

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

		e			f			g			h		
		4	5	6	5	6	7	4	5	6	4	5	6
PSO	mean	5292.15	5543.24	5651.97	15895.47	16736.79	17244.10	10728.62	11389.45	11759.68	<b>23260.43</b>	<b>24547.01</b>	25371.72
	SD	6.95	15.60	58.89	14.40	233.59	173.97	17.19	40.99	92.71	<b>0.17</b>	<b>1.76</b>	10.60
	wilcoxon	-	-	-	-	-	-	-	-	-	+	+	-
QPSO	mean	5294.41	5547.50	5697.39	15903.51	16812.53	17383.57	10739.27	11433.64	11888.02	23258.69	24540.11	25358.21
	SD	3.62	15.97	15.55	5.14	23.51	52.36	3.32	21.02	18.20	6.29	5.59	22.96
	wilcoxon	-	-	-	-	-	-	-	-	-	-	-	-
CQPSO	mean	<b>5295.60</b>	5548.71	5704.48	15903.36	16821.96	17434.78	10735.95	11450.34	<b>11900.42</b>	23239.00	24502.68	25328.09
	SD	0.00	16.72	16.59	5.17	27.75	38.43	3.55	10.62	<b>7.52</b>	40.37	96.56	111.95
	wilcoxon	=	-	-	-	-	-	-	-	+	-	-	-
MPSO	mean	5058.98	5188.65	5183.65	15035.72	15439.88	15860.55	9900.97	10318.80	10523.17	23148.18	24303.41	25014.48

	SD	137.85	284.87	257.21	487.72	819.38	584.74	438.89	347.20	337.66	71.25	122.54	206.98
	wilcoxon	-	-	-	-	-	-	-	-	-	-	-	-
DE	mean	5294.77	5549.81	5694.87	15895.18	16786.55	17369.27	10720.90	11403.74	11839.66	23219.86	24426.38	25201.98
	SD	1.03	10.58	13.41	8.61	26.66	38.63	9.77	22.62	27.32	37.36	64.31	61.90
	wilcoxon	-	-	-	-	-	-	-	-	-	-	-	-
MRLDE	mean	5295.33	5552.03	5693.63	15898.14	16801.29	17375.24	10729.71	11418.42	11845.90	23238.55	24498.57	25286.43
	SD	0.64	8.11	12.47	9.30	24.80	40.97	7.19	19.97	30.38	14.80	39.87	45.45
	wilcoxon	-	-	-	-	-	-	-	-	-	-	-	-
SDE	mean	5294.81	5548.02	5693.40	15886.42	16791.44	17366.99	10726.36	11406.29	11826.76	23223.94	24457.90	25255.86
	SD	0.90	8.75	10.37	16.00	27.43	25.74	7.01	32.39	30.15	20.54	63.74	59.77
	wilcoxon	-	-	-	-	-	-	-	-	-	-	-	-
ABC	mean	5295.52	5558.71	5704.72	15903.13	16817.64	17422.42	10735.14	11442.40	11882.72	23252.80	24534.88	25347.13
	SD	0.33	3.57	9.17	5.11	20.27	27.71	4.63	12.72	15.72	7.09	7.41	21.82
	wilcoxon	-	-	-	-	-	-	-	-	-	-	-	-
MABC15	mean	<b>5295.60</b>	5560.51	5429.20	15904.62	15990.09	14823.00	10739.11	10875.84	11296.73	23259.95	24538.74	25356.10
	SD	0.00	3.56	1245.56	2.25	3668.39	6226.93	2.84	2495.11	2591.67	0.62	6.20	18.34
	wilcoxon	=	-	-	-	-	-	-	-	-	-	-	-
I_ABC	mean	5290.14	5545.78	5690.53	15883.23	16760.10	17330.51	10722.41	11415.72	11841.23	23241.14	24505.09	25269.05
	SD	10.38	15.45	15.40	24.10	64.79	98.71	11.73	23.15	29.90	13.76	32.90	71.73
	wilcoxon	-	-	-	-	-	-	-	-	-	-	-	-
ILTD _ABC	mean	<b>5295.60</b>	<b>5562.28</b>	<b>5714.75</b>	<b>15905.21</b>	<b>16834.42</b>	<b>17448.91</b>	<b>10740.19</b>	<b>11455.61</b>	11899.84	23260.26	24545.09	<b>25374.24</b>
	SD	<b>0.00</b>	<b>1.21</b>	<b>8.98</b>	<b>0.00</b>	<b>6.69</b>	<b>22.21</b>	<b>0.78</b>	<b>3.45</b>	7.04	0.91	4.50	<b>8.66</b>



(a) ABC



(b) ABC



(c) ABC



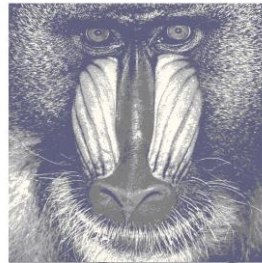
(d) ABC



(a') ILTD\_ABC



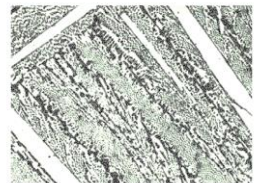
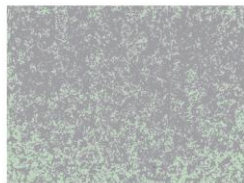
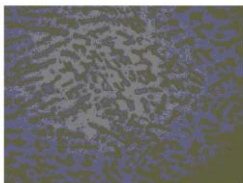
(b') ILTD\_ABC



(c') ILTD\_ABC



(d') ILTD\_ABC









		SD wilcoxon	2.73E-02 -	4.97E-03 -	4.68E-03 -	1.03E-01 -	1.73E-02 -	1.09E-02 -	1.56E-02 -	4.67E-03 -	3.33E-03 -	1.57E-02 -	<b>9.15E-04</b>
	6	mean	23.8684	23.8895	23.9062	23.4241	23.8549	23.8628	23.8501	23.9164	23.9114	23.8976	<b>23.9234</b>
		SD wilcoxon	4.19E-02 -	4.09E-02 -	2.90E-02 -	1.78E-01 -	2.78E-02 -	3.21E-02 -	3.23E-02 -	1.25E-02 -	1.87E-02 -	1.87E-02 -	<b>1.46E-02</b>
c	4	mean	18.3177	18.2989	18.3428	18.1866	18.3726	18.3465	18.3638	18.3797	<b>18.3905</b>	18.3324	18.3295
		SD	5.66E-02	4.33E-02	6.41E-02	7.04E-02	3.09E-02	4.88E-02	4.54E-02	3.74E-02	<b>2.83E-02</b>	4.85E-02	6.20E-02
		wilcoxon	-	-	+	-	+	+	+	+	+	+	
	5	mean	21.1907	21.1262	21.2872	20.0786	21.2181	21.0209	21.2201	21.2714	<b>21.2926</b>	21.1972	21.1246
		SD	1.20E-01	1.10E-01	5.67E-02	1.81E-01	5.03E-02	6.46E-02	5.72E-02	3.67E-02	<b>1.28E-02</b>	9.57E-02	1.64E-01
		wilcoxon	+	+	+	-	+	-	+	+	+	+	
	6	mean	23.76	23.6745	23.9254	23.1564	23.8415	23.8162	23.8132	23.9286	<b>23.9399</b>	23.8514	23.8541
		SD	1.54E-01	1.66E-01	1.04E-01	2.58E-01	6.24E-02	7.29E-02	7.19E-02	2.97E-02	<b>3.02E-02</b>	9.59E-02	1.71E-01
		wilcoxon	-	-	+	-	-	-	-	+	+	-	
d	4	mean	19.6674	19.647	19.6703	19.1796	19.6211	19.6374	19.6182	19.6643	19.6647	19.5961	<b>19.672</b>
		SD	4.05E-03	3.54E-02	3.29E-03	1.60E-01	2.15E-02	2.26E-02	2.97E-02	7.90E-03	4.71E-03	6.16E-02	<b>6.26E-04</b>
		wilcoxon	-	-	-	-	-	-	-	-	-	-	
	5	mean	22.5407	22.531	22.5537	21.8477	22.4357	22.4872	22.4472	22.5457	22.5483	22.4694	<b>22.5634</b>
		SD	2.18E-02	3.68E-02	3.40E-02	2.62E-01	5.25E-02	3.15E-02	5.34E-02	1.87E-02	1.06E-02	6.10E-02	<b>3.65E-03</b>
		wilcoxon	-	-	-	-	-	-	-	-	-	-	
	6	mean	25.1216	25.1099	<b>25.2309</b>	24.311	25.0286	25.0695	25.027	25.1957	25.1784	25.0995	25.212
		SD	1.00E-01	1.06E-01	<b>3.55E-02</b>	2.53E-01	9.12E-02	7.35E-02	7.87E-02	2.21E-02	3.47E-02	7.10E-02	2.47E-02
		wilcoxon	-	-	+	-	-	-	-	-	-	-	
e	4	mean	13.8672	13.8617	13.871	13.5752	13.8475	13.8555	13.8554	13.8687	13.8694	13.1586	<b>13.871</b>
		SD	1.25E-02	1.46E-02	5.33E-15	1.31E-01	1.64E-02	1.50E-02	1.05E-02	2.43E-03	3.00E-03	3.02E+00	<b>5.33E-15</b>
		wilcoxon	-	-	-	-	-	-	-	-	-	-	
	5	mean	15.7911	15.7973	15.8055	15.175	15.7512	15.7602	15.7506	15.7907	15.8156	14.2004	<b>15.8272</b>
		SD	3.60E-02	3.65E-02	3.24E-02	1.85E-01	3.27E-02	2.62E-02	2.93E-02	2.95E-02	1.33E-02	4.73E+00	<b>5.64E-03</b>
		wilcoxon	-	-	-	-	-	-	-	-	-	-	
	6	mean	17.5089	17.5048	17.5795	16.6145	17.444	17.4311	17.4468	17.5355	17.5434	17.4775	<b>17.5658</b>
		SD	7.00E-02	6.29E-02	1.32E-03	2.85E-01	4.61E-02	6.45E-02	5.39E-02	3.32E-02	2.96E-02	5.18E-02	<b>2.38E-02</b>
		wilcoxon	-	-	-	-	-	-	-	-	-	-	
f	4	mean	16.4191	16.4233	16.4169	16.129	16.3945	16.4069	16.403	16.4174	16.4209	15.5864	<b>16.604</b>
		SD	8.98E-03	4.15E-03	9.35E-03	1.33E-01	1.16E-02	1.26E-02	1.00E-02	8.02E-03	7.31E-03	3.58E+00	<b>3.58E+00</b>
		wilcoxon	-	-	-	-	-	-	-	-	-	-	
	5	mean	18.8886	18.8875	<b>18.8979</b>	18.4186	18.8396	18.8519	18.8442	18.8882	18.8891	18.8603	18.8967
		SD	1.15E-02	1.19E-02	<b>3.53E-03</b>	1.85E-01	2.62E-02	2.56E-02	1.71E-02	1.22E-02	9.52E-03	1.67E-02	4.74E-03
		wilcoxon	-	-	+	-	-	-	-	-	-	-	
	6	mean	21.1392	21.1153	<b>21.1775</b>	20.3914	21.0839	21.0911	21.0994	21.1639	21.157	21.1099	21.1714
		SD	3.70E-02	6.57E-02	<b>5.18E-03</b>	2.51E-01	3.48E-02	4.25E-02	3.34E-02	8.34E-03	1.48E-02	2.73E-02	9.30E-03
		wilcoxon	-	-	+	-	-	-	-	-	-	-	
g	4	mean	16.8539	16.8539	16.8544	16.6649	16.8461	16.8484	16.8467	16.8538	16.853	16.8457	<b>16.8551</b>
		SD	1.36E-03	2.80E-03	6.72E-04	7.57E-02	5.72E-03	3.63E-03	3.68E-03	1.76E-03	2.15E-03	5.16E-03	<b>3.33E-04</b>
		wilcoxon											
	5	mean	19.3389	19.3238	19.3615	19.0718	19.3003	19.3137	19.2917	19.3563	19.3591	19.2923	<b>19.3685</b>
		SD	2.60E-02	4.77E-02	3.89E-03	1.12E-01	2.76E-02	2.10E-02	2.41E-02	8.81E-03	7.00E-03	4.24E-02	<b>6.47E-03</b>
		wilcoxon	-	-	-	-	-	-	-	-	-	-	
	6	mean	21.6094	21.6194	21.6913	21.3291	21.588	21.6156	21.584	21.6667	21.68	21.6002	<b>21.7043</b>

[illegible]