

Supplementary Materials: Efficient Convolution Network to Assist Breast Cancer Diagnosis and Target Therapy




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Table S1. Multiple comparisons for segmentation of breast cancer metastases on WSI dataset : LSD test.

LSD Multiple Comparision							
Measurement	(I) Method	(J) Method	Mean Difference (I-J)	Std. Error	Sig.	95% C.I.	
Precision	Proposed D-FCN2s	Proposed DSL-FCN2s	5.19	8.34	0.535	-11.33	21.71
		Proposed SL-FCN [1]	-1.27	8.49	0.881	-18.1	15.56
		Modified FCN [2-6]	-1.61	8.49	0.85	-18.44	15.23
		U-Net [7]	***38.98	8.49	<0.001	22.14	55.81
		SegNet [8]	***32.81	8.49	<0.001	15.97	49.64
		FCN [9]	***32.39	8.49	<0.001	15.56	49.23
		Deeplabv3+ [10] with MobileNet [11]	**23.23	8.49	0.007	6.39	40.06
		Deeplabv3+ [10] with Xception [12]	**26.23	8.49	0.003	9.39	43.06
Recall	Proposed D-FCN2s	Deeplabv3+ [10] with ResNet [13]	12.23	8.49	0.153	-4.61	29.06
		Proposed DSL-FCN2s	1.75	7.48	0.815	-13.07	16.57
		Proposed SL-FCN [1]	3.47	7.62	0.65	-11.63	18.58
		Modified FCN [2-6]	5.28	7.62	0.49	-9.82	20.39
		U-Net [7]	**24.7	7.62	0.002	9.59	39.8
		SegNet [8]	***30.11	7.62	<0.001	15.01	45.22
		FCN [9]	***38.95	7.62	<0.001	23.84	54.05
		Deeplabv3+ [10] with MobileNet [11]	**20.7	7.62	0.008	5.59	35.8
Dice coefficient	Proposed D-FCN2s	Deeplabv3+ [10] with Xception [12]	***44.95	7.62	<0.001	29.84	60.05
		Deeplabv3+ [10] with ResNet [13]	***30.53	7.62	<0.001	15.43	45.64
		Proposed DSL-FCN2s	3.6	6.96	0.606	-10.18	17.39
		Proposed SL-FCN [1]	1.17	7.09	0.869	-12.88	15.21
		Modified FCN [2-6]	1.98	7.09	0.78	-12.06	16.03
		U-Net [7]	***29.98	7.09	<0.001	15.94	44.03
		SegNet [8]	***40.15	7.09	<0.001	26.1	54.19
		FCN [9]	***41.31	7.09	<0.001	27.27	55.36
IoU	Proposed D-FCN2s	Deeplabv3+ [10] with MobileNet [11]	**22.31	7.09	0.002	8.27	36.36
		Deeplabv3+ [10] with Xception [12]	***38.4	7.09	<0.001	24.35	52.44
		Deeplabv3+ [10] with ResNet [13]	**24.23	7.09	0.001	10.19	38.28
		Proposed DSL-FCN2s	5.78	7.48	0.441	-9.05	20.61
		Proposed SL-FCN [1]	2.24	7.62	0.77	-12.87	17.35
		Modified FCN [2-6]	3.22	7.62	0.674	-11.89	18.33
		U-Net [7]	***30.8	7.62	<0.001	15.69	45.91
		SegNet [8]	***40.13	7.62	<0.001	25.02	55.24
		FCN [9]	***41.8	7.62	<0.001	26.69	56.91
		Deeplabv3+ [10] with MobileNet [11]	***27.72	7.62	<0.001	12.61	42.83
		Deeplabv3+ [10] with Xception [12]	***43.72	7.62	<0.001	28.61	58.83
		Deeplabv3+ [10] with ResNet [13]	***29.38	7.62	<0.001	14.27	44.49

The mean difference is significant at the level of *0.05, **0.01 and ***0.001.

Table S2. Multiple comparisons for segmentation of HER2 amplification on FISH breast dataset : LSD test.

LSD Multiple Comparison								
Measurement	(I) Method	(J) Method	Mean Difference(I-J)	Std. Error	Sig.	95%C.I.		
Accuracy	Proposed DSL-FCN2s	SL-FCN [1]	1.92	1.15	0.095	-0.34	4.17	
		Modified FCN [2-6]	2.08	1.15	0.07	-0.17	4.33	
		DeepLabv3+ [10]with Mobilenet [11]	***10.29	1.15	<0.001	8.04	12.54	
		DeepLabv3+ [10]with ResNet [13]	***10.4	1.15	<0.001	8.14	12.65	
		DeepLabv3+ [10]with Xception [12]	***18.62	1.15	<0.001	16.37	20.88	
		CPN [14]	***17.79	1.15	<0.001	15.54	20.04	
		SOLOv2 [15]	***7.35	1.15	<0.001	5.1	9.6	
		BCNet [16]	***9.47	1.15	<0.001	7.22	11.73	
Precision	Proposed DSL-FCN2s	SL-FCN [1]	-2.46	1.82	0.177	-6.02	1.11	
		Modified FCN [2-6]	-2.61	1.82	0.152	-6.17	0.96	
		DeepLabv3+ [10]with Mobilenet [11]	***13.77	1.82	<0.001	10.2	17.34	
		DeepLabv3+ [10]with ResNet [13]	***19.51	1.82	<0.001	15.94	23.08	
		DeepLabv3+ [10]with Xception [12]	***22.95	1.82	<0.001	19.38	26.52	
		CPN [14]	***31.75	1.82	<0.001	28.19	35.32	
		SOLOv2 [15]	***9.75	1.82	<0.001	6.19	13.32	
		BCNet [16]	***6.03	1.82	0.001	2.46	9.59	
Recall	Proposed DSL-FCN2s	SL-FCN [1]	***11.24	2.16	<0.001	7	15.47	
		Modified FCN [2-6]	***12.63	2.16	<0.001	8.4	16.87	
		DeepLabv3+ [10]with Mobilenet [11]	***29.82	2.16	<0.001	25.59	34.06	
		DeepLabv3+ [10]with ResNet [13]	***18.32	2.16	<0.001	14.09	22.56	
		DeepLabv3+ [10]with Xception [12]	***49.49	2.16	<0.001	45.26	53.72	
		CPN [14]	***17.81	2.16	<0.001	13.58	22.04	
		SOLOv2 [15]	***18.9	2.16	<0.001	14.67	23.13	
		BCNet [16]	***32.4	2.16	<0.001	28.17	36.63	
Dice Coefficient	Proposed DSL-FCN2s	SL-FCN [1]	*4.57	1.78	0.011	1.07	8.07	
		Modified FCN [2-6]	**5.14	1.78	0.004	1.64	8.64	
		DeepLabv3+ [10]with Mobilenet [11]	***22.18	1.78	<0.001	18.68	25.68	
		DeepLabv3+ [10]with ResNet [13]	***19.03	1.78	<0.001	15.53	22.53	
		DeepLabv3+ [10]with Xception [12]	***44	1.78	<0.001	40.5	47.5	
		CPN [14]	***26.2	1.78	<0.001	22.7	29.69	
		SOLOv2 [15]	***14.17	1.78	<0.001	10.67	17.66	
		BCNet [16]	***21	1.78	<0.001	17.5	24.5	
IoU	Proposed DSL-FCN2s	SL-FCN [1]	***7.61	1.98	<0.001	3.73	11.5	
		Modified FCN [2-6]	***8.59	1.97	<0.001	4.72	12.47	
		DeepLabv3+ [10]with Mobilenet [11]	***32.02	1.97	<0.001	28.15	35.89	
		DeepLabv3+ [10]with ResNet [13]	***28.28	1.97	<0.001	24.4	32.15	
		DeepLabv3+ [10]with Xception [12]	***51.84	1.97	<0.001	47.96	55.71	
		CPN [14]	***37.1	1.97	<0.001	33.23	40.97	
		SOLOv2 [15]	***22.62	1.97	<0.001	18.75	26.5	
		BCNet [16]	***30.76	1.97	<0.001	26.89	34.63	

The mean difference is significant at the level of *0.05, **0.01 and ***0.001.

Table S3. Multiple comparisons for segmentation of HER2 amplification on DISH breast dataset : LSD test.

LSD Multiple Comparison							
Measurement	(I) Method	(J) Method	Mean Difference(I-J)	Std. Error	Sig.	95%C.I.	
Accuracy	Proposed DSL-FCN2s	SL-FCN [1]	0.69	1.71	0.686	-2.68	4.06
		U-Net [7]+InceptionV4 [17]	***11.23	1.71	<0.001	7.86	14.6
		Ensemble of U-Net variants ^d	***10.51	1.71	<0.001	7.14	13.88
		U-Net [7]	***8.44	1.71	<0.001	5.07	11.81
		SegNet [8]	***9.16	1.71	<0.001	5.79	12.53
		FCN [9]	***11.58	1.71	<0.001	8.21	14.95
		Modified FCN [2-6]	***6.28	1.71	<0.001	2.91	9.65
		DeepLabv3+ [10]with Mobilenet [11]	***18	1.71	<0.001	14.63	21.37
		DeepLabv3+ [10]with ResNet [13]	***14.44	1.71	<0.001	11.07	17.81
		DeepLabv3+ [10]with Xception [12]	***16.61	1.71	<0.001	13.24	19.98
		CPN [14]	***11.72	1.71	<0.001	8.35	15.09
		SOLOv2 [15]	***10.55	1.71	<0.001	7.18	13.92
		BCNet [16]	***11.61	1.71	<0.001	8.24	14.98
Precision	Proposed DSL-FCN2s	SL-FCN [1]	4.03	3.15	0.202	-2.17	10.24
		U-Net [7]+InceptionV4 [17]	***17.25	3.15	<0.001	11.05	23.46
		Ensemble of U-Net variants ^d	***16.42	3.15	<0.001	10.21	22.63
		U-Net [7]	***20.41	3.15	<0.001	14.2	26.62
		SegNet [8]	***25.1	3.15	<0.001	18.9	31.31
		FCN [9]	***18.25	3.15	<0.001	12.05	24.46
		Modified FCN [2-6]	***8.69	3.15	<0.001	2.48	14.89
		DeepLabv3+ [10]with Mobilenet [11]	***35.75	3.15	<0.001	29.55	41.96
		DeepLabv3+ [10]with ResNet [13]	***31.81	3.15	<0.001	25.6	38.02
		DeepLabv3+ [10]with Xception [12]	***34.81	3.15	<0.001	28.6	41.02
		CPN [14]	***23.42	3.15	<0.001	17.21	29.63
		SOLOv2 [15]	***11.7	3.15	<0.001	5.49	17.9
		BCNet [16]	***17.2	3.15	<0.001	10.99	23.4
Recall	Proposed DSL-FCN2s	SL-FCN [1]	0.06	3.43	0.985	-6.7	6.83
		U-Net [7]+InceptionV4 [17]	***21.29	3.43	<0.001	14.53	28.05
		Ensemble of U-Net variants ^d	***22.57	3.43	<0.001	15.8	29.33
		U-Net [7]	***14.75	3.43	<0.001	7.99	21.51
		SegNet [8]	4.84	3.43	0.16	-1.92	11.6
		FCN [9]	***38.14	3.43	<0.001	31.38	44.9
		Modified FCN [2-6]	***24.43	3.43	<0.001	17.67	31.19
		DeepLabv3+ [10]with Mobilenet [11]	***14.34	3.43	<0.001	7.58	21.11
		DeepLabv3+ [10]with ResNet [13]	***10.57	3.43	<0.001	3.8	17.33
		DeepLabv3+ [10]with Xception [12]	*20.23	3.43	0.02	13.47	27
		CPN [14]	***16.62	3.43	<0.001	9.86	23.38
		SOLOv2 [15]	***31.4	3.43	<0.001	24.64	38.16
		BCNet [16]	***26.79	3.43	<0.001	20.03	33.55
Dice Coefficient	Proposed DSL-FCN2s	SL-FCN [1]	1.94	2.59	0.454	-3.16	7.04
		U-Net [7]+InceptionV4 [17]	***19.7	2.59	<0.001	14.59	24.8
		Ensemble of U-Net variants ^d	***20.2	2.59	<0.001	15.09	25.3
		U-Net [7]	***17.95	2.59	<0.001	12.85	23.05
		SegNet [8]	***16.35	2.59	<0.001	11.24	21.45
		FCN [9]	***32.86	2.59	<0.001	27.76	37.96
		Modified FCN [2-6]	***18.78	2.59	<0.001	13.68	23.89
		DeepLabv3+ [10]with Mobilenet [11]	***27.31	2.59	<0.001	22.21	32.41
		DeepLabv3+ [10]with ResNet [13]	***22.92	2.59	<0.001	17.82	28.02
		DeepLabv3+ [10]with Xception [12]	***29.2	2.59	<0.001	24.09	34.3
		CPN [14]	***20.75	2.59	<0.001	15.65	25.85
		SOLOv2 [15]	***24.86	2.59	<0.001	19.76	29.96
		BCNet [16]	***23.58	2.59	<0.001	18.48	28.68
IoU	Proposed DSL-FCN2s	SL-FCN [1]	2.92	3.06	0.341	-3.11	8.96
		U-Net [7]+InceptionV4 [17]	***26.56	3.06	<0.001	20.53	32.6
		Ensemble of U-Net variants ^d	***25.9	3.06	<0.001	19.87	31.94
		U-Net [7]	***24.62	3.06	<0.001	18.59	30.66
		SegNet [8]	***22.6	3.06	<0.001	16.56	28.64
		FCN [9]	***39.85	3.06	<0.001	33.81	45.88
		Modified FCN [2-6]	***24.91	3.06	<0.001	18.88	30.95
		DeepLabv3+ [10]with Mobilenet [11]	***33.6	3.06	<0.001	27.56	39.63
		DeepLabv3+ [10]with ResNet [13]	***29.04	3.06	<0.001	23	35.08
		DeepLabv3+ [10]with Xception [12]	***36.93	3.06	<0.001	30.89	42.97
		CPN [14]	***27.27	3.06	<0.001	21.23	33.31
		SOLOv2 [15]	***32.26	3.06	<0.001	26.22	38.3
		BCNet [16]	***29.1	3.06	<0.001	23.06	35.13

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