Tab. 1 Segmentation accuracy comparison among algorithms which are designed specifically for image segmentation problem

	a			b			c			d		
	4	5	6	5	6	7	4	5	6	4	5	6
PSO	9334.51 11.86	9931.36 33.49	10297.63 52.51	7167.71 15.77	7431.76 33.55	7621.87 40.82	5687.32 5.18	5946.74 9.08	6142.66 13.21	10817.55 2.29	11422.29 12.96	11855.99 35.7
QPSO	9342.57 2.05	9965.36 15.25	10368.47 11.53	7187.87 5.76	7479.82 9.74	7686.76 19.07	5692.16 0.76	5957.78 4.96	6155.86 8.96	10818.87 3.03	11429.78 5.66	11872.34 24.84
CQPSO	9340.12 3.1	9971.89 3.61	10374.3 13.13	7186.53 3.68	7485.36 8.95	7695.31 10.3	5690.49 2.36	5957.55 4.54	6159.79 4.68	10819.6 1.72	11431.84 6.77	**11900.74** **25.94**
MPSO	8665.85 325.25	8979.48 356.92	9246.93 277.23	6590.02 199.08	6755.81 191.03	6938 175.37	5513.35 108.72	5686.12 119.83	5803.32 115.41	10664.22 72.22	11140.23 101.41	11561.05 92.93
DE	9332.16 8.07	9934.65 20.3	10315.18 26.25	7165.99 13.25	7447.18 12.56	7651.44 16.49	5682.4 4.5	5945.02 8.2	6135.57 8.62	10804.65 8.09	11401.54 12.72	11842.96 26
MRLDE	9337.99 4.78	9944.75 15.54	10330.61 20.31	7168.28 8.25	7454.94 13.94	7651.61 18.5	5686.91 3.6	5947.19 6.84	6142.93 7.42	10810.96 5.11	11407.38 9.2	11838.01 20.31
SDE	9333.68 7.3	9936.41 17.88	10321.22 23.29	7164.57 11.97	7454.51 16.84	7644.73 17.59	5684.33 3.56	5941.49 8.51	6139.33 11.4	10806.69 4.99	11398.09 14.32	11839.24 15.11
ABC	9342.02 2.71	9968.37 4.89	10368.25 7.91	7182.87 4.13	7481.11 6.21	7684.36 8.53	5690.49 2.01	5956.04 3.64	6156.6 3.44	10816.58 2.63	11425.95 4.77	11885.48 18.93
MABC15	8719.43 2330.37	9637.98 1789.73	10022.63 1861.22	6945.38 1289.73	6981.75 1865.96	7177.54 1918.29	5690.53 2.11	5361.43 1787.14	5746.95 1535.94	10816.9 2.4	11428.06 4.82	11890.51 21.27
I_ABC	9334.21 6.03	9949.29 14.98	10333.47 25.08	7176.43 8.55	7466.52 13.87	7413.98 1376.83	5686.66 2.81	5948.31 6.28	6150.73 5.83	10809.37 4.68	11413.66 10.14	11853.65 18.42
ILTD _ABC	**9344.2** **0.15**	**9973.14** **1.09**	**10378.7** **7.85**	**7188.16** **2.71**	**7486.19** **6.01**	**7697.53** **7.75**	**5692.41** **0.04**	**5961.42** **1.77**	**6160.77** **4.69**	**10820.42** **1.2**	**11432.51** **2.97**	11891.11 22.72

	e			f			g			h		
	4	5	6	5	6	7	4	5	6	4	5	6
PSO	5292.15 6.95	5543.24 15.60	5651.97 58.89	15895.47 14.40	16736.79 233.59	17244.10 173.97	10728.62 17.19	11389.45 40.99	11759.68 92.71	**23260.43** **0.17**	**24547.01** **1.76**	25371.72 10.60
QPSO	5294.41 3.62	5547.50 15.97	5697.39 15.55	15903.51 5.14	16812.53 23.51	17383.57 52.36	10739.27 3.32	11433.64 21.02	11888.02 18.20	23258.69 6.29	24540.11 5.59	25358.21 22.96
CQPSO	**5295.60** 0.00	5548.71 16.72	5704.48 16.59	15903.36 5.17	16821.96 27.75	17434.78 38.43	10735.95 3.55	11450.34 10.62	**11900.42** **7.52**	23239.00 40.37	24502.68 96.56	25328.09 111.95
MPSO	5058.98 137.85	5188.65 284.87	5183.65 257.21	15035.72 487.72	15439.88 819.38	15860.55 584.74	9900.97 438.89	10318.80 347.20	10523.17 337.66	23148.18 71.25	24303.41 122.54	25014.48 206.98
DE	5294.77 1.03	5549.81 10.58	5694.87 13.41	15895.18 8.61	16786.55 26.66	17369.27 38.63	10720.90 9.77	11403.74 22.62	11839.66 27.32	23219.86 37.36	24426.38 64.31	25201.98 61.90
MRLDE	5295.33 0.64	5552.03 8.11	5693.63 12.47	15898.14 9.30	16801.29 24.80	17375.24 40.97	10729.71 7.19	11418.42 19.97	11845.90 30.38	23238.55 14.80	24498.57 39.87	25286.43 45.45
SDE	5294.81 0.90	5548.02 8.75	5693.40 10.37	15886.42 16.00	16791.44 27.43	17366.99 25.74	10726.36 7.01	11406.29 32.39	11826.76 30.15	23223.94 20.54	24457.90 63.74	25255.86 59.77
ABC	5295.52 0.33	5558.71 3.57	5704.72 9.17	15903.13 5.11	16817.64 20.27	17422.42 27.71	10735.14 4.63	11442.40 12.72	11882.72 15.72	23252.80 7.09	24534.88 7.41	25347.13 21.82
MABC15	5295.60 0.00	5560.51 3.56	5429.20 1245.56	15904.62 2.25	15990.09 3668.39	14823.00 6226.93	10739.11 2.84	10875.84 2495.11	11296.73 2591.67	23259.95 0.62	24538.74 6.20	25356.10 18.34
I_ABC	5290.14	5545.78	5690.53	15883.23	16760.10	17330.51	10722.41	11415.72	11841.23	23241.14	24505.09	25269.05

	10.38	15.45	15.40	24.10	64.79	98.71	11.73	23.15	29.90	13.76	32.90	71.73
ILTD	**5295.60**	**5562.28**	**5714.75**	**15905.21**	**16834.42**	**17448.91**	**10740.19**	**11455.61**	11899.84	23260.26	24545.09	**25374.24**
_ABC	**0.00**	**1.21**	**8.98**	**0.00**	**6.69**	**22.21**	**0.78**	**3.45**	7.04	0.91	4.50	**8.66**

(a) ABC

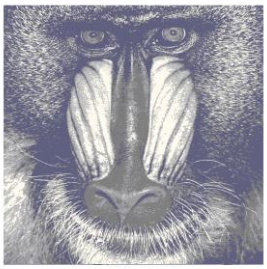
(b) ABC

(c) ABC

(d) ABC

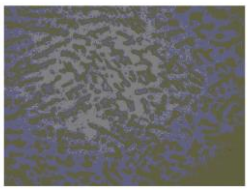
(a') ILTD_ABC

(b') ILTD_ABC

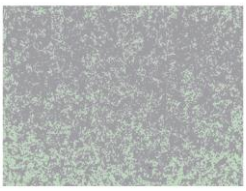


(c') ILTD_ABC

(d') ILTD_ABC

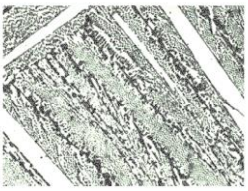


(e) ABC

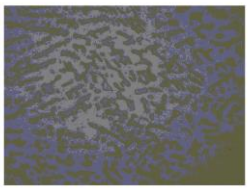


(f) ABC

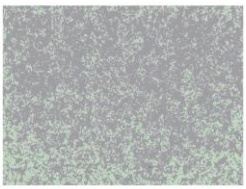
(g) ABC



(h) ABC

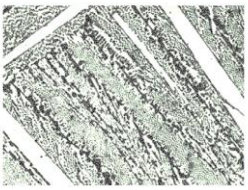


(e') ILTD_ABC



(f') ILTD_ABC

(g') ILTD_ABC



(h') ILTD_ABC

Fig. 1 Segmentation images, $M-1=4$

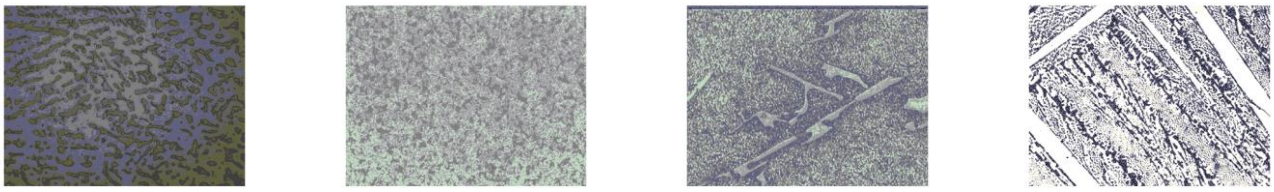
(a) ABC

(b) ABC

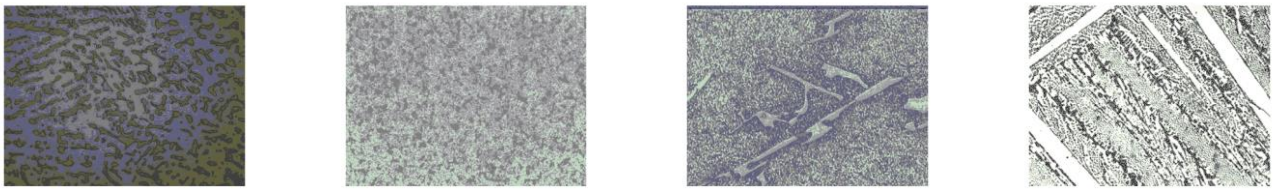
(c) ABC

(d) ABC

(a') ILTD_ABC (b') ILTD_ABC (c') ILTD_ABC (d') ILTD_ABC

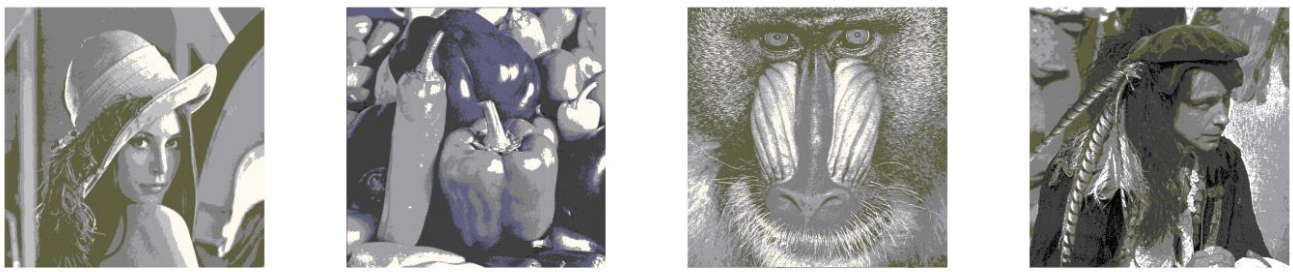


(e) ABC (f) ABC (g) ABC (h) ABC



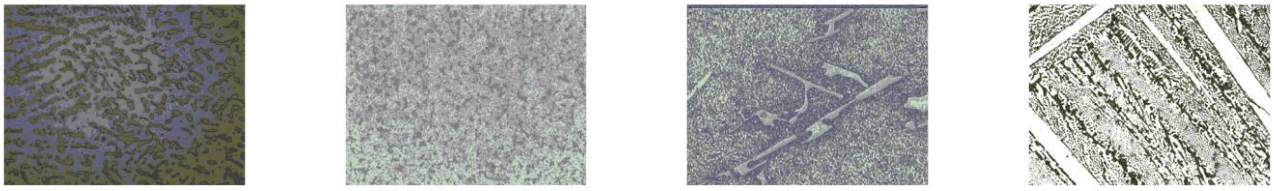
(e') ILTD_ABC (f') ILTD_ABC (g') ILTD_ABC (h') ILTD_ABC

Fig. 2 Segmentation images, $M-1=5$

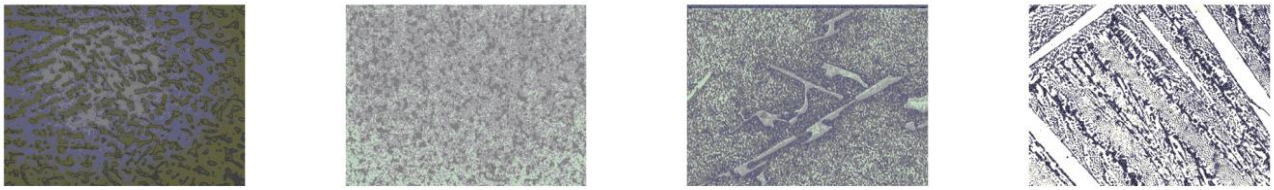


(a) ABC (b) ABC (c) ABC (d) ABC

(a') ILTD_ABC (b') ILTD_ABC (c') ILTD_ABC (d') ILTD_ABC



(e) ABC (f) ABC (g) ABC (h) ABC



(e') ILTD_ABC (f') ILTD_ABC (g') ILTD_ABC (h') ILTD_ABC

Fig. 3 Segmentation images, $M-1=6$