Improving Robustness of Semantic Segmentation to Motion-Blur using Class-Centric Augmentation SUPPLEMENTARY MATERIAL

Aakanksha Indian Institute of Technology Madras aakankshajha30@gmail.com

In this supplementary material, we include the following.

- 1. A discussion on the choice of blur kernels Linear or Non-Linear?
- 2. An ablation for the choice of 'p', the probability of blurring an image during training.
- 3. A class-wise comparison of quantitative performance gains of our approach over baseline methods on PAS-CAL VOC [4] and Cityscapes [3].
- 4. Additional qualitative results on synthetic spaceinvariant blur for PASCAL VOC [4] and Cityscapes [3] datasets.
- 5. Additional qualitative results on real blur for GOPRO [7] and REDS [6] datasets.

All the tables, figures and sections in this supplementary are numbered starting with an 'S' to make clear distinctions between the contents in the main paper and supplementary. The best results are highlighted in bold in all the tables.

S1. Linear v/s Non-Linear Blur Kernels

In our augmentation strategy, we synthesize spacevariant class-centric blur as well as space-invariant synthetic motion blur. Since class-centric blurring is meant to model dynamic scene blur, using linear blur may seem more appropriate. We argue that since our work attempts to model both camera motion blur (which is typically nonlinear [1]) and dynamic scene blur (which is pre-dominantly linear [5]) using a single augmentation strategy, it becomes imperative to include both linear and non-linear blur kernels during training. The blur kernel generation method detailed in Sec.3.1.1 in the main paper refers to 3 anxiety levels which control the non-linearity of the kernels generated, with lower anxiety level corresponding to less nonlinearity. The anxiety level of a = 0.00005 used while generating blur kernels, corresponds to an approximately linear blur which makes our set inclusive of both non-linear and linear blur kernels. Additionally, for non-rigid objects like

A. N. Rajagopalan Indian Institute of Technology Madras raju@ee.iitm.ac.in

humans, where motion blur can be caused by fast movement of body parts, using non-linear kernels is better.

To establish the effectiveness of our augmentation strategy even if linear kernels are used to model blur, we perform an ablation study where we train DeepLabv3+ [2] with MobileNetv2 [8] backbone on PASCAL VOC dataset using only linear blur kernels for different blur levels. We generated blur kernels with 3 levels of exposure as detailed in the paper but restricting anxiety to the lowest value of a = 0.00005. All the training setup remains the same and the model is trained with p = 0.5, the probability of an image being blurred. The performance metric used is standard mIoU as used in the main paper. The results are shown in Table S1. It can be clearly seen that modeling blur using linear blur kernels gives similar performance as non-linear blur kernels for clean images and blur level L1. A slight performance drop is observed at higher blur levels L2 and L3 when using linear blur kernels.

Table S1. Quantitative comparisons for training using CCMBA with linear vs non-linear blur kernels.

Blur Kernel Type	Clean	L1	L2	L3
Linear	69.6	68.5	65.9	60.5
Non-Linear	69.3	68.2	66.6	61.5

S2. Ablation for the blurring probability hyper-parameter p

In this section, we document results for blurring with different probabilities during training. We chose p = 0.5 during the training of all our models in the main paper.

Table S2. Quantitative comparisons for training with CCMBA using different p values.

Probability of Blurring	Clean	L1	L2	L3
p = 0.3	69.6	67.9	64.9	60.2
p = 0.5	69.3	68.2	66.6	61.5
p = 0.7	68.7	68.2	65.2	62.0
p = 0.9	67.7	67.7	65.4	61.6

	Background	Aeroplane	Bicycle	Bird	Boat	Bottle	Bus	Car	Cat	Chair	Cow	Dining Table	Dog	Horse	Motorbil	e Perso	n Po	otted	Sheep	Sofa	Train	Tv Monitor
No-Retraining	93.26	79.71	41.15	85.6	71.76	72.56	90.81	83.25	91.19	32.57	83.73	60.87	86.43	82	82.35	82.01	5	7.88	83.69	49	84.52	68.04
Finetune	88.12	80.01	34.14	70.97	46.73	40.81	79.58	76.4	74.7	18.56	59.63	38.34	67.33	65.52	65.52	75.18	3	4.52	66.23	34.93	60.03	51.92
MBA	92.39	81.98	40.46	86.28	48.81	65.38	91.38	85.34	90.19	35.53	78.96	58.76	84.7	83.55	79.77	83.48	3 4	6.43	76.19	49.57	80.78	70.89
Ours	94.01	86.4	41.46	86.13	62.26	73.22	92.64	87.18	89.1	36.54	85.51	59.54	83.08	84.35	82.68	85.7	6	2.28	80.67	43.97	87.21	77.03
	1	Table S4	. Class	-wise	comp	oarisor	n of m	nIoUs	with	basel	ines o	n PAS	SCAL	. vo	C for ir	nages	with	n L1	blur.			
	Background	l Aeroplar	e Bicycl	e Bird	Boat	Bottle	Bus	Car	Cat	Chair	Cow	Dining	Dog	Horse	Motorbi	a Perso	n Pe	otted	Sheep	Sofa	Train	Tv Monitor
No-Retraining	91.91	74.52	37.23	75.02	61.22	69.85	88.18	81.68	85.09	29.13	73.32	51.12	80.17	73.77	79.61	78.3	4	9.65	71.98	46.71	79.31	67.57
Finetune	91.42	78.85	39.31	82.53	56.09	57.6	90.32	83.93	86.64	33.53	69.68	54.89	82.82	76.52	78.97	79.6	2 4	12.9	75	48.67	79.81	62.87
MBA	91.97	80.87	39.2	82.81	48.27	65.55	92.15	83.89	88.74	32.28	74.25	59.07	83.25	80.08	77.66	81.4	7 4	14.5	72.89	49.55	81.66	66.92
Ours	93.58	83.23	40.82	84.25	63.37	76.22	90.97	85.1	88.02	38.72	83.89	57.31	82.73	82.6	81.26	83.4	36	51.9	79.03	42.13	85.9	77.7
Table S5. Class-wise comparison of mIoUs with baselines on PASCAL VOC for images with L2 blur.																						
	Background	Aeroplane	Bicycle	Bird	Boat	Bottle	Bus	Car	Cat	Chair	Cow	Dining Table	Dog	Horse	Motorbil	e Perso	n Po	otted 'lant	Sheep	Sofa	Train	Tv Monitor
No-Retraining	89.38	68.48	31.74	64.3	42.77	63.67	77.97	72.07	74.07	24.84	61.92	36.82	67.74	65.17	66.59	72.44	4	12.8	46.19	37.76	67.8 76.95	60.93
MBA	91.03	70.74	37.44	70.58	33.01 47.86	58.95 63.58	89.08	82.05	85.65	32.51	05.01 71.47	55.5 56.37	81.42 78 30	75.02	76.13	78.20) 4.) 4!	2.07	70.69	47.1	77.03	66 94
Ours	93.07	80.28	39.17	82.18	58.92	71.86	89.88	82.73	86.27	38.04	79.01	57.11	79.42	79.33	79.46	81.87	5	8.25	75.89	40.82	84.44	76.25
	7	Table S6	. Class	-wise	comp	oarisor	n of m	nIoUs	with	basel	ines o	n PAS	SCAL	. vo	C for in	nages	with	L3	blur.			
			n: 1	D: 1		D. of			a .	<i>c</i> 1. ·		Dining					Po	otted	C1			Tv
	Background	Aeroplane	Bicycle	Bird	Boat	Bottle	Bus	Car	Cat	Chair	Cow	Table	Dog	Horse	Motorbil	e Perso	n P	lant	Sheep	Sofa	Train	Monitor
No-Retraining	85.41	61.53	28.05	51.21	24.41	50.75	60.53	57.82	57	16.62	28.85	14.08	52.71	41.45	41.02	60.22	2 3	0.26	29.42	25.22	41.03	51.76
Finetune	90.08	69.99	34.81	74.15	52.83	57.73	82.83	77.07	81.05	28.99	63.99	50.53	76.66	66.42	71.01	74.71	4	3.67	74.27	43.53	70.99	62.19
MBA	90.52 92.16	72.91	34.19	76.44 78.18	46.1 54 74	59.09 65.68	82.37 88.04	797	82.39 82.61	27.8	69.52 77.62	54.03 54.05	77.10	75.67	69.62 73.14	75.72	4	5.61 5.95	08.57 73.5	43.95	72.47 82.91	67.45
	72.10	11.54	55.00	70.10	54.74	05.00	00.04	19.1	02.01	54.54	77.02	54.05	15.07	/ 5.0/	75.14	77.0.	, 3.	5.75	15.5	50.70	02.71	07.02
		T-1	-1- 07	C1				.	-T-TL		11	•			.	.1						
		Ta	ole S7.	Class	-wise	comp	ariso	n of n	nIoU	s with	basel	ines c	on Cit	yscap	bes for	clean i	mag	ges.				
	Road S	Tal	ole S7.	Class	-wise	comp Pole	arison Tr. Ligh	n of n	nIoUs	s with	basel	ines c	on Cit	yscar	es for	clean i	mag	ges.	Train	Mote	orcycle	Bicycle
No Retraining	Road S 97.93	Tal idewalk H 83.77	ble S7. Building 91.82	Class Wall 46.47	-wise Fence 59.01	Pole 61.95	Tr. Ligh	n of n t Tr. 3 76	nIoUs	with Vegetation 92.32	basel	ines c	on Cit	yscar	Rider C	clean i	mag	ges. Bus 85.85	Train 71.80	Mote 5	orcycle 9.36	Bicycle 75.72
No Retraining Finetuning MBA	Road S 97.93 97.25 97.86	Tal idewalk F 83.77 79.42 83.29	ble S7. Building 91.82 90.45 92.00	Class Wall 46.47 32.62 41.98	-Wise Fence 59.01 49.39 53.98	Pole 61.95 59.07 64.06	arison Tr. Ligh 66.72 58.88 68.37	n of n t Tr. 3 76 74 76	nIoUs	s with Vegetation 92.32 90.46	basel	ines c in Si 34 94. 40 93. 12 94	on Cit	yscar rson 0.60 8.44	Des for 0 Rider 0 59.99 94 56.99 93 61.90 94	clean i ar Tru .39 74 .27 69	mag ick .78 .40	Bus 85.85 78.50	Train 71.80 62.60	Mote 59 41	orcycle 9.36 8.83	Bicycle 75.72 72.04 75.40
No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88	Tal idewalk F 83.77 79.42 83.29 83.60	ole S7. Building 91.82 90.45 92.00 92.28	Class Wall 46.47 32.62 41.98 47 73	-Wise Fence 59.01 49.39 53.98 56.78	Pole 61.95 59.07 64.06 65.54	Tr. Ligh 66.72 58.88 68.37 70.18	n of n t Tr. 3 76 74 76 74 76 79	nIoUs Sign 7 48 12 44 10	s with Vegetation 92.32 90.46 92.01 92.35	basel	ines c in Sk 4 94. 40 93. 12 94. 18 94	on Cit	yscar rson 0.60 8.44 1.21	Rider Q 59.99 94 56.99 93 61.90 94 62.30 94	clean i ar Tru .39 74 .27 69 .27 70 65 72	mag Ick .78 .40 .14	Bus 85.85 78.50 82.57 85.11	Train 71.80 62.60 66.01 66.34	Mot 59 44 60	orcycle 9.36 8.83 0.68	Bicycle 75.72 72.04 75.40 76.96
No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88	Tal idewalk F 83.77 79.42 83.29 83.60	ble S7. Building 91.82 90.45 92.00 92.28	Class Wall 46.47 32.62 41.98 47.73	-Wise Fence 59.01 49.39 53.98 56.78	Pole 61.95 59.07 64.06 65.54	Tr. Ligh 66.72 58.88 68.37 70.18	n of n t Tr. 3 76 74 76 79	nIoUs Sign 7 48 12 44 10	s with Vegetation 92.32 90.46 92.01 92.35	basel n Terra 63.8 56.4 63.0 64.4	ines c in SI 4 94. 40 93. 12 94. 18 94.	on Cit xy Pe 57 80 08 74 82 8 89 82	yscar rson 0.60 8.44 1.21 2.05	Des for G Rider 0 59.99 94 56.99 93 61.90 94 62.30 94	clean i ar Tru .39 74 .27 69 .27 70 .65 72	mag ick 78 40 14 07	Bus 85.85 78.50 82.57 85.11	Train 71.80 62.60 66.01 66.34	Mot 5 4 6 6	orcycle 9.36 8.83 0.68 3.72	Bicycle 75.72 72.04 75.40 76.96
No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88	Tal idewalk F 83.77 79.42 83.29 83.60 Table	ble S7. Building 91.82 90.45 92.00 92.28 S8 C1	Class Wall 46.47 32.62 41.98 47.73	-W1SC Fence 59.01 49.39 53.98 56.78	Pole 61.95 59.07 64.06 65.54	arisoi Tr. Ligh 66.72 58.88 68.37 70.18	n of n t Tr. 3 76 74 76 74 76 74 76 74 76 74 76 74 76 74 76 74 76 74 76 74 76 74 76 76 74 76 76 76 76 76 76 76 76 76 76	nIoUs Sign 7 48 12 44 10	s with Vegetation 92.32 90.46 92.01 92.35 th base	basel	ines c in Sk 4 94. 0 93. 2 94. 8 94. 8 94.	on Cit	yscar rson 0.60 8.44 1.21 2.05	Rider C 59.99 94 56.99 92 61.90 94 62.30 94	clean i ar Tru .39 74 .27 69 .27 70 .65 72	mag 100 100 100 100 100 100 100 10	Bus 85.85 78.50 82.57 85.11	Train 71.80 62.60 66.01 66.34	Mot 5 4 6 6	orcycle 9.36 8.83 0.68 3.72	Bicycle 75.72 72.04 75.40 76.96
No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88	Tal idewalk F 83.77 79.42 83.29 83.60 Table	ble S7. Building 91.82 90.45 92.00 92.28 S8. Cla	Class Wall 46.47 32.62 41.98 47.73	-wise Fence 59.01 49.39 53.98 56.78 Se coi	Pole 61.95 59.07 64.06 65.54	arison Tr. Ligh 66.72 58.88 68.37 70.18	n of n t Tr. 3 76 74 76 79 79	nIoUs Sign 7 48 12 44 10 Us wi	s with Vegetation 92.32 90.46 92.01 92.35 th bas	basel n Terra 63.8 56.4 63.0 64.4 selines	ines c ⁱⁱⁿ Sk ⁱⁱⁱ 94. ⁱⁱⁱ 94. ⁱⁱⁱ 94. ⁱⁱⁱ 94. ⁱⁱⁱ 94. ⁱⁱⁱ 94. ⁱⁱⁱ 94.	on Cit	yscar rson 0.60 8.44 1.21 2.05 apes	Des for 0 Rider 0 59.99 94 56.99 93 61.90 94 62.30 94 for ima 0	clean i ar Tri .39 74 .27 69 .27 70 .65 72 ges wi	mag 100 100 100 100 100 100 100 10	ges. Bus 85.85 78.50 82.57 85.11	Train 71.80 62.60 66.01 66.34 Ur.	Mot 5 4 6 6	orcycle 9.36 8.83 0.68 3.72	Bicycle 75.72 72.04 75.40 76.96
No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88 97.88 97.38	Tal idewalk F 83.77 79.42 83.29 83.60 Table f idewalk F	ble S7. Building 91.82 90.45 92.00 92.28 S8. Cla Building	Class Wall 46.47 32.62 41.98 47.73 ASS-WI Wall 40.10	-wise Fence 59.01 49.39 53.98 56.78 Se COI Fence	Comp Pole 61.95 59.07 64.06 65.54 nparis Pole	arison Tr. Ligh 66.72 58.88 68.37 70.18 300 of Tr. Ligh	n of n t Tr. 5 76 74 76 79 79 70 70 70 70 70 70 70 70 70 70	nIoUs Sign (48 12 44 10 Us wi Sign (22	s with Vegetation 92.32 90.46 92.01 92.35 th bas Vegetation	baselines	ines c in Sk 44 94. 10 93. 12 94. 18 94. 5 on C in Sk	on Cit	yscar rson 0.60 8.44 1.21 2.05 apes 1 rson	Des for C Rider C 59.99 94 56.99 93 61.90 94 62.30 94 for ima Rider Rider C	clean i ar Tr .39 74 .27 69 .27 70 .65 72 ges wi ar Tru .20 69	mag 100 100 100 114 107 100 100 100 100 100 100 100	ges. Bus 85.85 78.50 82.57 85.11 L1 bl Bus 78.62	Train 71.80 62.60 66.01 66.34 UI. Train	Mot 5 4 6 6	orcycle 9.36 8.83 0.68 3.72	Bicycle 75.72 72.04 75.40 76.96 Bicycle
No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88 97.88 97.39 97.39 97.39	Tal idewalk I 83.77 79.42 83.60 83.60 Table 1 idewalk I 80.71 82.21	ble S7. Building 91.82 90.45 92.00 92.28 S8. Cla Building 90.00 91.51	Class Wall 46.47 32.62 41.98 47.73 MSS-Wi Wall 40.19 46.46	-wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 52.20	COMP Pole 61.95 59.07 64.06 65.54 Pole Pole 56.55 50.65	arison Tr. Ligh 66.72 58.88 68.37 70.18 con of Tr. Ligh 59.99 65.40	n of m t Tr. 3 76 74 76 74 76 79 79 70 79 70 70 74 76 74 76 79 70 70 74 76 76 76 76 74 76 76 76 76 76 76 76 76 76 76	nIoUs Sign 7 48 12 44 10 Us wi Sign 7 32 08	s with Vegetation 92.32 90.46 92.01 92.35 th bas Vegetation 90.40 91.74	basel: n Terra 63.8 56.4 63.0 64.4 Selines n Terra 59.9 61.6	ines c iin Sk 44 94. 10 93. 12 94. 18 94. 18 94. 5 on C 11 Sk 17 91. 2 91. 3 01.	on Cit y Pe 57 80 08 78 82 8 89 82 Citysci 56 72 56 72 14 77 14 77 1	yscar rson 0.60 8.44 1.21 2.05 apes : rson 5.87 8.01	Des for C Rider C 59.99 94 56.99 93 61.90 94 62.30 94 for ima Rider Rider C 52.28 93	clean i ar Tr 39 74 .27 69 .27 70 .65 72 ges wi ar Tr .20 68 .05 72	mag 100 100 100 114 107 114 114 107 114 114 114 114 114 114 114 11	ges. Bus 85.85 78.50 82.57 85.11 L1 bl Bus 78.62 83.65	Train 71.80 62.60 66.01 66.34 UIT. Train 55.30 72 44	Mot 5 4 6 6 Mot 5 5	orcycle 9.36 8.83 0.68 3.72 prcycle 3.55	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA	Road S 97.93 97.25 97.86 97.88 97.88 97.39 97.39 97.39 97.74 97.5	Tal idewalk I 83.77 79.42 83.60 Image: State S	ble S7. Building 91.82 90.45 92.00 92.28 S8. Cla Building 90.00 91.51 91.43	Class Wall 46.47 32.62 41.98 47.73 ASS-WI Wall 40.19 46.46 41.49	-Wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 53.89 51.28	comp 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 59.27	arison Tr. Ligh 66.72 58.88 68.37 70.18 300 of Tr. Ligh 59.99 65.40 66 90	n of n t Tr. : 76 74 76 79 79 79 79 70 t Tr. : 71 74 75 71 74 75 79	nIoUs <u>3ign</u> <u>48</u> 12 44 10 Us wi <u>32</u> 98 08	s with 92.32 90.46 92.01 92.35 th bas Vegetation 90.40 91.74 91.63	basel n Terra 63.8 56.4 63.0 64.4 selines 59.9 61.6 62.2	ines c in Sk 44 94. 10 93. 12 94. 18 94. 5 on C 17 91. 13 94. 17 94. 17 94.	on Cit y Pe 57 80 08 78 82 8 89 82 Citysc: 56 72 14 78 41 78	yscar <u>5.87</u> <u>8.44</u> <u>1.21</u> <u>2.05</u> <u>apes</u> <u>5.87</u> <u>8.91</u> <u>9.57</u>	Rider C 59.99 94 56.99 93 61.90 94 62.30 94 for ima Rider 62.28 93 57.76 93 50.28 93	clean i ar Trn .27 69 .27 70 .65 72 ges Wi .ar Trn .20 68 .95 72 .95 72 .90 73	mag ick 78 40 14 07 th L ick 27 39 38	ges. Bus 85.85 78.50 82.57 85.11 .1 bl Bus 78.62 83.65 81.32	Train 71.80 62.60 66.01 66.34 UIT. Train 55.30 72.44 64.99	Moti 5 4 6 6 6 7 5 5 5 5 5	orcycle 9.36 8.83 0.68 3.72 prcycle 3.55 8.10 7 84	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88 97.88 97.88 8 97.39 97.74 97.75 97.76 97.76	Tal idewalk I 83.77 79.42 83.29 83.60 Table I idewalk I 80.71 82.31 82.39 82.67	ble S7. Building 91.82 90.45 92.00 92.28 S8. Cla Building 90.00 91.51 91.43 91.87	Class Wall 46.47 32.62 41.98 47.73 ASS-WI Wall 40.19 46.46 41.49 48.61	-Wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 53.89 51.28 54.31	Comp 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 61.27 63.21	arisol Tr. Ligh 66.72 58.88 68.37 70.18 300 of Tr. Ligh 59.99 65.40 66.99	n of n t Tr. : 76 74 76 74 76 79 79 79 70 t Tr. : 71 74 75 77	nIoUs <u>3ign</u> <u>48</u> 12 44 10 Us wi <u>32</u> 98 08 54	s with 92.32 90.46 92.01 92.35 th bas Vegetation 90.40 91.74 91.63 92.03	basel <u>n</u> Terra 63.8 56.4 63.0 64.4 Selines n Terra 59.9 61.6 62.2 63.9	ines c in Sk 44 94. 40 93. 12 94. 18 94. 5 on C 13 94. 17 91. 13 94. 17 94. 14 94.	on Cit y Pe 57 86 88 89 82 Citysc 56 72 14 73 41 75 50 8	yscar <u>5.87</u> <u>8.44</u> <u>1.21</u> <u>2.05</u> <u>apes</u> <u>5.87</u> <u>8.91</u> <u>9.57</u> <u>0.68</u>	Des for Construction Rider C 55.99 92 56.99 92 61.90 94 62.30 94 for imaa Rider C 52.28 92 57.76 92 60.32 94	clean i ar Trn .39 74 .27 69 .27 70 .65 72 ges Wi .20 68 .95 72 .00 73 .33 74	mag ick 78 40 14 07 th L ick 27 39 38 38	ges. Bus 85.85 78.50 82.57 85.11 <u>J1 bl</u> Bus 78.62 83.65 81.32 84.72	Train 71.80 62.60 66.01 66.34 UI . Train 55.30 72.44 64.99 65.92	Moti 4 6 6 Moti 5 5 6	orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.79 75.14
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88 97.88 97.39 97.74 97.75 97.76 97.76	Tal idewalk I 83.77 79.42 83.29 83.60 Table idewalk I 80.71 82.31 82.39 82.67	ble S7. Building 91.82 90.45 92.00 92.28 S8. Cla Building 90.00 91.51 91.43 91.87	Class Wall 46.47 32.62 41.98 47.73 ASS-WI Wall 40.19 46.46 41.49 48.61	-Wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 53.89 51.28 54.31	comp Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 61.27 63.21	arisoi Tr. Ligh 66.72 58.88 68.37 70.18 300 of Tr. Ligh 59.99 65.40 66.90 68.99	n of n t Tr. : 76 74 76 79 71 71 74 75 77	nIoUs <u>Sign</u> 12 44 10 Us wi <u>Sign</u> 32 98 08 54	s with Vegetation 92.32 90.46 92.01 92.35 th bas Vegetation 90.40 91.74 91.63 92.03	basel n Terra 63.8 56.4 63.0 64.4 selines n Terra 59.9 61.6 62.2 63.9	ines c ain Sk bit 94. bit 94. bit 94. bit 94. s on c on	on Cit y Pe 57 86 08 73 82 8 89 82 Citysc: 56 72 14 75 50 86	yscar rson 0.60 8.44 1.21 2.05 apes 1 rson 5.87 8.91 9.57 0.68	Des for Rider C Rider C 50.99 92 56.99 92 61.08 94 62.30 94 62.30 94 for ima Rider C 52.28 92 57.76 92 60.32 94 61.08 94	clean i ar Tr 39 74 .27 69 .27 70 .65 72 ges wil ar Tr .20 68 .95 72 .00 73 .33 74	mag 10ck 78 40 14 07 th L 10ck 27 39 38 38 38	ges. Bus 85.85 78.50 82.57 85.11 L1 bl Bus 78.62 83.65 81.32 84.72	Train 71.80 62.60 66.01 66.34 UI. Train 55.30 72.44 64.99 65.92	Mot 5 6 6 5 5 5 5 6	orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88 97.88 97.39 97.39 97.74 97.75 97.76	Tal 88.77 79.42 83.29 83.60 Table idewalk B 80.71 82.31 82.39 82.67 Table	ble S7. Building 91.82 90.45 92.00 92.28 S8. Cla Building 90.00 91.51 91.43 91.87	Class Wall 46.47 32.62 41.98 47.73 ASS-WI Wall 40.19 46.46 41.49 48.61	-Wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 53.89 51.28 54.31	comp Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 61.27 63.21	arisol Tr. Ligh 66.72 58.88 68.37 70.18 300 Of Tr. Ligh 59.99 65.40 66.90 68.99	n of n t Tr. : 76 74 76 79 71 71 74 75 77 77	nIoUs <u>Sign</u> 12 44 10 Us wi <u>Sign</u> 32 98 08 54	s with Vegetation 92.32 90.46 92.01 92.35 th bas Vegetation 90.40 91.74 91.63 92.03 th bas	basel n Terra 63.8 56.4 63.0 64.4 selines n Terra 59.9 61.6 62.2 63.9	ines c in Sk 4 94. 6 93. 9 94. 8 94. 5 on C in Sk 7 91. 3 94. 7 94. 94. 94. 94. 94. 94. 94. 94.	on Cit xy Pe 57 80 08 74 82 8 89 82 Citysc: xy Pe 56 72 14 74 41 75 50 80 50 80	yscar rson 0.60 8.44 1.21 2.05 apes : rson 5.87 8.91 9.57 0.68	Des for Rider O Rider C 59.99 94 56.99 92 56.99 92 61.90 94 62.30 94 for ima Rider C 52.28 92 57.76 92 60.32 94 61.08 94 94 94	clean i ar Tr 39 74 .27 69 .27 70 .65 72 ges Wil ar Tr .20 68 .95 72 .00 73 .33 74	mag 10ck 78 40 14 07 th L 10ck 27 39 38 38 41-1	ges. Bus 85.85 78.50 82.57 85.11 1 bl Bus 78.62 83.65 81.32 84.72	Train 71.80 62.60 66.01 66.34 UIT. Train 55.30 72.44 64.99 65.92	Mot 5 6 6 5 5 5 5 6	orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours	Road S 97.93 97.93 97.25 97.86 97.88 97.88 8 97.39 97.39 97.39 97.75 97.76	Tal idewalk F 83.77 79.42 83.60 F Table 60.71 82.31 82.31 82.33 82.39 82.34 70.71 82.35 70.71 79.42 70.71	ble S7. Building 91.82 90.45 92.00 92.28 S8. Cla Building 90.00 91.51 91.43 91.87 S9. Cla	Class Wall 46.47 32.62 41.98 47.73 ATTEND 44.98 47.73 ATTEND 46.46 41.49 48.61 ATTEND	-Wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 53.89 51.28 54.31 Se COI	Comp Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 61.27 63.21 mparis	arisol Tr. Ligh 66.72 58.88 68.37 70.18 con of Tr. Ligh 59.99 65.40 66.90 68.99 con of	n of n at Tr. 3 76 74 76 74 76 79 70 71 71 74 75 77 77 77 77	nIoU: Sign 7 48 12 44 10 Us wi Sign 7 32 98 08 54 Us wi	s with Vegetation 92.32 90.46 92.01 92.35 th bas Vegetation 90.40 91.74 91.63 92.03 th bas	basel: n Terra 63.8 56.4 63.0 64.4 seliness n Terra 59.9 61.6 62.2 63.9 63.9 64.4 59.9 61.6 62.2 63.9 64.6 63.8 59.9 61.6 64.2 63.8 59.9 61.6 64.2 63.8 59.9 61.6 64.2 63.8 59.9 61.6 64.2 63.8 64.4 64.6 64.4 64.4 64.4 64.6 64.4	ines co in Sk 44 94. 40 93. 2 94. 8 94. 8 94. 8 94. 8 94. 9 94.	on Cit xy Pe 57 86 08 7; 82 8 89 8; 2: 1: 1: 1: 1: 1: 1: 1: 1: 1: 1	yscar rson 0.60 8.44 1.21 2.05 apes 5.87 8.91 9.57 0.68 apes	Des for Rider C Rider C 59.99 94 56.99 92 56.99 92 61.90 94 62.30 94 for ima Rider C 52.28 92 60.32 94 61.08 94 for ima 94 94 94	clean i ar Trn .39 74 .27 69 .27 70 ges wil ar Trn .20 68 .95 72 .00 73 .33 74 ges wil	mag res res 40 14 07 th L 14 27 39 38 38 th L	ges. 85.85 78.50 82.57 85.11 .1 bl Bus 78.62 83.65 81.32 84.72 .2 bl	Train 71.80 62.60 66.01 66.34 UIT. Train 55.30 72.44 64.99 65.92 UIT.	Mot 4 6 6 6 5 5 5 5 6	orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.85 97.88 97.88 97.39 97.74 97.75 97.76 97.76	Tal idewalk I 83.77 79.42 83.29 83.60 Table I idewalk I 80.71 82.31 82.37 82.67 Table I idewalk I idewalk I	ble S7. Building 91.82 90.45 92.00 92.28 S8. Cla Building 90.00 91.51 91.43 91.43 91.87 S9. Cla Building	Class Wall 46.47 32.62 41.98 47.73 ASS-WI Wall Mall Mass-Wi Wall Wall	-wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 53.89 51.28 54.31 Se COI Fence	Comp Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 59.65 61.27 63.21 mparis Pole	arison Tr. Ligh 66.72 58.88 68.37 70.18 con off 77. Ligh 65.40 66.90 68.99 con off Tr. Ligh	n of n t Tr. 5 76 74 76 74 76 79 70 70 71 74 75 77 77 70 71 74 75 77 77 77 70 71 74 75 77 77 77 77 76 78 79 78 78 79 78 78 78 79 78 78 78 78 79 78 78 78 78 78 78 78 78 78 78	nIoU: Sign 7 48 12 44 10 Us wi Sign 7 32 98 08 54 Us wi Sign 7 12 12 44 10 12 44 10 12 44 10 12 44 10 10 10 10 10 10 10 10 10 10	s with Vegetation 92.32 90.46 92.01 92.35 th bas Vegetation 90.40 91.74 91.63 92.03 th bas Vegetation	basel: n Terra 63.8 56.4 63.0 64.4 selines n Terra 59.9 61.6 62.2 63.9 selines n Terra	ines c sin Sk 94. 94. 10 93. 12 94. 12 94. 12 94. 12 94. 12 94. 12 94. 13 94. 13 94. 17 91. 13 94. 17 94. 14 94. 14 94. 15 on C 16 on C 17 94. 14 94. 15 on C 16 on C 17 94. 14 94.	on Cit xy Pe 57 88 08 73 82 8 83 8 Citysc: xy Pe 56 72 14 73 50 88 Citysc: xy Pe 56 88 Citysc: xy Pe 56 88 Citysc: xy Pe 57 88 57 78 56 72 56 72 56 88 56 72 56 88 56 72 56 88 57 88 56 72 56 88 56	yscap rson 0.60 8.44 1.21 2.05 apes : rson 5.87 8.91 0.57 0.68 apes : rson	Dess for Rider C Rider 0 9 56.99 92 9 61.90 94 94 62.30 94 94 for ima Rider 0 57.76 92 94 61.08 94 94 for ima 81 94 for ima 81 94 for ima 81 94	clean i ar Trn .39 74 .27 69 .27 70 .65 72 ges Wi ar Trn .20 68 .95 72 .00 73 .33 74 ges Wi ar Trn	mag ick 78 40 1.14 007 th L ick 27 39 38 38 th L ick ick 27 39 38 38 th L	ges. Bus 85.85 78.50 82.57 85.11 .1 bl Bus 78.62 83.65 81.32 84.72 .2 bl Bus	Train 71.80 62.60 66.01 66.34 UIT. Train 55.30 72.44 64.99 65.92 UIT. Train	Mot 4 6 6 Mote 55 55 6 Mote	orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24 prcycle	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours No Retraining	Road S 97.93 97.25 97.86 97.86 97.87 97.88 97.39 97.39 97.74 97.75 97.76 97.76	Tal idewalk F 83.77 79.42 83.60 F Table idewalk idewalk F 82.31 82.33 82.33 82.31 82.39 82.67 Table idewalk idewalk F 71.99 F	ble S7. building 91.82 90.45 92.00 92.28 S8. Cla S8. Cla S8. Cla S8. Cla 90.00 91.51 91.43 91.87 91.87 93.91 94.87 95.92 95.92 96.9 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.92 90.93 90.92 90.93 91.91 91.91 91.92 91.92 91.92 91.92 91.93 91.93 91.93 91.93 91.93 91.93 91.93 91.95 91.93 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.95 91.9	Class Wall 46.47 32.62 41.98 47.73 Wall 40.19 46.46 41.49 48.61 Wall Wall 19.99 Wall 19.99	-wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 53.89 51.28 54.31 Se COI Fence 34.06	Comp Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 59.65 59.65 59.65 59.62 61.27 63.21 mparis Pole 46.92	arison Tr. Ligh 66.72 58.88 68.37 70.18 50.00 ff 7r. Ligh 59.99 65.40 66.90 68.99 50.00 ff Tr. Ligh 45.14	n of n t Tr. : 76 74 76 79 TMIO t Tr. : 71 74 75 77 71 74 75 77 71 74 75 77 71 74 75 79 70 79 70 70 70 70 70 70 70 70 70 70	nIoUs Sign 7 48 12 44 10 Us wi Sign 7 32 98 08 54 Us wi Sign 7 59	s with Vegetation 92.32 90.46 92.01 92.35 th bas Vegetation 90.40 91.74 91.63 92.03 th bas Vegetation 83.91 83.91	basel: n Terra 63.8 56.4 63.0 64.4 Selines n Terra 59.9 61.6 62.2 63.9 Selines n Terra 42.9 42.9	ines c in Sk in Sk id 93. 2 94. S on C in Sk id 94. S on C in Sk id 94. S on C id 95. S on C id 95. S on C id 96. S on C id 106. S on C id 96. S on C id	on Cit xy Pe 57 88 08 73 82 8 89 8 Citysc: 56 72 14 73 41 75 50 8 Citysc: xy Pe 50 8 Citysc: 56 72 14 73 41 75 50 8 Citysc: 56 8 Citysc: 56 72 56 8 57 8 56 72 56 8 57 8 56 72 56 72 56 8 57 8 56 8	yscar rson 2.05 apes : rson 5.87 8.91 9.57 0.68 apes : rson 4.94	Des for Rider 0 59.99 94 56.99 92 61.90 94 62.30 94 for ima Rider 61.02 94 57.76 92 61.08 94 for ima 94	clean i ar Tn 39 74 .27 69 .27 70 .65 72 ges Wil ar Tn .20 68 .95 72 .00 733 .33 74 ges Wil ar Tn .45 54	mag ick 78 40 114 007 th L ick 27 39 38 38 th L ick 48 48 48	ges. Bus 85.85 78.50 82.57 85.11 <u>J</u> bl Bus 81.32 84.72 <u>J</u> bl Bus 65.28	Train 71.80 62.60 66.01 66.34 UIT. Train 55.30 72.44 64.99 65.92 UIT. Train 25.67	Mot 6 6 6 5 5 5 5 6 6 Mote 4 4 4 4 4 4 4 4 4 4 4 4 4	orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24 prcycle 0.05	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle 57.96
No Retraining Finetuning MBA Ours No Retraining MBA Ours No Retraining Finetuning Finetuning	Road S 97.93 97.93 97.25 97.86 97.88 97.88 Road S 97.74 97.75 97.76 97.76 97.78 95.26 95.26 97.58	Tal idewalk I 83.77 79.42 83.60 I Table i idewalk I 80.71 82.31 82.39 82.39 82.39 82.67 Table i idewalk I 71.99 81.02 81.02 14.02	ble S7. building 91.82 90.45 92.00 92.28 S8. Cla building 90.00 91.51 91.43 90.45 90.45 90.45 91.43 91.43 90.45 90.45 90.45 91.43 91.87 90.45 90.45 90.45 91.43 91.43 90.45 90.45 90.45 90.45 91.43 90.45	Class Wall 46.47 32.62 41.98 47.73 MSS-Wi Wall 46.46 41.49 48.61 MSS-Wi Wall 19.99 45.21 29.12 20.12 45.21 20.12 45.21 20.12 45.21 20.12 45.21 20.12 45.21 20.12 45.21 45.	-wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 53.89 51.28 54.31 Se COI Fence 34.06 50.65 90.65	Comp Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 61.27 63.21 mparis Pole 46.92 56.68 69.65	arison Tr. Ligh 66.72 58.88 68.37 70.18 300 of Tr. Ligh 59.99 65.40 66.90 68.99 300 of Tr. Ligh 45.14 62.47 62.47	n of n it Tr. : 76 74 76 77 79 70 70 71 71 74 75 77 77 77 77 77 77 70 71 74 75 77 77 77 77 70 78 79 79 79 70 70 79 70 70 70 70 70 70 70 70 70 70	nIoUs Sign 7 48 12 44 10 Us wi Sign 7 32 98 08 54 Us wi Sign 7 59 12 60	s with Vegetation 92.32 90.46 92.01 92.35 th bas Vegetation 90.40 91.74 91.63 92.03 th bas Vegetation 92.03 1.74 91.63 92.03 1.74 91.25 92.03	basel n Terra 63.8 56.4 63.0 64.4 selines n Terra 66.2 63.9 59.9 61.6 62.2 63.9 64.6 62.2 63.9 64.4 63.0 64.4 64.4 63.0 64.4 64.4 63.0 64.4 64	ines c in Sk 44 94. 10 93. 12 94. 18 94. 18 94. 17 91. 13 94. 17 91. 13 94. 17 94. 14 94. 16 01 16 16 16 16 16 16 16 16 16 16 16 16 16	on Cit y Pe 57 88 08 74 82 88 89 82 Citysc: xy Pe 56 72 14 74 41 75 50 88 Citysc: xy Pe 56 72 14 75 50 88 Citysc: xy Pe 50 87 50 88 Citysc: xy Pe 50 87 50 88 Citysc: xy Pe 50 87 50 88 50 87 50 88 Citysc: xy Pe 50 87 50 88 Citysc: xy Pe 50 87 50 88 50 87 50 88 Citysc: xy Pe 50 87 50 88 50 87 50 88 50 88	yscar rson 0.60 3.44 1.21 2.05 apes apes 3.91 0.57 0.68 apes rson 4.94 7.36	Rider C Rider C 59.99 42 56.99 92 61.90 92 62.30 92 for ima Rider C 57.76 92 61.08 94 for ima Rider C 8.ider C Rider C 35.60 85 55.92 92	clean i ar Tn .39 74 .27 69 .27 70 .65 72 ges wil ar Tn .20 68 .20 68 .20 68 .20 74 .20 68 .20 74 .20 74 .20 74 .20 74 .20 74 .20 74 .20 74 .20 74 .33 74 .33 74 .33 74 .33 74 .33 74 .33 74 .33 74 .33 74	mag ick 78 40 14 07 th L ick 27 39 38 38 th L ick 48 61 40 14 14 14 14 14 14 14 14 14 14	ges. Bus 85.85 78.50 82.57 85.11 <u>J</u> bl Bus 84.72 <u>J</u> bl Bus 65.28 80.09 20.65	Train 71.80 66.01 66.34 Ur. Train 55.30 72.44 64.99 65.92 Ur. Train 25.67 64.94 (1.92	Mot 5 4 6 6 6 5 5 5 6 6 Mote 44 55	orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24 prcycle 0.05 5.07	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle 57.96 71.70
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours No Retraining Finetuning MBA	Road S 97.93 97.25 97.85 97.88 97.88 97.39 97.74 97.75 97.75 97.76 97.76 97.76 97.58 97.58	Tal idewalk I 83.77 79.42 79.42 83.29 83.60 I Table I idewalk I 82.31 82.30 82.67 I Table I Idewalk I 81.02 81.40	ble S7. suilding 91.82 90.45 92.00 92.28 S8. Cla suilding 90.00 91.51 91.43 91.87 S9. Cla suilding 84.01 90.84 90.84 90.81 91.87	Class Wall 46.47 32.62 41.98 47.73 ASS-Wi Wall 46.46 41.49 48.61 ASS-Wi Wall 19.99 45.21 39.13 46.02	-wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 53.89 51.28 54.31 Se COI Se COI 51.26 54.31 Se COI 51.23 51.23	Comp Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 59.65 61.27 63.21 mparis Pole Pole 66.8 58.55 6.68 58.55	arison Tr. Ligh 66.72 58.88 68.37 70.18 300 of Tr. Ligh 59.99 65.40 66.90 68.99 300 of Tr. Ligh 45.14 62.47 63.79 66.14	n of n t Tr. : 76 74 76 77 79 70 70 71 74 75 77 77 77 70 71 74 75 77 77 70 71 74 75 77 77 70 71 74 76 79 79 79 70 70 79 70 70 70 70 70 70 70 70 70 70	nIoUs Sign 7 48 112 44 10 Us wi Sign 7 32 98 08 54 Us wi Sign 7 12 60 29 29 29 29 29 29 29 29 29 29	s with Vegetation 92.32 90.46 92.01 92.35 th bas Vegetation 90.40 91.74 91.63 92.03 th bas Vegetation 83.91 91.25 91.07 91.59	basel n Terra 63.8 56.4 63.0 64.4 selines n Terra 59.9 61.6 62.2 63.9 63.8 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 63.9 63.9 63.9 64.2 63.9 63.9 64.2 63.9 63.9 64.2 63.9 64.2 63.9 64.2 64	ines c in Sk 44 94. 40 93. 12 94. 8 94. 5 on C 13 94. 5 on C 14 94. 15 01 15 01 16 01 17 91. 3 94. 5 on C 18 01 19 01 10 03 10 0 10 0 10	on Cit y Pe 57 88 08 74 82 88 889 82 Citysc: y Pe 56 72 14 74 41 75 50 88 Citysc: y Pe 46 66 71 77 21 77 22 77	yscar rson .60 8.44 1.21 2.05 apes .87 8.91 9.57 0.68 apes 	Design for C Rider C 59.99 92 56.99 92 61.90 94 62.30 94 For ima Rider 752.28 92 57.76 92 60.108 94 for ima Rider 61.08 94 for ima S5.92 55.92 93 58.76 92 58.78 93 58.78 93	clean i ar Tn .39 74 .27 69 .27 70 .65 72 ges wil ar Tn .20 68 .95 72 .00 73 .33 74 ges Wil ar Tn .45 54 .45 71 .92 72	mag ick 78 40 14 07 th L 27 39 38 38 th L ick 48 61 40 89	ges. Bus 85.85 78.50 82.57 85.11 J1 bl Bus 78.62 83.65 81.32 84.72 2 bl Bus 65.28 80.09 78.69 78.69	Train 71.80 66.01 66.34 Ur. Train 55.30 72.44 64.99 65.92 UIT. Train 25.67 64.94 61.37 60.04	Mot 5 4 6 6 6 6 5 5 5 6 6 6 6 6 6 6 6 6 6 6 6 6	orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24 brcycle 0.05 5.07 4.23	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle 57.96 71.70 71.33 73.09
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88 97.88 97.39 97.74 97.75 97.76 97.76 8 97.39 97.74 97.75 97.76 97.76 97.76 97.76 97.77 97.76	Tal idewalk F 83.77 79.42 79.42 83.60 Table - idewalk F 82.31 82.31 82.31 82.33 82.33 82.31 82.34 - math between the state of the st	ble S7. auilding 91.82 90.45 92.00 92.28 S8. Cla auilding 90.00 91.51 91.43 91.87 S9. Cla auilding 84.01 90.81 90.81 90.81 91.32	Class Wall 46.47 32.62 41.98 47.73 Wall 40.19 46.46 41.49 48.61 Mass-Wi Wall 19.99 45.21 39.13 46.03	-wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 53.89 51.28 54.31 Se COI Fence 34.06 50.65 48.83 51.23	Comp Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 61.27 63.21 mparis Pole 46.92 56.68 58.55 60.55	arison Tr. Ligh 66.72 58.88 68.37 70.18 300 of Tr. Ligh 65.40 66.90 68.99 300 of Tr. Ligh 45.14 62.47 63.79 66.19	n of n t Tr. 3 76 74 76 77 79 70 70 71 71 74 71 74 75 77 77 77 77 77 77 77 77 77	nIoUs Sign 7 48 12 44 10 Us wi Sign 7 98 08 54 Us wi Sign 7 59 12 60 29	s with Vegetation 90.46 92.01 92.35 th bas Vegetation 90.40 91.74 91.63 92.03 th bas Vegetation 83.91 91.25 91.07 91.59	basel n Terra 63.8 56.4.4 63.0 64.4 Seliness n Terra 59.9 61.6 62.2 63.9 64.4 Seliness n Terra 42.9 60.2 61.3 62.6	ines c in Sk 44 94. 10 93. 12 94. 18 94. 5 on C in Sk 17 91. 33 94. 14 94. 5 on C in Sk 13 94. 14 94. 5 on C in Sk 13 94. 14 94. 15 94. 16 93 86. 17 94. 16 93 86. 17 94. 16 93 86. 17 94. 16 94. 17 94. 17 94. 16 94. 17 94. 19 94. 19 94. 19 94. 19 94. 19 94. 10 94. 1	on Cit cy Pec 57 80 87 82 889 82 Citysc: Citysc: cy Pec 50 87 214 71 50 88 Citysc: Citysc: cy Pec Citysc: Citysc: Citysc: Citysc: <	yscar rson .60 8.44 1.21 2.05 apes : .891 9.57 8.91 8.94 8.95 8.91 8.95 8.91 8.95 8.91 8.95 8.91 8.95 8.91 8.95 8.91 8.95 8.91 8.95 8.91 8.94 8.95 8.55	Best for Rider C Rider C So.99 92 56.99 92 So.99 92 61.90 94 So.97 94 for ima Rider C So.77.6 92 60.32 94 Go.32 94 Go.32 94 for ima Rider C So.77.6 92 So.77.6 92 So.77.6 92 So.77.6 92 So.77.6 92 So.77.6 92 So.78 92 So.78 92 So.78 92 So.78.78 92 <td< td=""><td>clean i ar Tn .39 74 .27 69 .27 70 .65 72 ges wil ar Tn .20 68 .95 72 .00 73 .33 74 .33 74 .44 .5 .44 .9 .51 .71 .92 .73</td><td>mag ick 78 40 14 07 th L ick 27 39 38 38 th L ick 48 61 40 89</td><td>ges. Bus 85.85 78.50 82.57 85.11 .1 bl Bus 78.62 83.65 81.32 84.72 .2 bl Bus 65.28 80.09 78.69 81.55</td><td>Train 71.80 62.60 66.01 66.34 UIT. Train 55.30 72.44 64.99 65.92 UIT. Train 25.67 4.94 61.37 60.04</td><td>Mot 5 4 6 6 Mot 5 5 5 6 6 6 6 6</td><td>orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24 orcycle 0.05 5.07 4.23 1.16</td><td>Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle 57.96 71.73 71.33 73.09</td></td<>	clean i ar Tn .39 74 .27 69 .27 70 .65 72 ges wil ar Tn .20 68 .95 72 .00 73 .33 74 .33 74 .44 .5 .44 .9 .51 .71 .92 .73	mag ick 78 40 14 07 th L ick 27 39 38 38 th L ick 48 61 40 89	ges. Bus 85.85 78.50 82.57 85.11 .1 bl Bus 78.62 83.65 81.32 84.72 .2 bl Bus 65.28 80.09 78.69 81.55	Train 71.80 62.60 66.01 66.34 UIT. Train 55.30 72.44 64.99 65.92 UIT. Train 25.67 4.94 61.37 60.04	Mot 5 4 6 6 Mot 5 5 5 6 6 6 6 6	orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24 orcycle 0.05 5.07 4.23 1.16	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle 57.96 71.73 71.33 73.09
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88 97.87 97.39 97.74 97.75 97.75 97.76 97.76 97.76 97.58 97.58 97.58 97.58 97.58 97.58	Tail idewalk I 83.77 79.42 79.42 83.29 83.60 I Table I idewalk I 80.71 82.31 82.37 I Table I idewalk I 81.02 81.40 81.24 Table S	ble S7. building 91.82 90.45 92.00 92.28 S8. Cla building 90.00 91.51 91.43 91.87 S9. Cla building 84.01 90.84 90.84 90.81 91.32 S10. Cl	Class Wall 46.47 32.62 41.98 47.73 ISS-Wi Wall 40.19 46.46 41.49 48.61 ISS-Wi Wall 45.21 39.13 46.03 aSS-W	-wise Fence 59.01 49.39 53.98 56.78 8e COI 53.89 51.28 54.31 8e COI 54.31 8e COI 34.06 50.65 51.23 51.23 51.23 51.23 51.23	Comp Pole 61.95 59.07 64.06 65.54 mparis Pole 61.27 63.21 mparis Pole 46.92 56.68 58.55 60.55 60.55	arisoo Tr. Ligh 66.72 58.88 68.37 70.18 000 of 65.40 65.40 66.90 65.40 66.90 68.99 000 of Tr. Ligh 45.14 62.47 63.79 66.19 66.19 500 00	n of rr t Tr. : . 776 74 779 797 797 797 797 797 797	nloU: Sign (1) 48 12 44 10 Us wi 51 98 08 54 59 12 60 29 Us wi 59 12 60 29 Us wi 59 12 44 59 12 44 12 44 12 44 12 44 44 12 44 12 44 12 44 12 44 12 44 12 44 12 44 12 44 12 44 12 44 12 44 12 44 12 44 12 44 12 44 12 44 12 44 12 12 12 12 12 12 12 12 12 12	s with Vegetation 92.32 90.46 92.01 92.35 th bas Vegetation 90.40 91.74 91.63 92.03 th bas Vegetation 83.91 91.25 91.07 91.59 ith ba	basel n Terra 63.8 56.4 63.0 64.4 selines n Terra 59.9 61.6 62.2 63.9 62.2 63.9 62.2 63.9 62.2 63.9 62.2 63.9 64.4 59.9 61.6 62.6 62.6 63.9 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.0 64.4 63.9 64.2 63.9 64.2 63.9 64.2 63.9 64.2 63.9 64.2 64	ines c sin Ski sin Ski son C son C son C sin Ski son C sin Ski son C sin Ski	String Period type Period type </td <td>yscap rson 0.60 8,44 1.21 2.05 appes : rson 4.94 7.36 appes : rson 4.94 7.74 8.52 cappes</td> <td>Design for Rider C 55.99 9 56.99 9 56.99 9 61.90 94 61.90 94 62.30 94 60r 1maa Rider C 52.28 92 57.76 92 57.76 92 56.30 94 61.08 94 94 94 for imaa Rider C 35.60 85 55.92 93 58.78 93 58.86 92 for imaa for imaa 69 60 100 94</td> <td>clean i ar Tn 39 74 27 69 27 70 .65 72 ges wi ar aar Tn .20 68 .95 72 .00 73 .33 74 ges wi ar ar Tn .45 54 .45 54 .45 54 .92 73 ages W wages W</td> <td>mag ick 78 40 14 107 th L ick 27 39 38 38 th L ick 40 61 40 89 ith l</td> <td>ges. Bus 85.85 78.50 82.57 85.11 Bus 78.62 83.65 81.32 84.72 2 bl Bus 65.28 80.09 81.55 L3 bl</td> <td>Train 71.800 62.60 66.01 66.34 Ur. Train 55.33 72.44 64.99 65.92 55.37 72.44 64.99 65.92 25.67 64.94 61.37 60.04 1ur.</td> <td>Mot 5 6 6 6 7 5 5 5 5 5 6 6 6</td> <td>orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24 orcycle 0.05 5.07 4.23 1.16</td> <td>Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle 57.96 71.70 71.33 73.09</td>	yscap rson 0.60 8,44 1.21 2.05 appes : rson 4.94 7.36 appes : rson 4.94 7.74 8.52 cappes	Design for Rider C 55.99 9 56.99 9 56.99 9 61.90 94 61.90 94 62.30 94 60r 1maa Rider C 52.28 92 57.76 92 57.76 92 56.30 94 61.08 94 94 94 for imaa Rider C 35.60 85 55.92 93 58.78 93 58.86 92 for imaa for imaa 69 60 100 94	clean i ar Tn 39 74 27 69 27 70 .65 72 ges wi ar aar Tn .20 68 .95 72 .00 73 .33 74 ges wi ar ar Tn .45 54 .45 54 .45 54 .92 73 ages W wages W	mag ick 78 40 14 107 th L ick 27 39 38 38 th L ick 40 61 40 89 ith l	ges. Bus 85.85 78.50 82.57 85.11 Bus 78.62 83.65 81.32 84.72 2 bl Bus 65.28 80.09 81.55 L3 bl	Train 71.800 62.60 66.01 66.34 Ur. Train 55.33 72.44 64.99 65.92 55.37 72.44 64.99 65.92 25.67 64.94 61.37 60.04 1ur.	Mot 5 6 6 6 7 5 5 5 5 5 6 6 6	orcycle 9.36 8.83 0.68 3.72 orcycle 3.55 8.10 7.84 4.24 orcycle 0.05 5.07 4.23 1.16	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle 57.96 71.70 71.33 73.09
No Retraining Finctuning MBA Ours No Retraining Finctuning MBA Ours No Retraining Finctuning MBA Ours	Road S 97.93 97.25 97.85 97.88 97.88 97.39 97.74 97.75 97.76 97.76 Road S 95.26 97.58 97.58 97.58 97.58 97.58	Tal idewalk F 83.77 79.42 83.29 83.60 Table idewalk F 71.99 81.02 81.40 81.24 Table S idewalk F	ble S7. auilding 91.82 90.45 92.09 92.28 88. Cli building 90.00 91.51 91.43 91.87 91.87 89. Cli auilding 84.01 90.84 90.81 9	Class Wall 46.47 32.62 41.98 47.73 45.78 46.46 41.49 46.46 41.49 48.61 Uss-Wi Wall 19.99 45.21 39.13 46.03 ass-Wi Wall 40.03 40.	-wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 51.28 54.31 Se COI Fence 54.55 Se Se COI Fence 54.55 Se Se S	COMP Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 61.27 63.21 mparis Pole 46.92 56.68 58.55 60.55 60.55 60.55	arisou Tr. Ligh 66.72 58.88 68.37 70.18 on of Tr. Ligh 66.90 66.90 66.90 77. Ligh 66.90 66.90 66.90 66.91 66.91 66.91 66.47 63.79 66.19 66.19	n of r t Tr. t. Tr. 76 74 76 79 79 70 70 71 71 71 74 71 74 71 74 75 77 77 77 77 77 77 77 77 77	nIoU: Sign (1) 48 12 44 10 US Wi 32 32 33 32 33 32 35 54 US Wi 54 US Wi 59 12 60 29 US Wi 59 12 20 29 US Wi 59 12 12 12 12 12 12 12 12 12 12	s with Vegetation 92.32 90.46 92.01 92.35 10.46 92.01 92.35 10.46 92.01 91.74 91.63 92.03 10.40 91.74 91.63 92.03 10.40 91.75 91.07 91.59 11.07 91.59	basel: n Terra 63.8 56.4 63.0 64.4 Selines n Terra 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.2 62.2 63.9 61.2 62.2 63.9 61.4 62.2 63.9 61.4 62.2 63.9 61.4 62.2 63.9 61.4 62.2 63.9 61.4 62.2 63.9 61.4 62.2 63.9 61.4 62.2 63.9 61.4 62.2 63.9 61.4 62.2 63.9 61.4 62.2 63.9 61.4 62.2 63.9 61.4 62.2 63.9 61.2 63.9 61.2 63.9 61.2 63.9 61.2 63.9 61.2 63.9 61.2 63.9 61.2 63.9 61.2 63.9 61.2 63.9 63.2 63.9 64.4 63.9 63.9 64.4 63.9 64.4 64.4 64.2 63.9 64.2 64.2 63.9 64.2 6	ines cc in 514 94, 10 93, 12 94, 10 93, 12 94, 10 93, 12 94, 10 94, 17 91, 17 91, 17 91, 17 94, 13 86, 13 86, 13 86, 19 93, 13 99, 14 94, 15 99, 13 99, 14 94, 15 99, 15 99, 1	cm Cit cy Pe cs Pe	yscar rson 0.60 8.44 1.21 2.05 apes : 8.87 8.91 9.57 0.68 apes : 7.74 1.94 7.36 7.74 8.52 apes : 7.06 7.74 7.76 7.76 7.74 7.76 7.776 7.76 7.777 7.76 7.777 7.76 7.777 7.76 7.76 7	Best for Rider C Rider C So,99 92 56,99 92 So,99 92 61,90 94 So,99 92 62,30 92 So,99 92 61,90 94 So,77,6 92 60,32 94 So,77,76 92 61,08 94 So,77,76 92 for imaa Rider C So,77,76 92 55,92 92 So,78 92 So,78 92 58,66 92 So,78	clean i ar Tra 39 74 27 69 27 70 .65 72 ges Wil ar Tra .20 68 .95 72 .00 73 .33 74 ges Wil ar Tra ray Tra .00 73 .33 74 ges Wil ar Tra .02 73 .03 74 .04 69 .51 71 .92 73 .92 73 .92 .93	mag res res 40 14 07 th L 14 07 th L 12 39 38 38 th L 16k 48 61 40 89 ith l 16k 17 18 19 10 10 14 14 14 14 14 14 14 14 14 14	ges. Bus 85.85 78.50 82.57 85.11 Bus 78.62 83.65 81.32 2 bl Bus 65.28 80.09 81.55 81.52 81.52 80.09 81.55 81.55 80.09 81.55 80.57 80.00 80.57 80.00 80.57 80.00 80.	Train 71.80 62.60 66.01 66.34 UI. Train 55.30 72.44 64.99 65.92 UI. Train 64.94 61.37 64.94 61.37 64.94 61.37 64.04 1.37 64.04 61.37 64.04 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 64.94 61.37 72 72 72 72 72 72 72 72 72 72 72 72 72	Mot 5 5 5 6 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	orcycle 9.36 8.83 0.68 8.372 orcycle 8.10 8.10 8.10 7.84 4.24 0.05 5.07 4.23 1.16	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle 57.96 71.70 71.33 73.09 Bicycle
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours No Retraining MBA Ours	Road S 97.93 97.25 97.86 97.86 97.86 97.87 97.74 97.75 97.76 97.76 8 97.39 97.74 97.75 97.75 97.76 97.75 97.76 97.88 97.58 8 87	Tal idewalk F 83.77 79.42 83.78 79.42 83.79 83.60 Table I idewalk F 80.71 82.31 82.39 82.67 Table I idewalk F 71.99 81.02 81.40 81.24 Table 56.01	ble S7. building 90.82 90.45 92.00 92.28 S8. Cla Building 90.00 91.51 91.43 91.51 91.43 91.87 S9. Cla S9.	Class Wall 46.47 32.62 41.98 47.73 HSS-W1 Wall 19.99 45.21 19.99 45.21 9.03 46.03 HSS-W1 Wall 43.85 45.85 45.8	-wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 51.28 54.31 Se COI 50.65 51.28 54.31 Se COI 50.65 51.23 51.	COMP Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 61.27 63.21 mparis Pole 46.92 56.68 58.55 60.55 60.55	arisou Tr. Light 66.72 58.88 68.37 70.18 00n of fTr. Light 65.40 66.90 68.99 00n of Tr. Light 65.47 66.90 68.99 66.90 67.10 66.90 66.90 66.90 67.10 66.90 67.10 67.10 67.10 67.10 67.10 67.10 67.10 77.10	n of r t Tr. : Tr. : 766 744 767 79 79 79 70 70 71 71 71 74 75 71 71 74 75 70 70 70 70 70 70 70 70 70 70 70 70 70	nIoUs Sign (12) 48 12 44 10 Us wi Sign (12) 32 98 08 54 Us wi Sign (12) 59 12 60 29 Us wi Sign (12) 12 12 12 12 12 12 12 12 12 12	s with Vegetation 92,32 90,46 92,01 92,35 th bas Vegetation 91,74 91,63 92,03 91,74 91,63 92,03 th bas Vegetation 91,74 91,63 91,74 91,63 91,74 91,63 91,63 91,74 91,63 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,59 91,74 91,74 91,59 91,74 91,74 91,74 91,59 91,745 91,745 91,	basel: n Terra 63.8 56.4 63.0 64.4 selines: n Terra 59.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 61.3 62.2 61.3 62.2 61.3 62.2 61.3 62.6 62.2 61.3 62.6 62.2 61.3 62.6 62.2 61.3 62.6 62.2 61.3 62.6 62.2 61.3 62.6 62.2 61.3 62.6 62.2 61.3 62.6 62.2 61.3 62.6 62.2	ines cc si inin Si inin Si inin Si son CC Si inin Si son CC Si inin Si si 94.4 vi/7 94.4 vi/7 94.4 son CC Si	n Citt y Pe 008 77 80 008 77 80 89 88 014 77 14 77 50 80 014 77 14 77 50 80 014 77 14 77 50 80 014 77 14 77 50 80 014 77 14 77 14 77 50 80 014 77 14 77 12 77 17	yscap rson 3.44 1.21 2.05 appes : rson 5.87 3.91 9.57 0.68 appes : rson 4.94 7.36 7.74 8.52 capes : stan 8.92 2.95 2.	Dess for Rider C Rider C 50.99 92 56.99 92 56.99 92 61.90 94 62.30 94 for ima Rider C 52.28 93 for ima Rider C 35.60 85 for ima Rider C 35.60 85 55.92 93 58.78 92 58.78 92 58.76 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.78 92 58.76 92 58.76 92 58.76 92 58.76 92 58.76 92 58.76 92 58.76 92 58.76 92 58.76	clean i ar Tr 39 74 27 69 27 70 65 72 ges Wil ar Tr 20 68 95 72 .00 73 .33 74 ges Wil ar Tr .45 54 .49 69 .51 71 .92 73 ages Wil ar Tr .92 73	mag ick 78 40 14 07 th L ick 40 39 38 38 th L ick 48 61 40 89 ith l ick 91	ges. Bus 85.85 78.50 82.57 85.11 <u>J</u> bl Bus 78.62 83.65 81.32 84.72 <u>J</u> bl Bus 65.28 80.09 78.69 81.55 <u>Bus</u> 65.28 80.09 78.50 <u>Bus</u> 81.55 <u>Bus</u> 84.72 <u>J</u> bl Bus 65.28 80.99 78.50 <u>Bus</u> 84.72 <u>J</u> bl Bus 65.28 80.99 78.50 <u>Bus</u> 84.72 <u>J</u> bl Bus 65.28 80.99 78.60 <u>Bus</u> 84.72 <u>J</u> bl Bus 65.28 80.99 78.60 84.72 <u>J</u> bl Bus 65.28 80.99 78.60 84.75 <u>Bus</u> 84.72 <u>J</u> bl Bus 65.28 80.99 78.60 84.75 <u>Bus</u> 84.72 <u>J</u> bl Bus 65.28 80.99 78.60 84.75 <u>Bus</u> 65.28 84.75 <u>Bus</u> 64.75 <u>Bus</u> 65.28 84.75 <u>Bus</u> 65.28 84.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 64.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u>Bus</u> 84.75 <u></u>	Train 71.80 62.60 66.01 66.34 UI. Train 72.44 64.99 65.92 UI. Train 60.04 01.37 60.04 UI. Train 15.47	Mot 5 5 5 5 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	orcycle 9.36 8.83 3.55 8.10 7.84 4.24 orcycle 0.05 6.07 1.16	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle 57.96 71.70 71.33 73.09 Bicycle 34.33
No Retraining Finctuning MBA Ours No Retraining Finctuning MBA Ours No Retraining Finctuning MBA Ours No Retraining Finctuning MBA Ours No Retraining Finctuning MBA Ours	Road S 97.93 97.25 97.86 97.88 97.88 97.39 97.74 97.75 97.76 97.76 97.58 97.58 97.58 97.76 97.58 97.58 97.58 97.58 97.58 97.58 97.58 97.58 97.58 97.58 97.58 97.58 97.58 97.58	Tail idewalk I 83.77 79.42 79.42 83.29 83.29 83.60 Table 1 idewalk I 82.31 82.39 82.67 Table idewalk I 81.02 81.40 81.24 Table S idewalk I 76.01 78.11	ble S7. building 91.82 90.45 92.00 92.28 S8. Cli building 90.00 91.51 91.43 91.87 S9. Cli building 84.01 90.84 90.84 90.84 90.81 91.32 S10. Cli building 70.76 S9.58	Class Wall 46.47 32.62 41.98 47.73 40.19 46.46 44.149 48.61 19.99 48.61 19.99 45.21 39.13 46.03 46.03 45.21 39.13 46.03	-wise Fence 59.01 49.39 53.98 56.78 52.16 53.89 51.28 54.31 Se COI Fence 54.31 Se COI Fence 51.28 54.31 Se Fonce 51.28 54.31 Se Fonce 51.28 55.28 5	Comp Pole 61.95 59.07 64.06 65.54 65.54 59.65 59.65 61.27 63.21 mparis Pole 46.92 56.68 58.55 60.55 60.55 mpari Pole 31.88 50.35	arisou Tr. Light 66.72 58.88 68.37 70.18 con of Tr. Light 66.99 65.40 66.99 00 of 66.90 00 of 7r. Light 45.14 66.19 50.00 O 7r. Light 55.97 66.19 77.19 800 O	n of rr t Tr. : 766 74 76 79 79 79 79 79 79 79 79 79 70 71 71 74 75 77 77 77 77 77 77 77 77 77 77 77 77	Ious Sign * 12 * 14 * 12 * Us with * Sign *	s with Vegetation 92,32 90,46 92,37 92,01 92,01 92,03 10,90,40 91,74 91,63 92,03 92,03 11,74 91,63 92,03 11,74 91,63 91,25 91,07 91,59 11,59	basel n Terra 63.8 56.4 63.0 64.4 selines n Terra 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 60.2 61.6 62.2 63.9 60.2 61.6 62.2 63.9 60.2 61.6 62.2 61.8 62.2 61.3 62.6 61.2 63.9 60.2 61.2 63.9 60.2 61.2 61.2 62.2 61.3 62.6 61.2 61.2 61.2 62.2 61.3 62.6 61.2 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 61.3 62.6 62	ines cc Si iii Si 94,4 iii Si 94,4 iii Si 94,4 iii Si 94,4 s on CC iiii Si 96,6 iiii Si 94,4 s on CC iiii Si 96,6 iiii Si 96,0 iiii Si 96,0 iiii Si 96,0 iiii Si 06,0 ci Si 01,0	on Citt typ Pee transform transform transform	yscal rson 0.60 8.44 1.21 2.05 apes : rson 5.87 0.57 0.68 apes : rson 0.57 0.68 apes : rson 3.91 0.57 0.68 apes : rson 3.94 7.74 3.52 apes : rson 3.92 0.95 3.92 0.95 3.92 0.94 0.95 0.94 0.94 0.94 0.94 0.94 0.95 0.94 0.95 0.94 0.94 0.94 0.94 0.94 0.94 0.94 0.94 0.94 0.94 0.94 0.95 0.94 0.94 0.94 0.94 0.95 0.94 0.94 0.94 0.94 0.94 0.95 0.94 0.94 0.94 0.94 0.95 0.94 0	Design for Gradient	clean i ar Tn 39 74 27 69 27 70 .65 72 .00 73 .03 74 .05 72 .00 73 .33 74 ges Wi ar Tn .45 54 .49 69 .51 71 .92 73 ages Wi ar Tn .92 73 ages W ar Tn .92 73	mag ick 78 40 14 07 th L ick 27 39 38 38 th L ick 40 27 39 38 38 th L ick 40 27 39 38 38 53 53 53	ges. Bus 85.85 78.50 85.51 Bus 78.62 83.65 81.32 84.72 .2 bl Bus 65.28 80.09 78.69 81.55 L3 b Bus Bus 49.24 49.24	Train 71.80 62.60 66.01 66.34 ur. Train 55.30 72.44 64.99 65.92 ur. Train 72.44 64.99 61.37 60.04 10.7 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 80.04 i 10.04 i 10.04 i 10.04 i 10.04 i 10.00	Mot 5 4 6 6 0 0 0 0 0 0 0 0 0 0 0 0 0	orcycle 9.36 8.83 3.72 orcycle 0.65 8.10 7.84 4.24 0.05 0.67 4.23 1.16 orcycle 0.67 5.86 0.07 4.23 1.16	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle 57.96 71.70 71.33 73.09 Bicycle 34.33 67.75
No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.85 97.88 97.88 97.39 97.74 97.75 97.76 97.76 97.78 97.75 97.76 97.76 97.78 97.78 86.87 97.58 86.87 97.24 97.26 97.58	Tal idewalk I 83.77 79.42 79.42 83.69 83.60 I Table I idewalk I 82.31 82.31 82.31 82.33 82.31 82.31 82.39 82.67 Table I idewalk I 81.02 81.02 81.02 81.40 81.24 I Table 56.01 78.69 78.69	ble S7. kuilding 91.82 90.45 92.00 92.28 88. Cli kuilding 90.00 91.51 91.43 91.87 89. Cli kuilding 90.84 90.81 90.81 91.32 84.01 90.81 90.81 90.82 90.81 90.82 90.81 90.82 90.81 90.82 90.81 90.82 90.81 90.82 90.81 90.82 90.81 90.82 90.81 90.82 9	Classs Wall 46.47 32.62 41.98 47.73 Wall 40.19 48.61 HSS-W1 Wall 45.21 39.13 46.03 45.21 39.13 46.03 45.21 39.13 46.03	-wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 53.89 51.28 54.31 Se COI Fence 34.06 54.83 51.23 Se COI Fence 12.99 43.82 43.17 Se COI Fence 12.99 43.82 51.78	COMP Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 59.65 61.27 63.21 mparis Pole 46.92 56.68 58.55 60.55 60.55 60.55 60.55 60.55	arisol Tr. Ligh 66.72 58.88 68.37 70.18 59.99 59.99 65.40 65.40 65.40 66.90 68.99 con of Tr. Ligh 45.14 66.79 66.19 66.79 66.19 66.79 66.79 66.79 66.79 77.79 57.56 58.71	n of n t Tr. : 76 76 74 76 79 70 70 70 70 70 70 70 70 70 70	nIoUs sign ' 48 12 44 10 US wi sign ' 54 US wi sign ' 54 US wi sign ' 54 US wi sign ' 54 US wi 54 US wi 56 US	s with Vegetation 92,32 90,46 92,01 92,35 th bas Vegetation 91,74 91,63 92,03 th bas Vegetation 91,74 91,67 91,25 91,07 91,07 91,25 91,07 91,25 91,07 91,25 91,07 91,25 91,07 90,07	basel: n Terra 63.8 56.4 63.0 64.4 Selines: n Terra 59.9 61.6 62.2 63.9 Selines: n Terra 42.9 60.2 61.3 62.6 59.3 62.6 1.3 62.6 1.3 62.6 59.9 61.5 6.5 6.5 6.5 6.5 6.5 6.5 6.5 6	ines cc ines si in SI in SI in SI son C Si son C Si inin SI son C Si <	n Citt y Pe 57 80 808 77 82 88 88 88 Citysc: y Pe 66 77: 50 80 Citysc: y Pe 75 80 80 80 80 80 80 80 80 80 80	yscar rson 0.60 8.44 1.21 2.05 appes 8.87 8.91 9.57 0.68 appes 1.74 9.49 7.36 7.74 9.49 7.36 7.74 9.49 7.36 8.52 2.96 8.92 2.96 8.91 9.57 9.5	Design of the set of	clean i ar Tra 39 74 27 69 2.27 70 .65 72 .65 72 .00 73 .33 74 ges will ar Tra .33 74 ges will ar Tra .33 74 ges will ar Tra .95 72 .33 74 ges will ar Tra .95 73 .95 72 .95 73 .92 73 .92 73 .92 .93 .93 .94 .95 .67 .14 .65	mag ick 78 40 14 07 th L ick 27 39 38 38 th L ick 40 14 07 th L ick 40 14 07 th L ick 27 39 38 38 th L ick 40 14 14 14 14 14 14 14 14 14 14	ges. Bus 85.85 82.57 85.11 Bus 78.62 83.65 83.65 84.72 Bus 65.28 80.09 81.55 Bus 65.28 80.69 81.55 Bus 81.55	Train 71.80 62.60 66.01 66.34 72.44 64.99 65.92 072.44 64.99 65.92 072.44 64.99 65.92 072.44 64.99 61.37 60.04 01.77 60.04 01.77 15.42 25.360 0.04 01.77 15.42 25.360 0.04 01.77 15.42 15.44 15.42 15.44 15.	Mot 5 4 6 6 6 6 6 6 6 6 6 6 6 6 6	orcycle 9.36 8.83 0.68 3.72 0.68 3.72 0.68 3.72 0.73 8.10 7.84 4.24 0.05 6.07 4.23 1.16 0.07 4.23 5.86 0.67 5.86 0.69	Bicycle 75.72 72.04 75.40 76.96 8 0.82 73.77 73.59 75.14 Bicycle 57.96 71.70 71.33 73.09 8 Bicycle 34.33 67.75 67.09
No Retraining Finetuning MBA Ours Finetuning MBA Ours No Retraining Finetuning MBA Ours No Retraining Finetuning MBA Ours	Road S 97.93 97.25 97.86 97.88 97.88 97.39 97.74 97.75 97.76 97.76 80.87 97.58 97.58 97.58 97.58 97.58 97.58 97.58 97.58 97.58	Tal idewalk F 83.77 79.42 83.77 79.42 83.78 79.42 83.60 Table idewalk F 82.31 82.31 82.31 82.31 82.33 82.37 Table Idewalk 71.99 81.02 81.40 81.24 Table S 56.01 78.11 78.69 78.27 79.27	ble S7. building 90.82 90.45 92.00 92.28 88. Cla Building 90.00 91.51 91.43 91.87 91.87 89. Cla building 84.01 90.81 90.81 90.84 90.81 90.82 90.92 8100 Cla	Class Wall 46.47 32.62 41.98 47.73 HSS-W1 Wall 19.99 45.21 Wall 19.99 45.21 39.13 46.03 46.03 44.38 41.96 43.85 43.83 43.30	-wise Fence 59.01 49.39 53.98 56.78 Se COI Fence 52.16 53.89 51.28 54.31 Se COI Fence 34.06 50.65 51.23 Se COI Fence 34.06 50.65 51.23 Se COI Fence 34.06 50.65 51.23 Se COI Fence 34.06 50.65 51.23 Se COI Fence 34.06 50.57 Se COI Fence 34.85 Se Se COI Fence 34.85 Se Se COI Fence 34.85 Se Se COI Fence 34.57 Se COI Fence 35.57 Se SE SE SE SE SE SE S	COMP Pole 61.95 59.07 64.06 65.54 mparis Pole 56.55 61.27 63.21 mparis Pole 46.92 56.68 58.55 60.55 60.55 mpari Pole 31.88 50.35 53.13	arisol Tr. Ligh 66.72 58.88 68.37 70.18 00n of Tr. Ligh 65.40 66.90 68.99 00n of Tr. Ligh 45.14 62.47 63.79 66.19 Son O Tr. Ligh 63.79 66.19 Son O	n of n t Tr. : Tr. : 76 76 79 79 70 70 70 70 70 70 70 70	nloU: sign '' 12 14 10 US wi sign '' 59 12 60 29 US wi sign '' 59 12 60 29 US wi 32 54 54 54 54 54 54 54 54 55 54 55 55	s with Vegetation 92,32 90,46 92,01 92,35 th bass Vegetation 83,91 91,25 91,07 91,59 11,	basel: n Terra 63.8 56.4 63.0 64.4 selines: n Terra 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 62.2 63.9 61.6 63.9	ines cc si in Si Si 94 94 94 93 93 92 94 94 92 94 8 94 92 94 8 94 8 94 8 94 94 33 94 94 94 94 94 94 94 94 94 95 94 95 94 95 94 95 94 95 94 12 74 94 12 74<	n Citt y Pee 08 77 80 08 77 80 28 89 82 Citysc: y Pe 66 77 50 80 Citysc: y Pe 66 66 66 66 66 66 71 77 22 78 Citysc: y Pee 66 66 80 Citysc: 21 77 22 78 Citysc: 21 77 22 78 Citysc: 25 67 25 78 27 78 28	yscaj rson 5.60 3.44 1.21 2.05 apes : rson 5.87 5.97 5.87 5.9	Design Gradient C Rider C S 50.99 92 S 56.99 92 S 61.90 94 S 62.30 94 S 60.32 94 S 55.92 93 S 58.78 93 S 58.78 93 S 58.78 93 S 58.76 92 S 54.30 92 S 54.30 92 S 5	clean i ar Tra 39 74 27 69 27 70 65 72 ges Wil ar Tra 200 73 33 74 ges Wil ar Tra 445 54 49 69 51 71 92 73 ages Wil ar Tra 97 18 95 67	mag ick 78 40 14 07 th L ick 27 39 38 38 th L ick 48 61 40 89 ith I ick 91 53 79 89	ges. Bus 85.85 82.57 85.11 L1 bl Bus 83.65 81.32 84.72 2 bl Bus 65.28 80.09 78.69 81.55 L3 b Bus 49.24 75.50 81.59 73.90 78.19 81.59 81.59 81.55	Train 71.80 62.60 66.01 66.34 UIT. Train 25.67 64.99 65.92 UIT. Train 25.67 64.94 61.37 60.04 UIT. Train 15.42 5.360 57.55 55.05	Mot 5 4 6 6 6 6 6 6 6 6 6 6 6 6 6	orcycle 9.36 8.83 0.68 3.35 8.10 7.84 4.24 orcycle 0.05 6.07 4.23 1.16	Bicycle 75.72 72.04 75.40 76.96 Bicycle 70.82 73.77 73.59 75.14 Bicycle 57.96 71.70 71.33 73.09 Bicycle 53.96 71.33 73.09

Table S3. Class-wise comparison of mIoUs with baselines on PASCAL VOC for clean images.

As can be seen from Table S2, as we increase the probability of an image being class-centric blurred, the performance on clean images sees a decrease but performance on higher levels of blur increases. So, p = 0.5 is a good choice during training.

S3. Class-wise evaluation of performance for space-invariant blur

In this section, we show class-wise quantitative comparisons of our method with baseline methods on PASCAL VOC (Table S3 - S6) and Cityscapes (Table S7 - S10) datasets to demonstrate that performance gains are achieved across most classes using our approach. In Table S3 and Table S7, we compare the performance of all baselines and our approach for clean sharp images. In Table S3, we can see that our method performs slightly worse than the 'No Retraining' baseline on the classes - Boat, Cat, Dining Table, Dog, Sheep and Sofa while improved performance scores are observed for all other classes for PASCAL VOC dataset. Similarly, in Table S7 for the Cityscapes dataset, our method performs slightly worse than the 'No Retraining' baseline on the classes - Sidewalk, Fence, Truck, Bus, Train while improved performance scores are observed for all other classes.

In Table S4 and Table S8, we provide comparisons for images with L1 level of blur for PASCAL VOC and Cityscapes datasets respectively. For certain classes, like Bus, Cat, Dining Table, Dog and Sofa, in PASCAL VOC, the 'MBA' baseline seems to give the best performance, while our method performs best for all the remaining



Figure S1. Qualitative results for space-invariant motion blur for DeepLabv3+ on PASCAL VOC. Note that our method consistently outperforms all baselines.



(a) (b) Figure S2. Qualitative results for space-invariant motion blur for DeepLabv3+ on Cityscapes.

classes. On the other hand, for Cityscapes, our model outperforms all baselines on all classes.

In Table **S5**, we compare the performances for images with L2 level of blur for PASCAL VOC dataset and our method performs better than all baselines for all classes except, Dog and Sofa, where the 'Finetune' baseline performs best. For Cityscapes, we compare the performances on images with L2 level of blur in Table S5 and our method outperforms all baselines on all classes except Road, Sidewalk, Rider and Train where our approach lags only by a small margin.

Lastly, in Table S6 and Table S10, we compare the performances for images from PASCAL VOC and Cityscapes with L3 level of blur. Our method outperforms all base-



Figure S3. Zoomed in regions from Fig. S2. Reference image is used only to depict the cropped region on the sharp image. Two regions are taken for each image and are highlighted by a red square and a blue square respectively. Note that our method captures finer details better and is more consistent across sharp and blurred images when compared to baseline methods.

lines for all classes in PASCAL VOC except, Dog and Sofa, where the 'Finetune' and 'MBA' baselines perform best respectively. On Cityscapes, our method outperforms all baselines for all classes except Train where the 'MBA' baseline performs best.

So, our method improves performance for almost all classes in the presence of different levels of blur when compared to baseline methods.

S4. Qualitative Results for Synthetic Blurred Images

In this section, we provide additional results on PASCAL VOC and Cityscapes datasets. For Cityscapes, we show zoomed in cropped regions to highlight the smaller regions because of the large image size.

Fig. S1(a) and Fig. S1(b) are both images taken from PASCAL VOC datset. Our method performs better than all the baselines, especially, at blur level L3 and the performance drop is very small as we move from clean images to blur level L3 for our method.

In Fig. S2, we show results for Cityscapes dataset for two images. Due to the large size of the images, the degradations due to blur are not very evident in baselines other than 'No Retraining'. For better visualization, we crop 2 square regions for each of the images and show the zoomed in results in Fig. S3 where (a) and (b) are crops of Fig. S2(a), and, (c) and (d) are crops of Fig. S2(b). On care-

ful observation, the first thing to notice is the consistency of our results across clean and blur images as opposed to other baselines for each of the crops. For S3(a), our results are significantly better than 'Finetune' baseline but comparable to 'MBA' baseline. But on considering, S3(b), our results are better than 'MBA' baseline and comparable to 'Finetune' baseline. So for the same image, different baseline methods give better performance in different regions but our method performs consistently well throughout.

Now considering Fig. S3(c), we draw attention to the handle of the cycle which is more consistently picked up by our approach across all blur levels. In Fig. S3(d), all the baseline models confuse parts of the background with the thin lamp-post which is better segmented using our method, especially, for blur level L3.

S5. Qualitative Results on GOPRO and REDS for Real Blur

We show additional results for GOPRO and REDS dataset using DeepLabv3+ model trained with our approach on PASCAL VOC dataset. Fig. S4(a) and (b) are examples from GOPRO and (c) is an example from REDS. In Fig. S4(a), we can clearly see that good segmentation maps are obtained for the sharp image using all the methods but for the blurred counterpart, the baseline models struggle. Our approach gives the best segmentation map for the blurred image with finer details like the legs of the person evident



Figure S4. Qualitative results for real motion blur for DeepLabv3+ on GOPRO and REDS.

from the map itself. In Fig. S4(b), the 'No Retraining' baseline performs best on sharp image while 'Finetune' baseline gives best results on blurred image. Our method gives comparable results to 'Finetune' baseline for blurred image and 'No Retraining' baseline for corresponding sharp image. In Fig. S4(c), note the heavily blurred man on the left. While other baseline methods struggle to segment out this region, owing to the spatial nature of the blur, our approach does a good job of segmenting out this man, while giving comparable performance to the baselines on the sharp image. These results clearly show that our method performs better than all the baselines on these real world blur images while also being able to retain performance on sharp images.

References

- Giacomo Boracchi and Alessandro Foi. Modeling the performance of image restoration from motion blur. *IEEE Transactions on Image Processing*, 21(8):3502–3517, 2012.
- [2] Liang-Chieh Chen, Yukun Zhu, George Papandreou, Florian Schroff, and Hartwig Adam. Encoder-decoder with atrous separable convolution for semantic image segmentation. In *Proceedings of the European conference on computer vision* (ECCV), pages 801–818, 2018. 1
- [3] Marius Cordts, Mohamed Omran, Sebastian Ramos, Timo Rehfeld, Markus Enzweiler, Rodrigo Benenson, Uwe Franke, Stefan Roth, and Bernt Schiele. The cityscapes dataset for semantic urban scene understanding. In *Proc. of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2016. 1
- [4] M. Everingham, L. Van Gool, C. K. I. Williams, J. Winn, and A. Zisserman. The PASCAL Visual Object Classes Challenge 2007 (VOC2007) Results. http://www.pascal-

network.org/challenges/VOC/voc2007/workshop/index.html, 2007. 1

- [5] Peidong Liu, Joel Janai, Marc Pollefeys, Torsten Sattler, and Andreas Geiger. Self-supervised linear motion deblurring. *IEEE Robotics and Automation Letters*, 5(2):2475–2482, 2020. 1
- [6] Seungjun Nah, Sungyong Baik, Seokil Hong, Gyeongsik Moon, Sanghyun Son, Radu Timofte, and Kyoung Mu Lee. Ntire 2019 challenge on video deblurring and superresolution: Dataset and study. In CVPR Workshops, June 2019. 1
- [7] Seungjun Nah, Tae Hyun Kim, and Kyoung Mu Lee. Deep multi-scale convolutional neural network for dynamic scene deblurring. In *CVPR*, July 2017. 1
- [8] Mark Sandler, Andrew Howard, Menglong Zhu, Andrey Zhmoginov, and Liang-Chieh Chen. Mobilenetv2: Inverted residuals and linear bottlenecks. In *Proceedings of the IEEE conference on computer vision and pattern recognition*, pages 4510–4520, 2018. 1