

IDD-AW: A Benchmark for Safe and Robust Segmentation of Drive Scenes in Unstructured Traffic and Adverse Weather



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<http://iddaw.github.io>



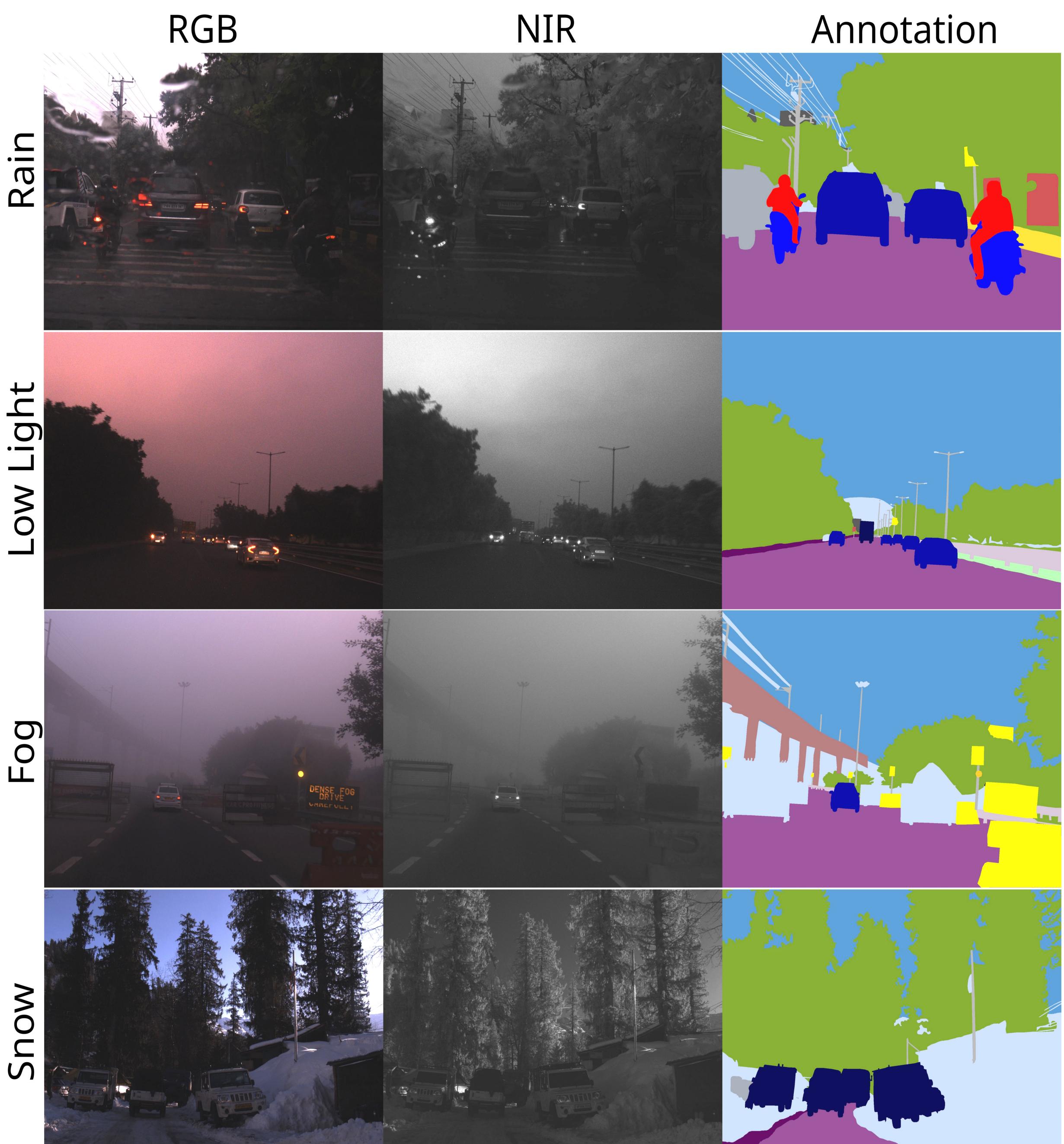
Code, Dataset and Toolkit

Dataset Characteristics:

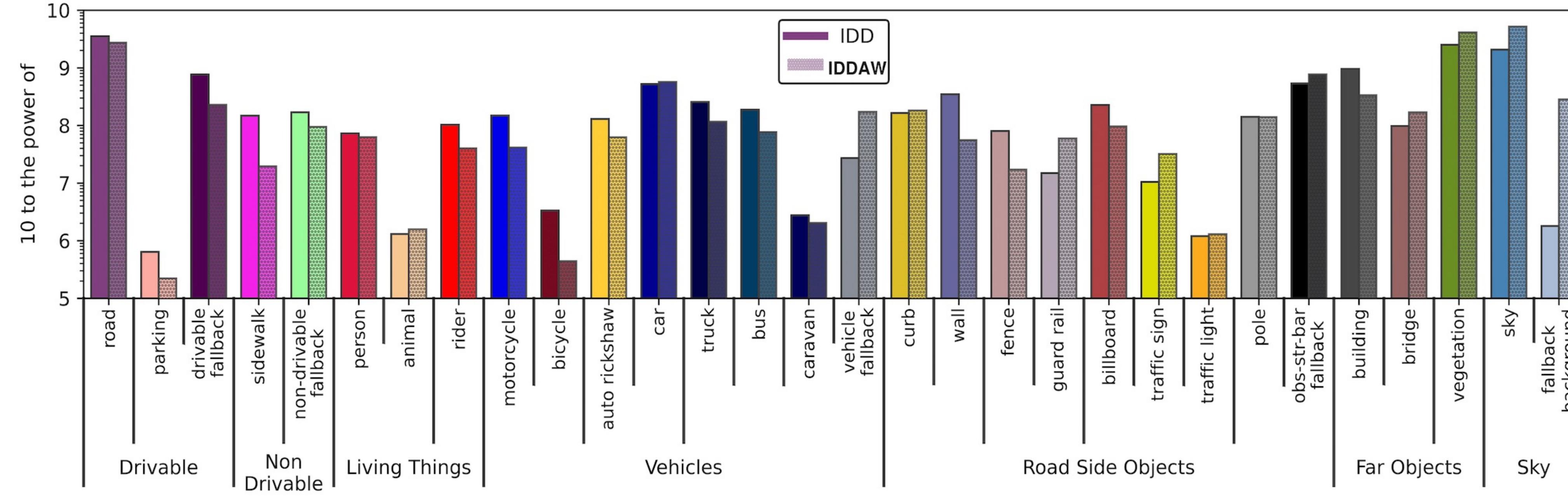
- Rain, Fog, Snow, Lowlight
- Unstructured Driving Conditions.
- Pixel level Annotations with 30 class labels.
- 5000 RGB-NIR paired images.

Dataset	Labeled images	Rain	Fog	Snow	Lowlight	Labels	NIR
Foggy Driving	101	0	101	0	0	19	
Foggy Zurich	40	0	40	0	0	19	
Nighttime Driving	50	0	0	0	50	19	
Dark Zurich	201	0	0	0	201	19	
Raincouver	326	326	0	0	95	19	
WildDash	226	13	10	26	13	19	
BDD100K	1346	213	23	345	765	19	
ACDC	4006	1000	1000	1000	1006	19	
IDD-AW	5000	1500	1500	1000	1000	30	✓

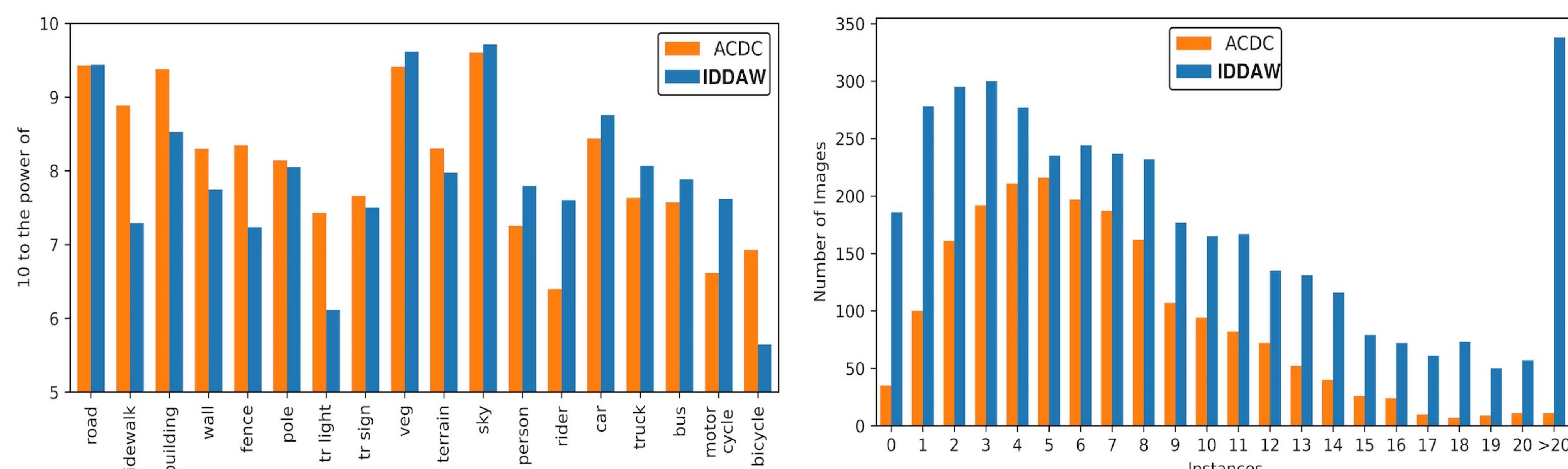
Dataset	CS	ACDC	IDD	Rain	Fog	LL	Snow	IDD-AW
CS RGB	83	-	-	46	45	42	43	46
ACDC RGB	-	75	-	47	51	42	38	48
IDD RGB	-	-	73	52	55	50	33	54
IDD-AW RGB	49	51	51	62	64	62	53	64
IDD-AW NIR	-	-	-	61	58	57	51	61
IDD-AW NIR+RGB	-	-	-	66	65	63	53	67



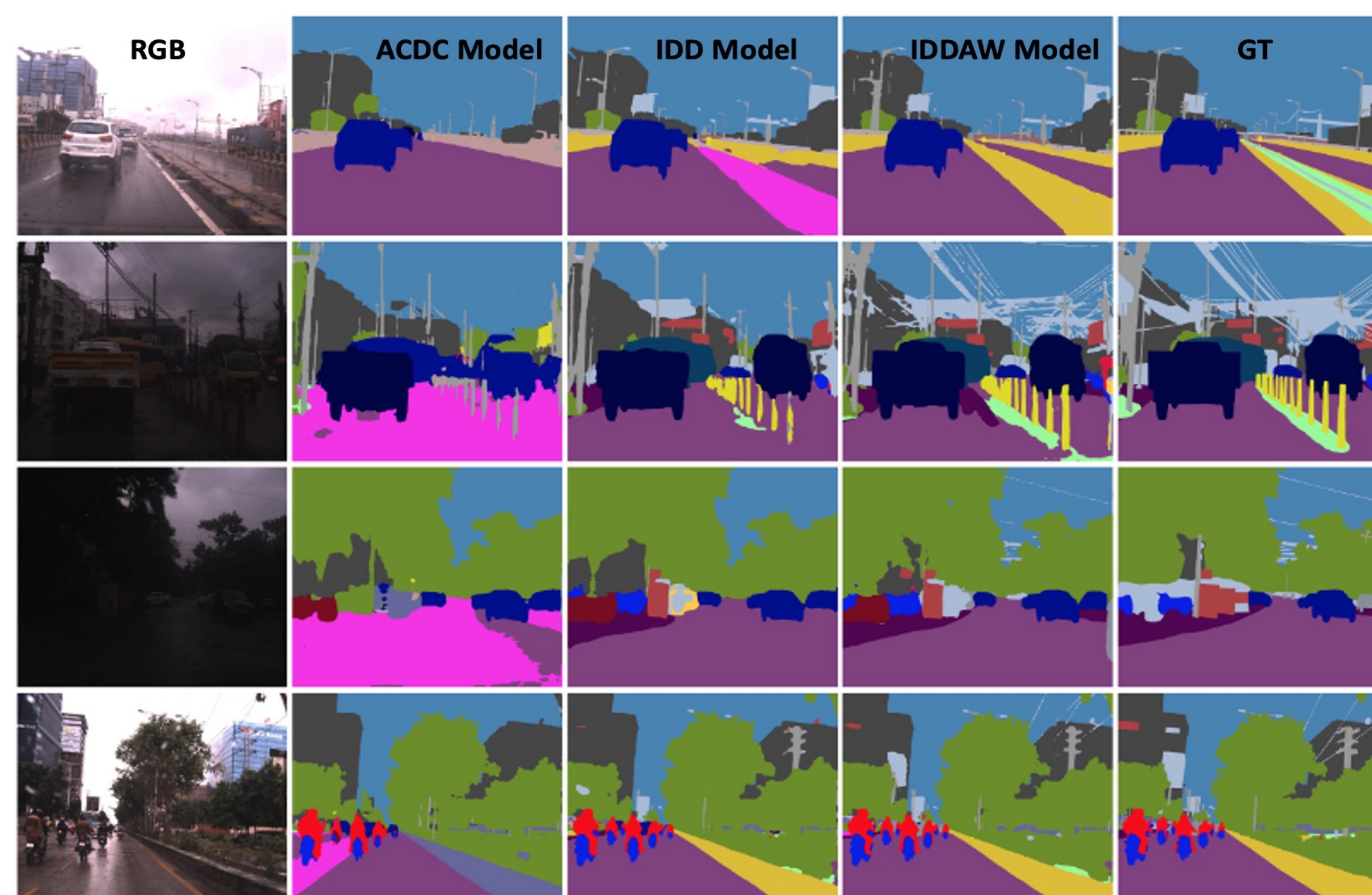
Label Hierarchy and Statistics



Higher pixel wise count per class and instances per image when compared with ACDC.



Metric	Condition	road	drivable	fallback	sidewalk	person	rider	bike	bicycle	rickshaw	car	truck	bus	vehicle	fallback	curb	wall	guard rail	billboard	traffic sign	traffic light
mIoU %	All	95	51	48	76	72	68	5	83	85	74	76	45	78	52	74	62	58	52		
	Rain	96	49	49	48	73	68	2	86	87	79	52	47	81	47	46	64	54	52		
	Fog	97	64	24	62	75	73	8	67	91	82	80	49	79	57	78	61	69	47		
	LL	95	60	54	73	73	68	38	75	80	69	86	29	65	50	72	58	35	53		
	Snow	85	42	-	80	62	40	0	-	82	58	70	48	23	56	64	60	37	-		
SmIoU %	All	92	32	16	64	58	52	-22	77	81	68	70	21	69	32	61	42	40	27		
	Rain	94	28	25	15	59	54	-7	81	84	74	46	23	74	22	20	46	32	26		
	Fog	95	51	-48	41	62	58	-63	43	87	78	77	28	71	52	69	45	53	12		
	LL	92	46	22	60	59	52	14	70	76	61	82	2	48	26	52	35	15	32		
	Snow	79	20	-	70	44	-2	-99	-	76	48	56	23	-46	23	42	38	5	-		



Experiments:

- Semantic Segmentation using InternImage-b framework.
- Comparison with Cityscapes, IDD and ACDC
- Safe mIoU vs mIoU comparison across various weather conditions and pretrained models for each class.
- Severity maps based on the level of dangerous mispredictions denoted by red, orange and yellow .

Safe mIoU:

$$I_{c,s}^{\text{safe}} = \frac{|gt_c \cap pred_s|}{|gt_c \cup pred_c|} \quad I_{c,c} = \frac{|gt_c \cap pred_c|}{|gt_c \cup pred_c|}$$

$$I_c^{\text{safe}} = \begin{cases} I_{c,c} - \sum_{s \in C, s \neq c} \frac{d(c,s)}{n} I_{c,s}^{\text{safe}} & \text{if } c \in C_{\text{imp}} \\ I_{c,c} - \sum_{s \in C_{\text{imp}}} \frac{d(c,s)}{n} I_{c,s}^{\text{safe}} & \text{else.} \end{cases} \quad (1)$$

$$\text{SmIoU} = \frac{\sum_{c \in C} I_c^{\text{safe}}}{|C|} \quad (2)$$

