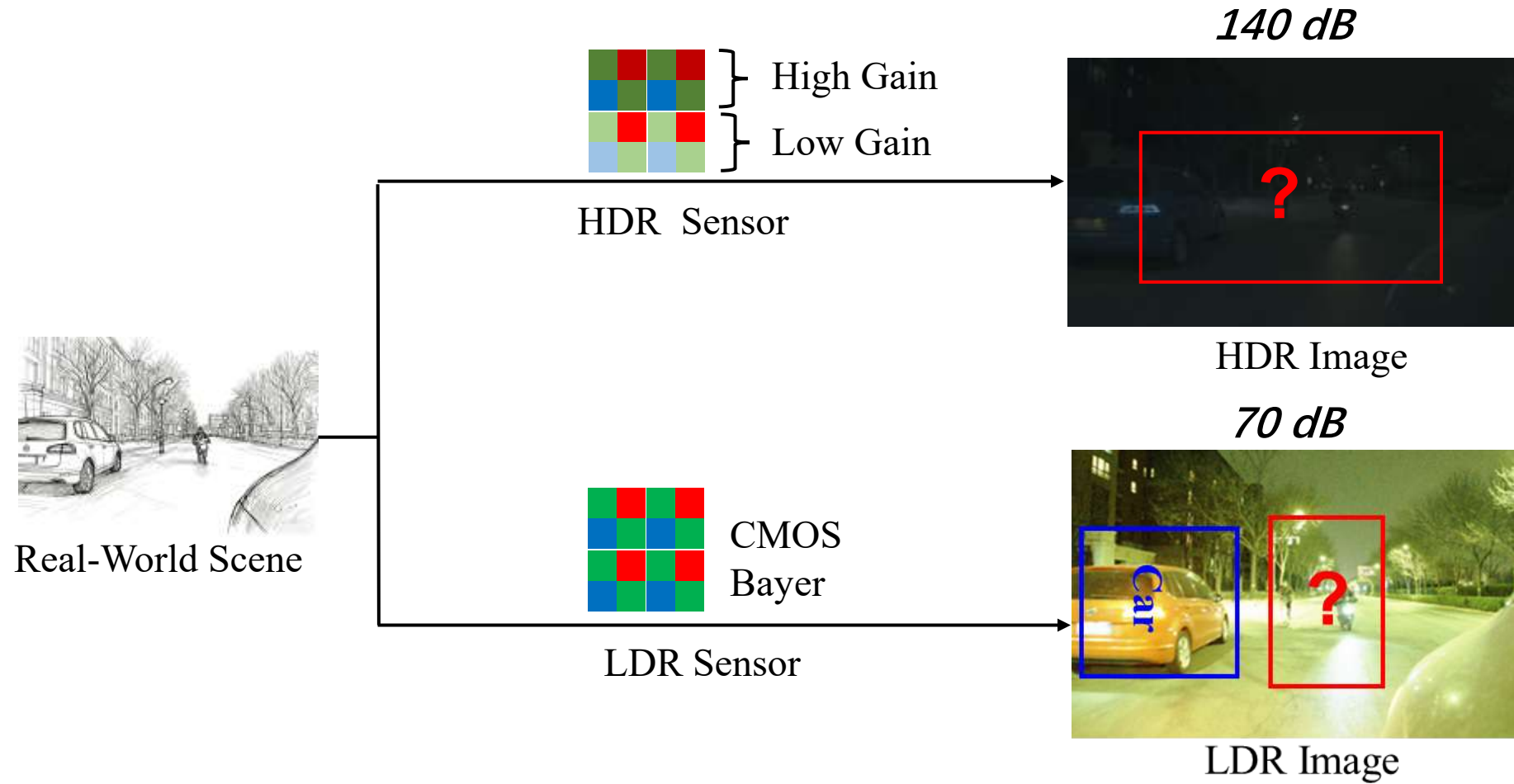
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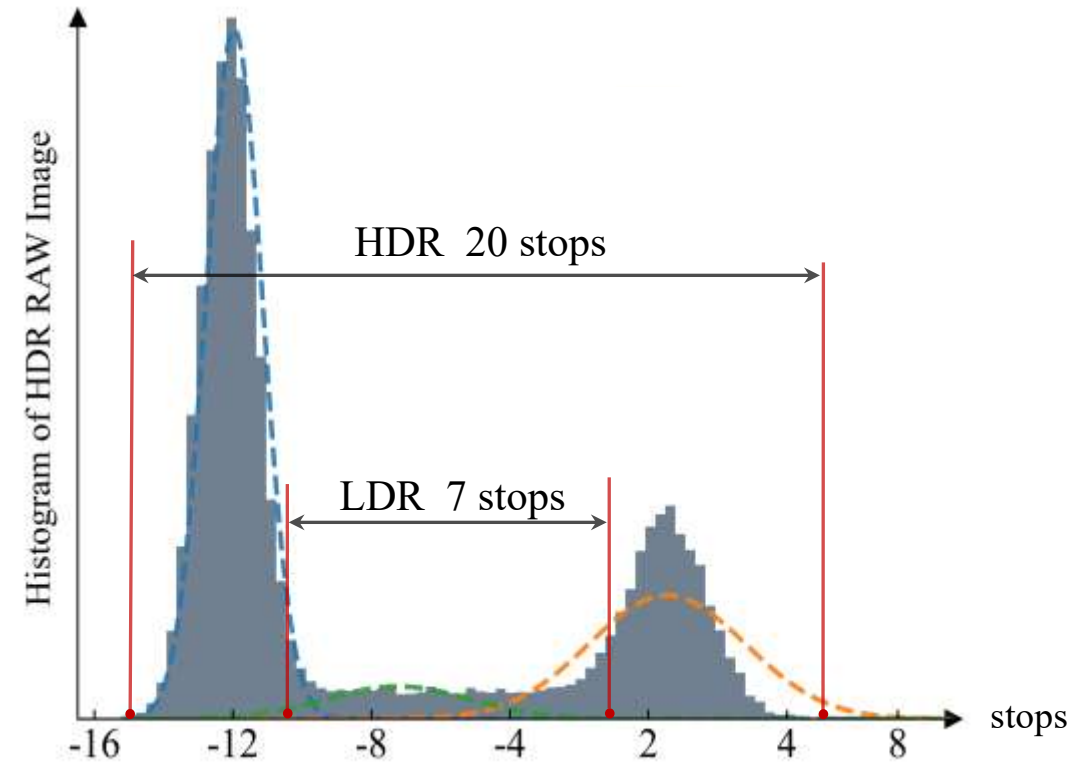
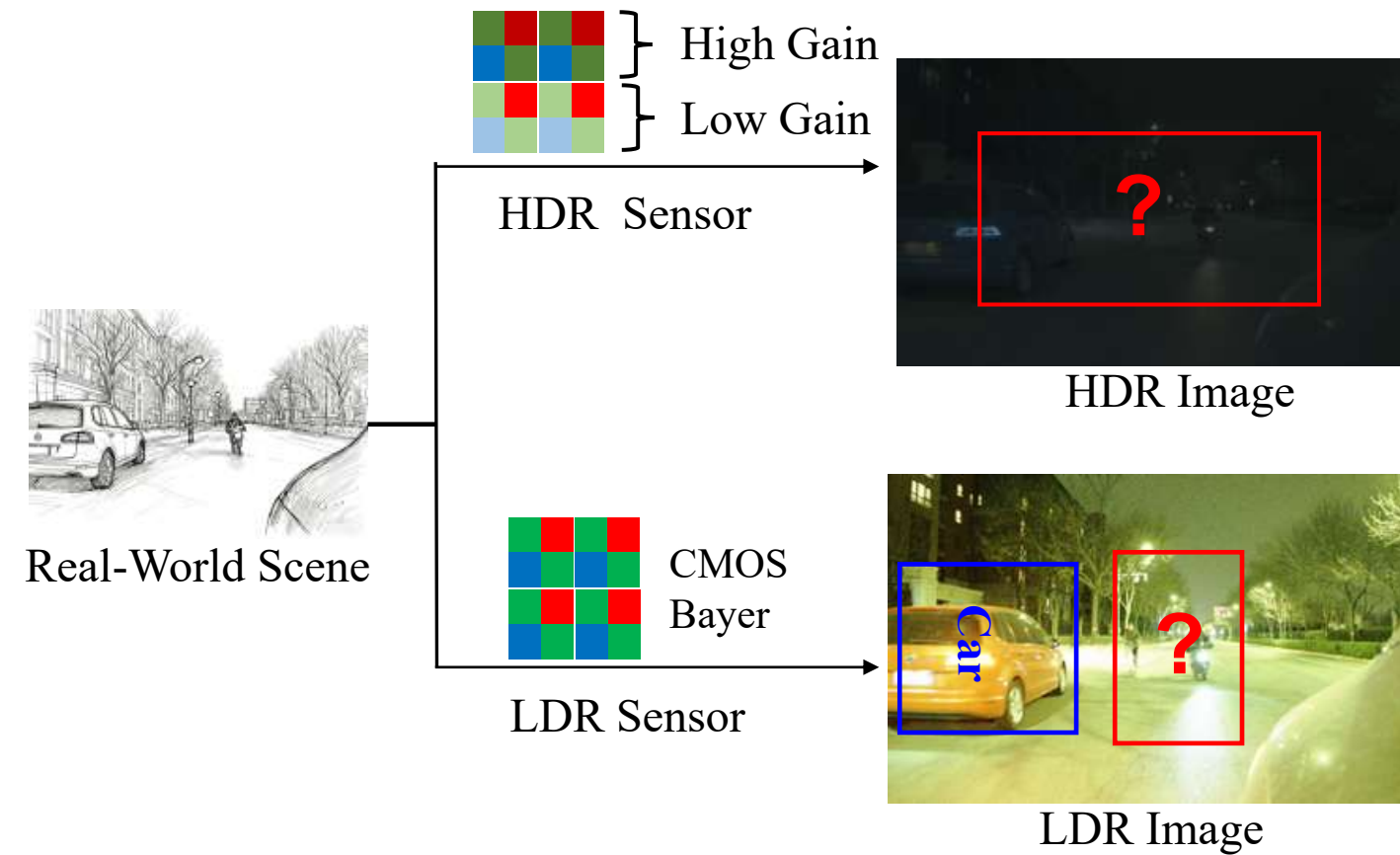
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HDR Object Detection

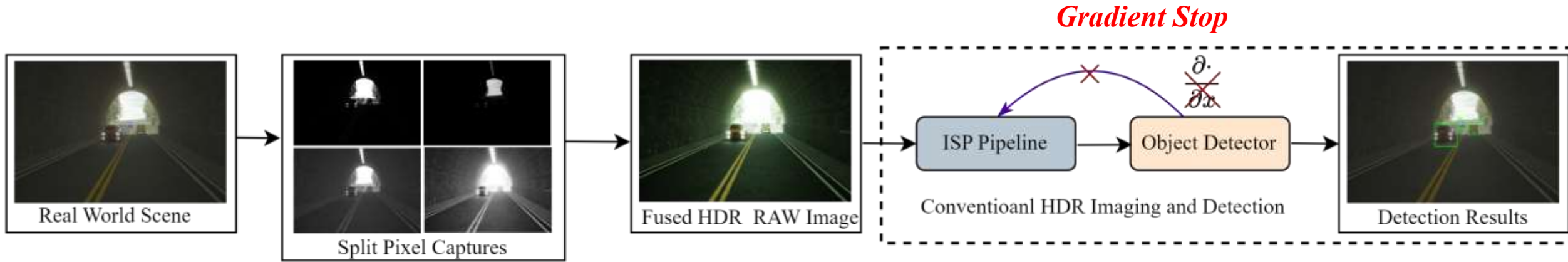


HDR Object Detection



Method

Conventional HDR Imaging and Detection

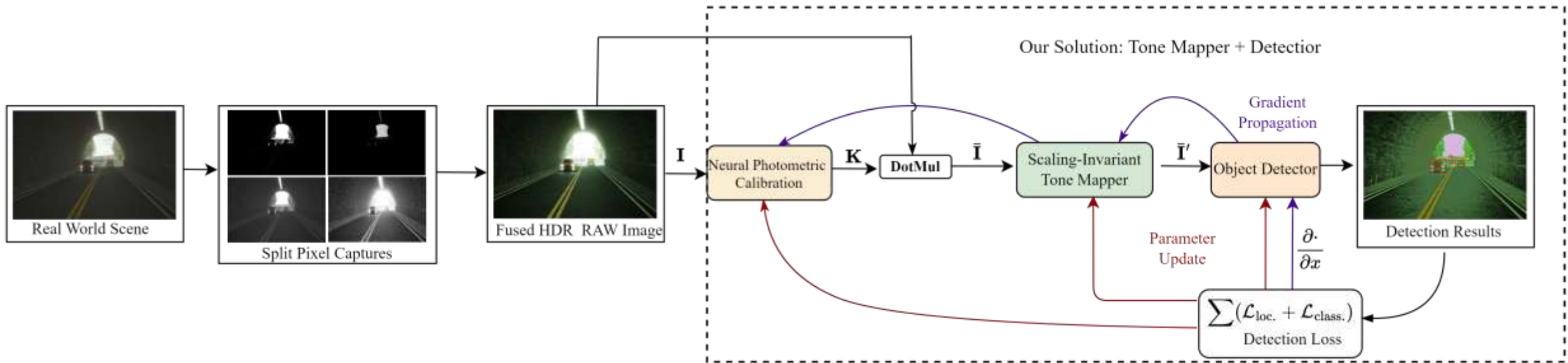


Data Flow: HDR RAW Image \longrightarrow Professional ISP Pipeline \longrightarrow Object Detector

$$\mathbf{R} = \sum_i \omega_i \cdot R_i \longrightarrow \bar{\mathbf{I}} = \text{ISP}(\mathbf{R}) \longrightarrow (\text{box, class, conf}) = \text{OD}(\bar{\mathbf{I}})$$

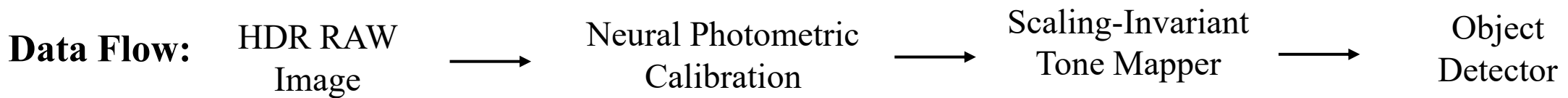
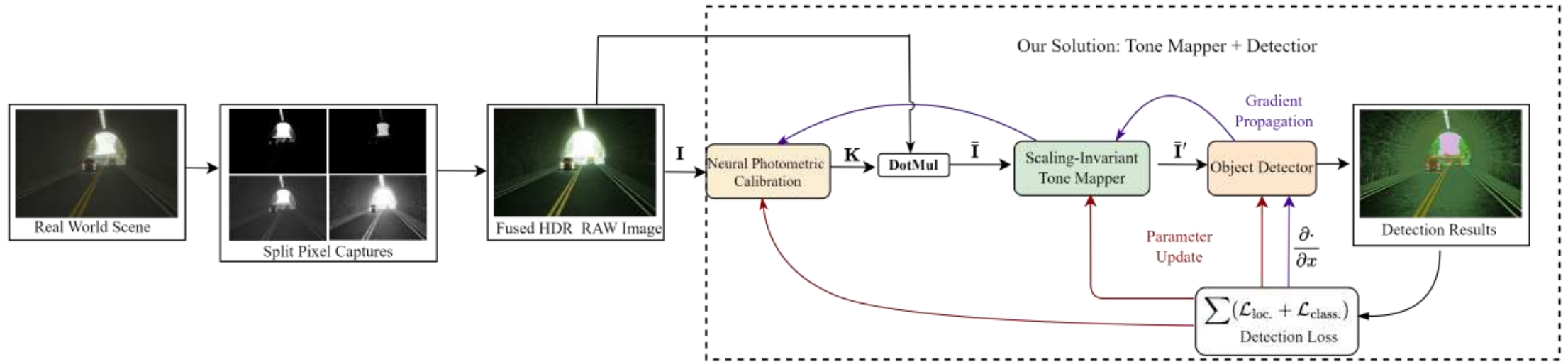
Method

Our Solution: Jointly Optimized Tone Mapper and Object Detector



Method

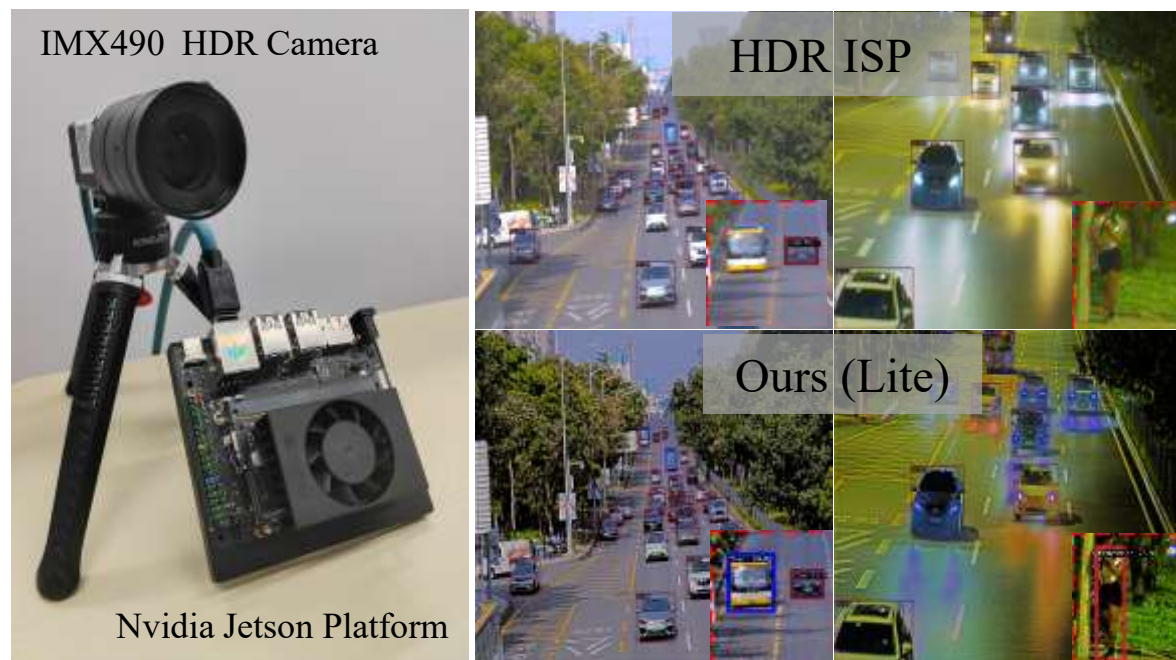
Our Solution: Jointly Optimized Tone Mapper and Object Detector



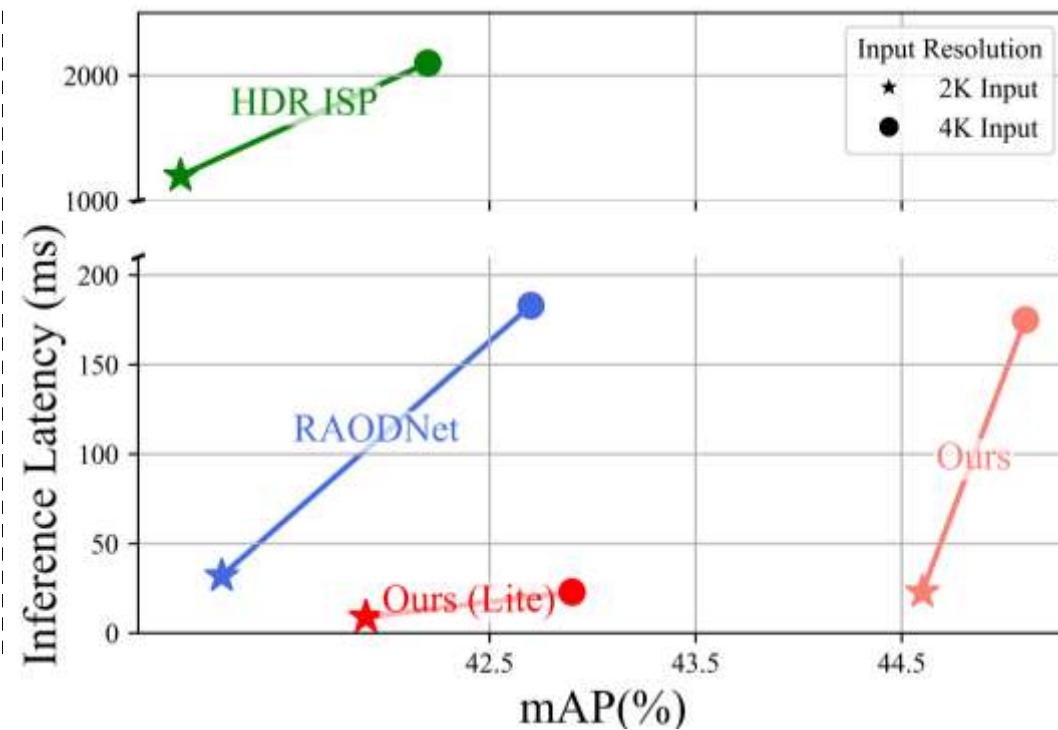
$$\mathbf{R} = \sum_i \omega_i \cdot R_i \longrightarrow \bar{\mathbf{I}} = (\mathbf{K} - b) \cdot \mathbf{R} + b \longrightarrow \bar{\mathbf{I}}' = \text{TM}_{\text{SI}}(\bar{\mathbf{I}}) \longrightarrow (\text{box, class, conf}) = \text{OD}(\bar{\mathbf{I}}')$$

Experiments

Prototype Setup



Latency v.s. mAP



Experiments

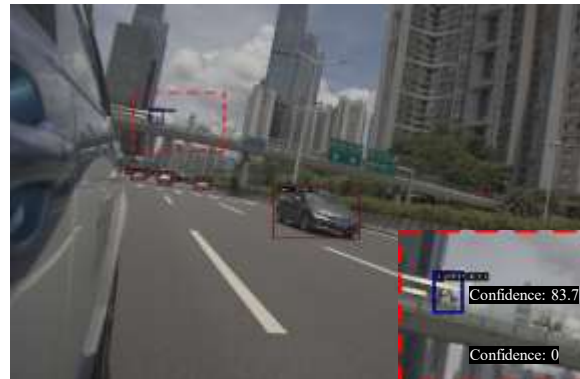
Quantitative Comparison against State-of-the-art

Methods	Method Group	Faster R-CNN [4]				YOLOv3 [5]				Latency(ms)	FLOPs(G)
		mAP	AP50	AP75	mAR	mAP	AP50	AP75	mAR		
HDR RAW	Direct Input	—NAN—				—NAN—				-	
HDR ISP [9]	ISP Pipeline	45.7	69.5	50.1	54.9	42.2	68.1	45.6	50.5	-	-
Mantiuk08 [12]	Handcrafted Tone Mapping	45.6	69.1	49.7	53.3	<u>44.8</u>	<u>71.0</u>	<u>49.1</u>	<u>52.8</u>	-	-
CLAHE94 [14]		44.2	68.2	49.1	53.0	43.0	69.2	46.5	51.4	-	-
ReconfigISP21 [19]	ISP Optimization	41.4	63.2	45.6	49.7	40.9	60.0	44.0	48.4	92.7	455.14
Zero-DCE++21 [21]	Low-Light Enhance	28.6	47.4	30.2	38.5	27.5	49.0	27.5	36.3	29.8	16.51
SCI22 [22]		26.1	43.7	27.0	35.6	25.1	45.6	25.1	33.5	64.3	283.14
AnscombeNet21 [18]	AI-ISPNet	26.8	43.6	27.5	37.8	22.0	41.5	23.1	30.4	123.3	382.04
IANet22 [16]		37.6	59.5	40.1	47.0	33.1	56.4	34.4	41.9	31.3	<u>0.96</u>
RAODNet23 [15]		46.1	69.4	50.6	55.4	42.9	65.8	46.5	50.9	41.2	0.81
RawOrCooked23 [42]		34.8	55.3	34.4	44.4	28.2	46.3	28.4	32.9	55.1	12.89
Ours (Lite)	End-to-End	<u>47.8</u>	<u>71.7</u>	<u>52.9</u>	<u>56.9</u>	42.6	68.5	46.6	51.3	8.8	23.40
Ours	Tone Mapping	49.8	73.3	55.6	58.7	45.1	71.4	50.2	53.0	<u>25.4</u>	62.11

Visual Comparison (Day)



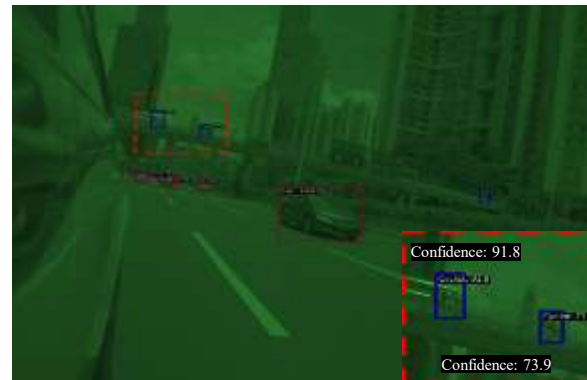
Ours



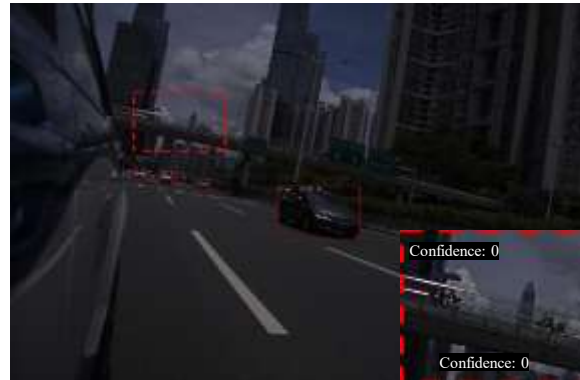
HDR ISP



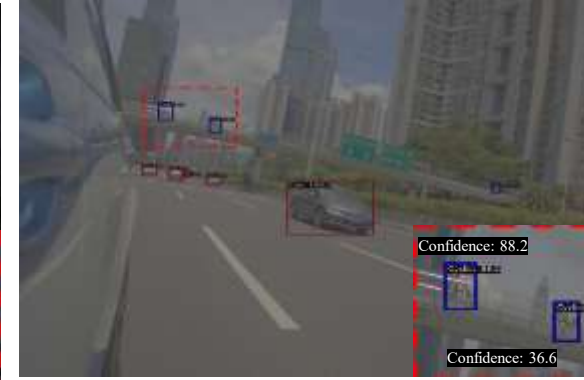
CLAHE94



RAODNet23



ZeroDCE++21



ReconfigISP21

Visual Comparison (Night)



Ours



HDR ISP



CLAHE94



RAODNet23



ZeroDCE++21



ReconfigISP21

Thank you for watching.

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