

Table1 segmentation results of 100 pictures in Berkeley datasets

Image ID	level	Our algorithm	BA	MMSA	IBA	OTSU
101085	2	63	68	62	69	63
(321×481)	3	60,108	65,114	61,105	66,109	62,106
	4	52,121,175	56,124,173	50,123,180	50,124,172	51,122,176
	5	47,136,188,216	52,136,192,219	47,139,188,213	51,135,189,218	49,136,189,216
119082	2	87	92	85	88	88
(481×321)	3	73,132	79,130	74,138	70,132	75,132
	4	70,129,186	70,130,188	74,136,187	69,128,193	69,132,189
	5	65,121,172,229	62,124,176,233	70,129,177,236	67,128,176,228	63,122,174,229
126007	2	97	101	97	104	100
(481×321)	3	86,128	85,132	91,135	94,136	84,127
	4	80,128,173	84,125,177	79,125,179	84,135,177	82,127,172
	5	72,128,173,229	74,127,172,232	69,128,171,236	78,128,174,236	72,129,173,230
156065	2	102	104	105	103	103
(481×321)	3	94,128	95,129	92,127	97,131	97,131
	4	85,119,181	87,115,185	83,119,184	93,116,181	88,119,184
	5	78,107,165,225	76,103,170,223	79,109,168,231	77,104,164,229	80,107,165,224
157055	2	117	123	125	119	120
(481×321)	3	102,136	103,136	100,136	106,134	100,139
	4	94,125,175	91,126,175	99,130,183	98,130,176	92,124,175
	5	83,110,163,205	81,114,165,208	80,109,169,208	82,110,163,209	85,108,161,207
16077	2	86	91	83	94	85
(481×321)	3	90,140	95,145	94,148	97,148	90,140
	4	72,111,149	70,110,149	71,108,151	80,118,155	70,110,148
	5	46,87,139,194	52,84,144,196	43,94,139,200	44,89,141,196	49,88,139,193
163085	2	93	93	99	90	96
(481×321)	3	85,117	86,121	90,124	93,121	84,116
	4	78,104,138	81,102,140	82,105,137	83,104,146	78,102,136
	5	71,96,129,173	73,97,132,179	69,93,128,175	76,99,126,172	74,95,130,174
167062	2	102	99	99	100	103
(481×321)	3	91,143	92,140	99,146	92,145	94,146
	4	85,136,188	82,140,186	84,135,193	91,142,190	88,134,191
	5	78,115,174,225	81,118,175,227	80,120,171,228	81,118,173,223	79,113,175,223
170057	2	115	120	120	114	117
(481×321)	3	106,134	107,138	109,134	104,133	105,135
	4	98,121,162	100,117,160	100,127,165	95,118,166	98,121,161
	5	84,114,152,197	86,117,153,200	84,115,150,195	84,115,155,196	86,116,153,199
175032	2	102	106	103	108	104
(321×481)	3	89,123	87,124	92,130	87,121	92,123
	4	81,112,154	77,110,157	87,110,157	78,110,158	82,114,155
	5	76,106,145,190	81,105,147,186	83,113,151,194	81,106,152,195	76,109,145,192
219090	2	99	99	105	98	100

(481×321)	3	91,127	93,127	98,126	99,124	93,129
	4	82,121,143	83,127,141	84,120,146	84,120,148	83,119,146
	5	80,119,136,177	82,123,142,181	84,126,144,181	84,123,139,184	81,117,139,178
220075	2	123	124	130	125	123
(481×321)	3	111,143	107,149	110,145	116,151	109,141
	4	105,132,162	105,129,167	102,130,166	110,138,159	104,134,161
	5	98,126,148,201	94,131,151,205	103,125,153,207	98,127,151,200	101,129,147,204
24077	2	141	136	138	142	145
(481×321)	3	135,186	131,190	133,181	129,184	134, 181
	4	121,167,201	117,160,196	119,162,203	123,171,204	118,164,205
	5	89,141,181,230	84,136,179,224	86,137,183,239	91,145,183,235	88,139,183,226
295087	2	117	123	120	122	118
(481×321)	3	104,130	104,131	107,130	108,128	103,128
	4	96,121,160	102,119,161	100,120,161	95,127,160	97,124,161
	5	85,107,146,184	84,108,151,188	93,105,150,192	88,112,149,182	85,105,147,183
296007	2	112	110	117	110	113
(481×321)	3	96,130	102,128	99,128	98,128	95,129
	4	88,121,145	90,126,143	85,129,142	93,120,143	86,124,147
	5	71,105,124,175	70,111,126,175	69,105,121,172	71,104,129,178	72,103,122,178
300091	2	106	107	113	104	109
(481×321)	3	98,125	98,130	106,128	102,132	98,128
	4	82,115,138	82,120,138	82,122,140	89,123,141	81,118,141
	5	77,103,124,173	78,107,129,174	84,109,131,180	77,100,122,177	78,105,126,173
38092	2	145	151	147	148	145
(481×321)	3	95,165	98,171	103,165	98,173	95,165
	4	61,124,181	62,129,180	69,131,184	65,129,182	61,122,183
	5	52,101,161,225	57,99,158,224	57,101,169,226	49,101,165,223	50,102,160,227
42049	2	88	84	85	86	85
(481×321)	3	66,165	62,161	63,162	64,167	64,163
	4	41,124,221	42,128,218	45,130,215	39,129,224	42,126,225
	5	45,91,161,235	40,93,167,228	41,86,158,229	48,96,168,231	42,89,159,231
43074	2	82	87	84	80	83
(481×321)	3	74,138	72,140	76,142	80,135	73,138
	4	65,124,164	65,123,163	66,130,172	65,129,163	65,127,167
	5	62,112,145,190	68,113,146,194	60,111,151,191	63,113,147,187	60,114,146,193
45096	2	52	48	57	49	50
(481×321)	3	51,104	47,100	59,110	48,103	51,102
	4	46,98,156	45,97,155	49,103,161	53,101,160	46,101,154
	5	42,86,135,212	40,86,140,209	49,93,132,212	43,93,134,218	40,89,137,214
58060	2	76	77	81	77	77
(481×321)	3	71,91	73,88	78,88	74,93	70,91
	4	62,82,156	60,84,162	61,89,156	65,80,158	62,81,157
	5	50,72,173,197	47,75,177,194	47,72,177,196	52,72,179,197	52,72,173,196
76053	2	99	99	98	107	100

(481×321)	3	86,145	88,141	91,148	86,148	87,146
	4	81,135,173	82,138,172	81,135,178	81,138,175	80,135,172
	5	71,124,151,208	68,120,156,208	72,124,149,210	79,127,148,214	73,125,154,206
78004	2	115	112	122	112	118
(321×481)	3	95,160	93,165	94,166	93,163	94,162
	4	84,146,173	81,142,175	90,144,178	85,145,175	85,144,174
	5	76,131,161,213	75,135,161,217	84,134,163,221	78,128,164,212	75,133,160,212
86000	2	102	100	102	106	100
(321×481)	3	98,143	103,141	97,142	97,151	98,146
	4	81,125,179	87,126,175	85,132,184	82,130,187	82,125,179
	5	73,114,156,210	72,118,152,206	77,115,162,209	70,114,158,207	74,116,157,212
89072	2	134	131	132	134	132
(321×481)	3	104,154	101,152	99,157	103,159	105,156
	4	97,137,181	91,132,180	92,135,183	94,134,184	93,136,186
	5	84,143,175,236	81,137,171,232	79,136,172,231	82,135,177,239	80,140,172,234
103070	2	102	101	103	101	101
(481×321)	3	86,131	91,134	94,128	94,131	89,132
	4	81,112,141	86,115,142	89,118,145	83,117,147	81,112,143
	5	72,94,154,185	68,96,160,188	73,96,158,191	76,94,156,187	75,94,155,183
108082	2	69	70	69	74	71
(481×321)	3	60,127	66,132	65,124	65,124	60,129
	4	54,114,177	53,115,176	60,113,180	59,118,176	54,112,180
	5	51,103,154,208	56,107,152,208	55,105,154,205	57,105,162,207	54,101,153,211
109053	2	117	120	114	114	117
(481×321)	3	102,154	107,151	105,158	101,159	102,157
	4	92,141,201	91,137,202	93,145,207	94,145,206	94,139,199
	5	78,130,184,211	80,135,180,217	82,135,184,217	76,130,189,209	77,132,182,212
12084	2	115	111	113	117	113
(481×321)	3	101,162	100,167	107,163	98,162	104,165
	4	94,146,186	98,142,185	99,146,193	92,147,193	96,147,188
	5	91,132,162,201	95,130,161,205	92,129,160,202	91,133,170,203	90,131,161,202
130026	2	104	100	101	102	106
(481×321)	3	74,125	74,130	79,127	80,127	72,124
	4	71,116,177	69,119,182	70,118,176	70,118,183	69,114,176
	5	65,105,157,214	71,105,156,219	63,112,160,213	65,104,154,214	63,104,158,213
14037	2	78	75	86	78	78
(481×321)	3	70,143	76,145	73,143	69,144	72,145
	4	65,134,194	64,134,193	72,140,202	68,133,200	64,137,197
	5	59,116,191,220	64,116,195,221	64,118,193,219	60,119,189,225	58,115,191,220
147091	2	84	89	84	91	82
(481×321)	3	78,188	84,191	77,187	85,188	78,191
	4	76,147,190	81,147,195	75,151,196	84,155,195	79,147,189
	5	70,136,181,210	76,137,178,214	76,144,178,209	73,144,178,214	69,136,181,211
148089	2	130	132	133	128	130

(481×321)	3	89,138	88,142	94,135	91,138	89,141
	4	76,134,190	72,133,194	78,136,195	79,136,191	74,133,188
	5	71,112,167,201	72,114,173,197	72,118,168,198	72,118,174,204	70,115,165,202
167083	2	82	78	82	89	85
(321×481)	3	75,112	73,114	72,115	76,109	78,113
	4	68,101,172	72,107,178	66,100,177	69,98,169	67,100,172
	5	62,99,144,196	68,97,146,201	64,100,149,198	59,98,148,193	60,100,145,194
189080	2	141	138	142	149	139
(321×481)	3	80,162	79,158	77,163	83,169	79,165
	4	74,145,168	71,150,167	72,152,171	73,143,170	76,148,168
	5	62,131,154,186	60,135,154,190	65,134,162,183	68,132,159,188	60,134,156,187
229036	2	76	77	73	80	74
(481×321)	3	67,130	71,135	75,135	73,129	67,130
	4	61,121,158	57,123,163	62,129,155	61,127,162	63,124,156
	5	56,105,131,187	52,105,128,187	63,108,137,185	57,108,139,188	57,108,133,189
241004	2	87	88	92	90	86
(481×321)	3	76,117	78,122	73,116	78,114	77,120
	4	71,105,158	71,106,156	79,113,166	74,112,161	74,105,161
	5	65,96,138,199	69,99,139,205	63,104,145,197	62,100,142,205	65,97,140,199
253027	2	121	123	127	123	120
(481×321)	3	86,151	87,147	89,157	86,152	84,151
	4	81,142,175	84,139,171	83,142,181	81,145,177	80,145,173
	5	80,121,165,203	82,127,161,209	78,126,171,203	79,123,168,207	83,122,166,202
260058	2	154	150	157	162	152
(481×321)	3	93,171	94,172	93,171	96,171	94,173
	4	87,161,201	83,160,207	84,164,208	94,168,208	87,160,202
	5	81,154,182,221	81,150,184,227	89,160,179,229	88,158,181,223	79,153,180,220
271035	2	111	112	113	119	112
(321×481)	3	61,151	66,157	68,153	60,156	63,151
	4	69,142,171	74,143,168	76,150,171	75,144,171	68,141,172
	5	71,134,166,195	73,137,168,194	69,137,173,195	77,132,164,198	73,136,165,198
285079	2	115	116	123	114	118
(321×481)	3	104,138	100,136	104,136	106,141	105,140
	4	98,128,171	97,128,170	101,134,170	102,136,168	96,131,172
	5	86,123,163,195	91,119,166,201	84,123,165,194	86,121,160,202	84,122,165,197
291000	2	87	85	92	86	85
(481×321)	3	81,136	77,139	86,136	88,140	83,139
	4	73,131,168	69,136,165	78,139,176	79,136,171	74,130,168
	5	69,124,141,194	70,128,147,192	66,126,138,202	77,124,149,194	72,122,142,194
304034	2	63	62	61	63	64
(481×321)	3	61,126	62,128	61,132	67,125	60,126
	4	59,93,150	57,91,156	63,95,154	64,91,158	60,91,149
	5	56,88,133,192	56,92,138,190	59,89,138,200	59,94,134,194	59,89,133,192
41033	2	95	100	102	95	95

(481×321)	3	78,97	82,96	84,97	81,105	81,98
	4	74,96,149	78,95,147	79,93,152	76,99,156	72,95,151
	5	68,92,142,203	67,96,145,202	73,94,141,204	74,89,147,206	70,93,142,204
54082	2	73	71	72	72	73
(321×481)	3	48,87	45,86	46,89	45,86	47,88
	4	35,52,121	32,54,125	36,56,124	33,51,118	32,50,124
	5	50,93,130,192	48,89,126,188	46,91,135,196	47,96,126,190	48,91,128,195
62096	2	107	113	114	112	106
(481×321)	3	89,123	94,121	97,130	94,122	87,123
	4	67,114,169	67,119,165	64,116,167	71,117,170	70,112,167
	5	61,105,154,192	65,101,153,189	58,112,159,198	62,110,157,192	64,103,156,190
69015	2	74	80	72	74	74
(321×481)	3	61,132	58,136	66,140	65,132	60,130
	4	60,122,182	56,118,178	59,130,184	57,128,182	62,122,183
	5	52,119,157,206	52,120,163,209	56,116,160,214	57,117,159,203	53,120,156,207
69040	2	102	101	108	104	103
(481×321)	3	91,140	97,136	92,145	98,141	93,143
	4	84,131,171	90,134,172	87,130,171	85,139,179	86,131,170
	5	76,122,152,194	75,119,149,193	77,127,157,193	78,122,155,199	79,120,152,193
8023	2	141	147	148	145	141
(481×321)	3	114,194	116,190	122,201	115,191	116,197
	4	104,162,203	106,166,202	101,163,205	109,164,207	104,161,202
	5	99,154,186,215	102,151,190,212	97,151,183,219	103,159,191,219	101,153,187,215
86016	2	95	91	92	91	93
(481×321)	3	87,121	83,119	84,116	82,123,	85,125
	4	82,124,152	81,126,151	84,123,147	79,119,143	81,126,151
	5	71,129,152,201	73,132,156,205	69,128,153,206	74,131,156,206	76,132,149,204
108005	2	102	98	109	102	102
(481×321)	3	75,112	77,116	79,116	72,109	74,114
	4	78,121,138	82,117,142	81,122,145	80,124,142	80,124,140
	5	71,122,151,186	70,121,153,184	70,123,157,191	72,119,151,190	71,120,149,185
108070	2	99	98	96	104	100
(481×321)	3	86,175	86,178	86,181	86,172	88,174
	4	73,141,205	78,144,204	81,140,205	77,143,205	75,139,205
	5	70,121,171,221	67,117,176,223	69,120,168,222	68,129,168,224	69,123,172,224
123074	2	114	113	121	117	116
(481×321)	3	114,164	113,168	115,168	111,166	117,166
	4	104,143,185	108,145,184	105,144,193	112,145,186	102,144,185
	5	101,123,162,194	103,119,160,200	101,123,165,193	105,127,168,195	100,125,164,196
134035	2	115	113	116	113	114
(481×321)	3	91,151	94,147	92,153	90,158	93,152
	4	84,145,175	81,150,173	83,146,175	87,148,183	87,146,178
	5	78,130,164,204	83,136,167,207	84,134,168,205	82,130,168,212	78,131,165,207
145086	2	114	117	122	118	115

(481×321)	3	90,149	91,145	90,147	98,157	89,148
	4	75,120,169	80,119,175	79,124,171	75,119,176	78,119,167
	5	65,108,154,198	62,107,153,196	67,105,153,202	69,107,152,198	66,106,156,197
148026	2	125	121	130	123	125
(321×481)	3	114,177	118,180	121,182	119,182	115,178
	4	82,153,190	82,152,194	89,150,188	87,156,189	83,156,190
	5	81,132,184,208	85,128,185,211	83,133,188,205	78,139,192,212	84,132,183,210
160068	2	119	116	117	117	118
(481×321)	3	117,169	112,170	115,172,	120,168,	119,171
	4	82,120,158	80,124,160	79,121,162	78,123,159	80,124,160
	5	90,121,150,200	91,125,153,204	92,123,154,203	87,118,151,197	88,120,154,201
182053	2	110	116	112	114	108
(481×321)	3	87,164	85,170	88,172	87,163	85,163
	4	74,141,178	77,141,176	71,138,186	73,145,184	75,139,180
	5	73,128,161,201	72,129,163,207	77,134,162,205	74,130,165,206	74,130,164,199
19021	2	91	96	90	90	91
(481×321)	3	83,141	87,138	86,140	83,147	84,139
	4	80,132,186	82,131,191	83,135,194	82,137,185	79,135,187
	5	77,92,162,211	80,88,158,213	79,93,164,210	83,89,163,216	78,90,161,214
196073	2	125	121	128	124	124
(481×321)	3	114,154	120,156	120,156	111,155	117,153
	4	102,123,167	106,124,164	107,128,174	108,120,168	105,121,170
	5	91,114,138,186	93,117,143,183	93,120,144,191	98,111,141,191	93,115,138,186
208001	2	80	78	88	77	79
(321×481)	3	79,154	81,151	81,151	82,154	78,152
	4	75,136,171	74,138,171	78,134,177	83,139,174	75,136,169
	5	79,115,154,192	76,121,152,196	82,113,158,200	76,123,151,196	80,114,156,195
210088	2	122	128	125	126	125
(321×481)	3	102,147	101,144	108,147	105,148	103,147
	4	99,132,177	96,132,175	107,140,181	96,135,185	98,134,176
	5	89,130,169,207	85,130,168,204	95,133,169,204	86,136,166,207	87,132,168,205
21077	2	102	104	105	103	103
(481×321)	3	95,130	91,129	92,134	94,135	93,133
	4	84,142,216	81,143,219	82,145,214	80,139,215	82,145,219
	5	80,117,143,225	78,114,147,227	77,115,141,221	76,115,149,220	78,119,141,224
216081	2	108	106	105	112	110
(481×321)	3	106,136	108,135	108,138	104,144	108,134
	4	82,112,149	80,111,147	90,117,150	85,118,150	85,113,149
	5	69,109,143,184	75,110,140,186	68,111,147,191	68,111,144,186	72,112,142,185
223061	2	131	128	139	139	133
(481×321)	3	114,164	117,169	117,172	121,164	115,167
	4	86,128,177	88,129,173	88,133,176	94,126,183	87,126,175
	5	73,145,169,208	73,145,175,209	80,148,172,205	77,147,176,209	71,145,169,207
227092	2	115	115	119	112	115

(321×481)	3	105,164	106,163	103,171	113,169	107,164
	4	95,143,186	93,141,188	92,143,184	97,140,185	95,146,186
	5	88,134,195,216	84,139,199,213	85,137,194,220	92,136,195,216	89,136,194,217
253055	2	102	103	107	102	100
(481×321)	3	99,134	98,140	101,142	98,138	100,137
	4	90,121,178	89,119,183	98,123,185	91,120,175	89,119,181
	5	81,112,145,188	77,116,147,187	88,116,146,195	82,112,143,195	81,114,147,189
306005	2	95	96	96	92	93
(481×321)	3	95,158	91,164	98,158	92,155	96,160
	4	91,141,181	89,138,185	91,140,184	99,138,182	92,143,182
	5	82,121,192,205	78,126,192,211	84,119,198,210	79,129,194,212	84,123,195,205
3096	2	77	79	82	82	76
(481×321)	3	35,79	32,79	36,85	32,76	34,80
	4	35,62,115	33,64,118	40,65,115	39,69,122	38,61,116
	5	35,61,112,168	34,66,118,173	35,59,112,176	33,64,119,165	37,63,111,170
33039	2	115	116	117	119	118
(321×481)	3	107,171	108,169	104,173	112,173	108,170
	4	102,158,195	98,154,201	106,161,194	102,158,192	105,159,194
	5	95,141,164,208	95,138,164,210	102,145,163,214	95,140,170,205	98,142,163,210
376043	2	140	137	147	138	143
(321×481)	3	102,145	101,146	99,146	104,149	102,147
	4	91,138,182	97,134,182	95,136,179	99,141,190	92,138,185
	5	82,128,156,216	81,131,162,214	79,135,153,218	85,136,163,219	83,131,156,219
38082	2	95	91	103	98	98
(481×321)	3	91,154	94,151	95,152	99,153	91,155
	4	80,138,173	81,134,175	81,140,173	85,142,181	78,136,174
	5	69,130,158,181	65,131,157,182	74,133,161,178	70,137,163,183	70,132,157,182
41069	2	71	70	73	70	69
(481×321)	3	69,117	65,116	76,120	76,125	72,116
	4	60,102,166	58,107,162	65,110,170	61,99,174	59,105,168
	5	56,95,145,177	56,94,142,178	54,93,149,179	63,94,143,183	56,93,147,180
86068	2	132	134	132	133	130
(481×321)	3	110,175	116,175	117,176	114,174	108,178
	4	104,136,194	100,137,191	101,143,191	101,141,191	102,135,192
	5	94,123,156,210	92,123,153,215	95,126,153,215	101,120,156,216	94,122,156,209
97033	2	82	86	85	79	82
(481×321)	3	76,155	81,155	75,160	84,155	79,155
	4	68,125,192	73,126,196	65,128,192	75,126,194	66,126,194
	5	60,91,169,229	58,94,167,227	58,89,171,233	60,90,176,234	61,94,172,231
101087	2	125	121	132	128	128
(321×481)	3	110,150	109,155	109,150	109,158	109,151
	4	80,127,159	81,127,161	79,125,162	85,132,158	82,125,162
	5	78,107,139,194	77,103,136,200	84,105,140,192	77,108,140,193	78,108,139,195
102061	2	136	134	133	144	136

(321×481)	3	103,175	105,176	106,174	109,174	102,175
	4	86,117,170	87,113,174	93,120,169	86,122,178	84,117,170
	5	60,106,166,174	57,108,164,170	58,103,172,172	64,105,167,180	62,107,168,173
105025	2	131	134	131	130	133
(481×321)	3	119,151	116,153	124,155	121,153	120,152
	4	101,137,171	102,135,171	100,144,173	105,136,172	103,139,172
	5	73,107,156,174	75,103,154,174	77,110,163,171	74,110,157,181	71,105,157,177
106024	2	117	114	123	125	117
(481×321)	3	101,141	103,142	99,146	105,145	100,139
	4	89,134,163	91,136,165	92,133,161	94,141,162	92,136,163
	5	84,127,144,179	88,124,142,177	86,130,145,187	81,130,145,185	87,125,145,179
143090	2	112	108	112	120	113
(481×321)	3	101,147	103,146	98,150	101,153	101,148
	4	76,122,162	75,118,167	81,124,167	77,124,161	76,120,160
	5	71,112,158,189	70,117,164,194	73,111,163,186	74,116,158,194	72,110,160,191
159008	2	146	150	144	144	144
(481×321)	3	121,166	125,165	120,171	121,174	124,169
	4	104,160,194	104,156,191	112,168,202	110,164,192	104,159,193
	5	74,136,188,220	80,139,185,217	81,133,185,225	71,135,186,227	72,135,189,218
175043	2	114	114	114	119	115
(481×321)	3	114,141	112,141	112,142	118,138	112,141
	4	104,138,184	105,140,189	101,142,192	103,145,185	107,139,187
	5	95,130,171,218	91,130,175,220	103,129,171,225	101,129,170,223	93,128,171,220
197017	2	121	117	128	125	119
(481×321)	3	106,151	108,150	109,148	105,152	108,151
	4	87,143,181	89,146,178	90,148,187	86,148,183	88,143,182
	5	84,136,177,214	82,133,173,211	92,141,180,216	92,135,184,221	87,135,175,217
236037	2	127	125	132	129	129
(481×321)	3	119,154	116,150	116,161	123,156	122,156
	4	104,136,171	106,141,170	105,142,175	112,142,173	103,137,173
	5	89,121,165,218	89,118,162,223	97,128,173,226	89,123,166,222	90,122,167,219
241048	2	168	174	176	173	168
(481×321)	3	147,188	149,188	147,189	149,192	146,188
	4	121,175,195	122,176,193	121,175,197	122,183,195	121,175,197
	5	102,160,190,231	98,158,186,232	105,163,197,234	100,163,191,234	103,160,193,229
296059	2	108	108	107	113	107
(481×321)	3	91,147	92,148	91,152	94,149	92,147
	4	84,158,186	86,157,188	84,164,191	92,165,193	83,158,186
	5	80,123,177,204	83,119,178,208	84,121,174,207	81,125,184,209	79,123,177,203
299086	2	128	124	132	135	127
(481×321)	3	115,141	112,141	113,143	117,142	115,143
	4	104,132,186	100,134,191	108,139,194	110,129,191	103,134,185
	5	91,115,171,225	97,111,167,227	92,113,168,223	93,119,174,225	92,116,169,223
302008	2	107	108	107	110	108



(321×481)	3	104,188	103,190	105,185	104,187	104,190
	4	91,175,210	96,172,207	95,182,208	99,174,213	93,173,211
	5	76,161,194,221	76,157,195,225	84,160,193,227	78,161,194,221	79,161,193,222
304074	2	136	134	135	135	136
(321×481)	3	127,173	124,170	130,171	129,173	127,173
	4	115,164,199	114,161,201	113,159,197	111,161,195	113,168,201
	5	104,153,190,229	105,149,187,225	106,151,188,226	103,151,190,227	104,156,187,228
351093	2	140	146	145	145	140
(481×321)	3	115,177	116,181	123,179	123,185	116,178
	4	106,169,199	106,174,203	108,166,200	110,171,198	105,167,197
	5	99,156,190,236	99,161,186,239	101,154,195,234	104,153,196,242	97,159,191,235
361010	2	115	111	114	119	117
(481×321)	3	112,145	115,150	110,144	118,152	111,145
	4	99,119,190	99,115,193	97,118,197	100,127,188	97,118,193
	5	74,110,179,220	79,111,185,222	81,108,182,225	81,116,184,221	72,112,179,220
37073	2	86	84,	85	84	86
(481×321)	3	54,91	51,94	52,95	50,88	51,89
	4	56,102,162,	54,103,165	52,106,159	53,99,159	57,104,165
	5	51,86,147,201	49,84,144,199	53,84,150,197	51,89,149,204	53,83,145,200
385039	2	134	135	131	134	133
(481×321)	3	104,151	105,156	107,154	108,156	102,149
	4	97,128,188	97,133,192	94,128,190	105,127,185	100,128,186
	5	76,114,177,229	82,111,174,225	75,120,178,231	74,111,178,228	79,114,178,228
42012	2	89	90	94	93	92
(321×481)	3	76,141	72,146	74,148	81,147	74,140
	4	71,108,175	69,107,171	77,105,183	74,112,180	69,109,177
	5	63,117,175,212	65,118,180,213	61,116,176,215	71,115,174,209	62,119,175,214
55073	2	97	98	100	105	96
(321×481)	3	84,147	84,148	90,152	84,154	82,149
	4	76,140,201	73,140,204	73,147,204	73,148,202	75,139,200
	5	69,132,182,233	75,129,180,238	75,132,181,231	73,140,179,238	70,130,183,233
65033	2	114	118	119	118	112
(481×321)	3	97,162	101,166	105,169	105,162	98,163
	4	82,145,203	81,142,201	89,147,204	81,152,209	81,147,202
	5	73,136,203,227	75,141,201,228	74,135,207,225	72,133,200,230	75,139,204,227
66053	2	75	72,	73	73,	74
(481×321)	3	71,148	70,146	73,145	69,145	68,146
	4	62,143,186	61,141,189	59,140,185,	60,147,188	60,142,189
	5	60,112,177,205	63,115,179,201	61,116,174,208	58,114,180,201	61,115,179,201
69020	2	102	107	105	102	104
(481×321)	3	95,136	92,142	102,144	97,137	98,137
	4	82,121,154	80,122,153	89,121,152	87,125,152	83,119,155
	5	69,97,141,195	72,93,140,194	76,104,144,201	77,103,141,195	71,95,141,196
85048	2	123	128	121	124	123

(481×321)	3	110,166	116,165	109,166	114,171	108,164
	4	93,156,173	95,154,175	97,157,177	99,155,174	95,159,172
	5	86,145,171,208	88,147,176,210	94,146,176,205	83,150,170,211	87,148,170,207
87046	2	128	129	131	135	126
(481×321)	3	117,153	122,154	117,161	120,153	116,156
	4	102,140,195	103,141,201	100,137,201	99,141,193	103,140,196
	5	80,132,171,210	85,131,174,210	78,133,173,210	84,140,171,210	78,132,173,210

Table 2 the information entropy (IE) of different segmented images using various algorithm

Image ID	level	Our algorithm	BA	MMSA	IBA	OTSU
101085	2	2.27	2.23	2.23	2.23	2.27
(321×481)	3	3.49	3.47	3.46	3.48	3.49
	4	5.14	5.08	5.07	5.08	5.11
	5	5.39	5.34	5.32	5.34	5.32
119082	2	2.53	2.49	2.49	2.49	2.53
(481×321)	3	3.96	3.93	3.92	3.92	3.96
	4	4.49	4.46	4.46	4.45	4.47
	5	4.78	4.70	4.68	4.69	4.74
126007	2	2.07	2.05	2.04	2.05	2.05
(481×321)	3	3.50	3.46	3.45	3.45	3.49
	4	4.28	4.24	4.24	4.24	4.23
	5	4.74	4.66	4.66	4.64	4.67
156065	2	2.14	2.12	2.11	2.12	2.13
(481×321)	3	4.80	4.76	4.75	4.77	4.79
	4	5.62	5.57	5.57	5.56	5.57
	5	6.28	6.20	6.19	6.20	6.21
157055	2	1.99	1.96	1.96	1.95	1.98
(481×321)	3	3.22	3.19	3.19	3.19	3.20
	4	3.83	3.77	3.77	3.77	3.79
	5	4.17	4.12	4.10	4.10	4.13
16077	2	2.14	2.10	2.10	2.09	2.13
(481×321)	3	3.51	3.46	3.47	3.47	3.50
	4	4.02	3.96	3.95	3.95	4.00
	5	4.35	4.30	4.29	4.30	4.31
163085	2	2.04	2.03	2.02	2.02	2.03
(481×321)	3	3.60	3.57	3.58	3.57	3.60
	4	4.89	4.85	4.85	4.85	4.84
	5	6.00	5.93	5.94	5.91	5.93
167062	2	2.17	2.14	2.14	2.14	2.15
(481×321)	3	3.24	3.22	3.23	3.22	3.22
	4	3.85	3.82	3.81	3.81	3.80
	5	4.35	4.31	4.30	4.30	4.31
170057	2	2.02	2.00	1.99	1.99	2.01
(481×321)	3	3.86	3.83	3.82	3.82	3.85

	4	4.61	4.58	4.58	4.57	4.59
	5	4.99	4.92	4.91	4.90	4.93
175032	2	2.61	2.57	2.57	2.57	2.59
(321×481)	3	3.61	3.58	3.57	3.56	3.58
	4	4.57	4.55	4.54	4.53	4.52
	5	5.10	5.06	5.04	5.03	5.05
219090	2	2.80	2.78	2.79	2.79	2.78
(481×321)	3	4.18	4.15	4.14	4.14	4.16
	4	5.50	5.45	5.44	5.45	5.46
	5	5.94	5.86	5.84	5.84	5.89
220075	2	2.60	2.58	2.57	2.58	2.60
(481×321)	3	3.96	3.92	3.93	3.92	3.93
	4	4.31	4.28	4.27	4.26	4.26
	5	4.63	4.55	4.53	4.53	4.58
24077	2	2.87	2.85	2.84	2.85	2.87
(481×321)	3	3.91	3.88	3.88	2.88	2.89
	4	4.64	4.59	4.58	4.58	4.61
	5	5.12	5.04	5.05	5.05	5.09
295087	2	2.57	2.55	2.54	2.55	2.56
(481×321)	3	3.88	3.82	3.83	3.82	3.87
	4	4.52	4.49	4.48	4.47	4.50
	5	4.81	4.76	4.77	4.75	4.74
296007	2	2.71	2.69	2.68	2.69	2.70
(481×321)	3	4.52	4.50	4.51	4.51	4.49
	4	6.17	6.13	6.12	6.11	6.15
	5	6.59	6.53	6.51	6.52	6.53
300091	2	2.49	2.47	2.47	2.46	2.47
(481×321)	3	3.87	3.84	3.83	3.85	3.86
	4	4.39	4.33	4.32	4.33	4.34
	5	4.63	4.55	4.54	4.53	4.57
38092	2	2.31	2.28	2.27	2.26	2.29
(481×321)	3	3.72	3.68	3.66	3.65	3.69
	4	4.28	4.23	4.22	4.22	4.24
	5	4.50	4.46	4.43	4.44	4.45
42049	2	2.19	2.18	2.17	2.17	2.18
(481×321)	3	3.24	3.21	3.22	3.22	3.22
	4	3.98	3.94	3.95	3.95	3.96
	5	4.45	4.39	4.38	4.39	4.41
43074	2	2.77	2.76	2.76	2.76	2.77
(481×321)	3	4.26	4.22	4.21	4.19	4.25
	4	4.95	4.92	4.90	4.89	4.91
	5	5.28	5.23	5.21	5.21	5.24
45096	2	2.05	2.03	2.02	2.01	2.05
(481×321)	3	4.34	4.31	4.30	4.28	4.32

	4	5.46	5.42	5.41	5.40	5.41
	5	6.15	6.10	6.09	6.08	6.10
58060	2	2.11	2.08	2.10	2.10	2.10
(481×321)	3	3.58	3.56	3.55	3.55	3.58
	4	4.39	4.33	4.32	4.33	4.34
	5	4.96	4.92	4.93	4.89	4.89
76053	2	2.59	2.57	2.58	2.57	2.58
(481×321)	3	4.32	4.31	4.29	4.30	4.31
	4	4.66	4.62	4.63	4.59	4.62
	5	4.76	4.72	4.71	4.68	4.69
78004	2	2.76	2.75	2.75	2.74	2.74
(321×481)	3	4.46	4.44	4.45	4.45	4.44
	4	5.46	5.42	5.43	5.39	5.43
	5	6.18	6.12	6.12	6.09	6.14
86000	2	1.94	1.90	1.91	1.89	1.93
(321×481)	3	3.49	3.44	3.43	3.42	3.48
	4	4.38	4.35	4.34	4.34	4.34
	5	4.93	4.88	4.86	4.86	4.86
89072	2	3.02	3.01	3.01	3.01	3.02
(321×481)	3	4.36	4.33	4.34	4.33	4.34
	4	5.23	5.20	5.21	5.21	5.23
	5	5.98	5.91	5.92	5.92	5.93
103070	2	2.11	2.08	2.07	2.06	2.11
(481×321)	3	3.58	3.54	3.53	3.54	3.56
	4	4.53	4.50	4.51	4.49	4.48
	5	5.08	5.05	5.04	5.02	5.04
108082	2	2.01	1.97	1.96	1.96	1.99
(481×321)	3	3.66	3.63	3.61	3.61	3.64
	4	4.39	4.34	4.34	4.34	4.34
	5	4.92	4.86	4.85	4.86	4.87
109053	2	2.18	2.17	2.16	2.16	2.17
(481×321)	3	3.87	3.83	3.82	3.84	3.85
	4	4.52	4.49	4.48	4.47	4.50
	5	5.05	4.99	5.01	4.98	4.98
12084	2	2.04	2.02	2.03	2.01	2.04
(481×321)	3	4.48	4.45	4.46	4.44	4.48
	4	5.56	5.51	5.52	5.49	5.53
	5	6.26	6.22	6.19	6.18	6.22
130026	2	2.65	2.64	2.63	2.64	2.64
(481×321)	3	4.11	4.07	4.08	4.04	4.09
	4	4.59	4.55	4.54	4.54	4.55
	5	4.77	4.72	4.73	4.67	4.73
14037	2	2.34	2.31	2.32	2.31	2.34
(481×321)	3	4.06	4.04	4.02	4.02	4.03

	4	4.54	4.51	4.52	4.51	4.51
	5	4.76	4.72	4.73	4.68	4.70
147091	2	2.64	2.62	2.61	2.61	2.64
(481×321)	3	4.38	4.35	4.34	4.32	4.37
	4	5.21	5.18	5.19	5.18	5.16
	5	5.49	5.44	5.43	5.44	5.45
148089	2	2.87	2.86	2.85	2.85	2.87
(481×321)	3	4.94	4.88	4.89	4.89	4.91
	4	5.50	5.47	5.46	5.47	5.47
	5	6.27	6.22	6.23	6.19	6.20
167083	2	2.31	2.30	2.29	2.30	2.30
(321×481)	3	4.00	3.96	3.96	3.94	4.01
	4	4.83	4.80	4.79	4.79	4.80
	5	5.12	5.08	5.10	5.05	5.05
189080	2	2.40	2.37	2.36	2.35	2.40
(321×481)	3	4.57	4.53	4.55	4.54	4.54
	4	4.91	4.87	4.88	4.84	4.86
	5	5.15	5.10	5.09	5.08	5.11
229036	2	2.07	2.03	2.04	2.03	2.06
(481×321)	3	3.60	3.56	3.55	3.55	3.58
	4	4.02	3.99	3.99	3.99	3.97
	5	4.49	4.42	4.42	4.40	4.42
241004	2	2.48	2.44	2.45	2.44	2.46
(481×321)	3	5.05	4.99	5.01	4.99	5.04
	4	5.84	5.78	5.77	5.78	5.79
	5	6.26	6.20	6.18	6.19	6.20
253027	2	3.05	3.03	3.03	3.03	3.03
(481×321)	3	6.00	5.98	5.99	5.99	6.00
	4	6.47	6.41	6.42	6.40	6.45
	5	6.78	6.73	6.74	6.70	6.74
260058	2	2.91	2.89	2.89	2.89	2.90
(481×321)	3	4.61	4.57	4.55	4.54	4.61
	4	5.51	5.48	5.49	5.48	5.48
	5	5.62	5.59	5.57	5.52	5.55
271035	2	2.02	2.01	2.00	2.00	2.02
(321×481)	3	4.05	4.02	4.03	3.98	4.04
	4	4.90	4.86	4.85	4.85	4.88
	5	5.46	5.41	5.43	5.40	5.40
285079	2	2.78	2.76	2.75	2.74	2.78
(321×481)	3	4.06	4.04	4.05	4.04	4.04
	4	5.25	5.19	5.21	5.19	5.22
	5	5.48	5.41	5.42	5.39	5.44
291000	2	2.71	2.70	2.70	2.70	2.70
(481×321)	3	4.29	4.26	4.27	4.27	4.28

	4	5.28	5.22	5.22	5.22	5.23
	5	5.89	5.81	5.80	5.81	5.83
304034	2	2.02	1.99	1.98	1.99	2.01
(481×321)	3	4.89	4.85	4.84	4.84	4.89
	4	5.31	5.27	5.27	5.27	5.26
	5	5.71	5.63	5.61	5.61	5.67
41033	2	2.55	2.53	2.52	2.52	2.54
(481×321)	3	4.37	4.34	4.33	4.33	4.38
	4	5.27	5.21	5.21	5.21	5.22
	5	5.75	5.70	5.68	5.68	5.71
54082	2	2.35	2.34	2.34	2.34	2.35
(321×481)	3	4.23	4.21	4.21	4.22	4.23
	4	5.52	5.48	5.49	5.49	5.51
	5	6.31	6.25	6.24	6.25	6.28
62096	2	2.62	2.60	2.60	2.60	2.60
(481×321)	3	4.20	4.14	4.15	4.14	4.19
	4	4.71	4.66	4.65	4.66	4.68
	5	5.18	5.11	5.09	5.10	5.12
69015	2	2.08	2.07	2.06	2.07	2.07
(321×481)	3	4.82	4.78	4.79	4.79	4.81
	4	5.91	5.87	5.87	5.87	5.89
	5	6.20	6.14	6.13	6.13	6.13
69040	2	2.15	2.14	2.13	2.13	2.15
(481×321)	3	4.03	3.98	3.98	3.97	4.03
	4	5.10	5.06	5.05	5.05	5.06
	5	5.92	5.85	5.84	5.83	5.85
8023	2	2.68	2.64	2.63	2.64	2.66
(481×321)	3	4.71	4.68	4.69	4.68	4.69
	4	5.29	5.24	5.24	5.24	5.25
	5	5.51	5.43	5.42	5.43	5.46
86016	2	2.23	2.22	2.21	2.22	2.23
(481×321)	3	3.41	3.39	3.38	3.38	3.40
	4	4.12	4.08	4.08	4.09	4.10
	5	4.67	4.62	4.63	4.62	4.62
108005	2	2.89	2.86	2.86	2.85	2.88
(481×321)	3	5.29	5.23	5.24	5.24	5.27
	4	6.16	6.11	6.10	6.10	6.12
	5	6.49	6.43	6.41	6.42	6.42
108070	2	2.83	2.79	2.79	2.79	2.83
(481×321)	3	4.16	4.13	4.13	4.13	4.16
	4	5.26	5.21	5.20	5.20	5.23
	5	5.66	5.58	5.57	5.56	5.60
123074	2	2.07	2.03	2.02	2.02	2.06
(481×321)	3	4.01	3.97	3.96	3.96	3.98

	4	4.78	4.72	4.71	4.72	4.74
	5	5.28	5.22	5.21	5.22	5.22
134035	2	2.16	2.15	2.14	2.15	2.14
(481×321)	3	4.60	4.57	4.57	4.56	4.60
	4	5.35	5.32	5.32	5.31	5.32
	5	5.63	5.57	5.57	5.56	5.57
145086	2	2.00	1.99	1.98	1.99	1.99
(481×321)	3	4.29	4.25	4.26	4.24	4.30
	4	4.82	4.79	4.79	4.78	4.80
	5	5.09	5.03	5.01	5.03	5.03
148026	2	2.17	2.16	2.16	2.15	2.17
(321×481)	3	3.77	3.74	3.74	3.73	3.74
	4	4.60	4.55	4.54	4.55	4.58
	5	5.16	5.08	5.07	5.07	5.10
160068	2	2.31	2.30	2.31	2.30	2.30
(481×321)	3	3.83	3.81	3.80	3.81	3.80
	4	4.76	4.71	4.70	4.71	4.72
	5	5.56	5.49	5.51	5.49	5.50
182053	2	2.69	2.68	2.67	2.68	2.67
(481×321)	3	4.81	4.78	4.79	4.78	4.81
	4	5.68	5.62	5.62	5.61	5.63
	5	6.09	6.02	6.02	6.00	6.04
19021	2	2.18	2.17	2.16	2.16	2.16
(481×321)	3	3.90	3.85	3.84	3.84	3.90
	4	4.41	4.35	4.34	4.35	4.38
	5	4.72	4.66	4.66	4.64	4.68
196073	2	2.55	2.54	2.53	2.53	2.54
(481×321)	3	3.64	3.59	3.58	3.59	3.64
	4	4.36	4.32	4.32	4.32	4.33
	5	4.64	4.59	4.57	4.58	4.59
208001	2	2.14	2.13	2.13	2.13	2.14
(321×481)	3	3.97	3.91	3.90	3.91	3.94
	4	4.55	4.50	4.49	4.50	4.52
	5	4.86	4.79	4.77	4.78	4.79
210088	2	2.30	2.29	2.29	2.28	2.29
(321×481)	3	3.73	3.70	3.71	3.69	3.72
	4	4.47	4.44	4.44	4.43	4.42
	5	4.80	4.75	4.74	4.74	4.75
21077	2	2.76	2.75	2.75	2.75	2.76
(481×321)	3	3.63	3.61	3.62	3.62	3.62
	4	4.32	4.28	4.29	4.28	4.30
	5	4.86	4.81	4.80	4.80	4.79
216081	2	2.86	2.85	2.85	2.84	2.86
(481×321)	3	4.37	4.32	4.31	4.31	4.36

	4	5.24	5.21	5.20	5.21	5.20
	5	5.70	5.64	5.62	5.62	5.64
223061	2	2.01	2.00	1.99	1.99	2.00
(481×321)	3	3.59	3.55	3.56	3.54	3.58
	4	4.73	4.70	4.69	4.69	4.70
	5	5.32	5.27	5.26	5.25	5.25
227092	2	2.68	2.67	2.66	2.66	2.68
(321×481)	3	4.36	4.31	4.32	4.30	4.34
	4	4.62	4.57	4.56	4.57	4.58
	5	5.00	4.92	4.92	4.91	4.94
253055	2	2.06	2.05	2.05	2.04	2.04
(481×321)	3	4.27	4.22	4.22	4.21	4.26
	4	5.33	5.28	5.28	5.27	5.30
	5	5.73	5.67	5.66	5.65	5.67
306005	2	2.84	2.82	2.82	2.81	2.84
(481×321)	3	4.61	4.57	4.58	4.58	4.61
	4	5.26	5.21	5.20	5.21	5.22
	5	5.32	5.24	5.22	5.24	5.28
3096	2	2.55	2.52	2.51	2.51	2.54
(481×321)	3	4.57	4.52	4.53	4.52	4.56
	4	5.27	5.24	5.23	5.24	5.24
	5	5.77	5.70	5.70	5.68	5.72
33039	2	2.47	2.43	2.43	2.42	2.46
(321×481)	3	4.33	4.31	4.31	4.31	4.32
	4	4.95	4.92	4.92	4.91	4.92
	5	5.29	5.23	5.21	5.22	5.25
376043	2	2.29	2.27	2.26	2.26	2.29
(321×481)	3	3.73	3.67	3.68	3.67	3.72
	4	4.31	4.28	4.28	4.27	4.29
	5	4.62	4.54	4.52	4.54	4.55
38082	2	2.35	2.31	2.31	2.30	2.35
(481×321)	3	4.28	4.24	4.23	4.24	4.28
	4	5.44	5.38	5.38	5.37	5.41
	5	5.94	5.88	5.86	5.87	5.89
41069	2	2.34	2.33	2.33	2.32	2.34
(481×321)	3	4.48	4.45	4.44	4.45	4.46
	4	4.96	4.92	4.92	4.92	4.93
	5	5.20	5.13	5.12	5.11	5.15
86068	2	2.41	2.40	2.40	2.40	2.40
(481×321)	3	3.82	3.76	3.75	3.77	3.81
	4	4.48	4.45	4.44	4.45	4.45
	5	4.81	4.74	4.72	4.72	4.74
97033	2	2.59	2.58	2.57	2.58	2.58
(481×321)	3	4.27	4.24	4.23	4.24	4.26



	4	5.14	5.09	5.09	5.08	5.09
	5	5.30	5.25	5.23	5.24	5.23
101087	2	2.13	2.12	2.11	2.11	2.13
(321×481)	3	3.69	3.64	3.65	3.63	3.69
	4	4.53	4.49	4.50	4.49	4.49
	5	4.84	4.78	4.77	4.76	4.80
102061	2	2.10	2.09	2.10	2.05	2.08
(321×481)	3	4.44	4.42	4.41	4.43	4.41
	4	4.90	4.85	4.86	4.85	4.88
	5	5.15	5.09	5.11	5.07	5.08
105025	2	2.84	2.80	2.81	2.79	2.82
(481×321)	3	4.24	4.18	4.20	4.18	4.22
	4	4.64	4.58	4.59	4.58	4.62
	5	4.91	4.86	4.88	4.85	4.87
106024	2	2.18	2.16	2.17	2.16	2.16
(481×321)	3	4.28	4.22	4.22	4.21	4.26
	4	5.20	5.15	5.16	5.15	5.18
	5	5.57	5.50	5.49	5.49	5.50
143090	2	2.23	2.22	2.21	2.20	2.23
(481×321)	3	4.01	3.97	3.98	3.98	4.02
	4	4.91	4.86	4.85	4.85	4.86
	5	5.29	5.24	5.23	5.22	5.25
159008	2	2.68	2.67	2.67	2.65	2.66
(481×321)	3	4.45	4.39	4.40	4.39	4.42
	4	5.07	5.03	5.04	5.03	5.02
	5	5.44	5.39	5.38	5.38	5.37
175043	2	2.54	2.53	2.53	2.51	2.52
(481×321)	3	4.32	4.27	4.26	4.27	4.31
	4	4.94	4.91	4.91	4.91	4.89
	5	5.28	5.22	5.24	5.21	5.22
197017	2	2.87	2.86	2.86	2.82	2.85
(481×321)	3	4.67	4.61	4.63	4.61	4.65
	4	5.54	5.50	5.52	5.49	5.49
	5	6.10	6.04	6.06	6.02	6.05
236037	2	2.29	2.28	2.27	2.28	2.28
(481×321)	3	4.14	4.10	4.09	4.11	4.14
	4	4.93	4.87	4.89	4.87	4.89
	5	5.36	5.32	5.33	5.26	5.31
241048	2	2.15	2.14	2.14	2.14	2.15
(481×321)	3	3.20	3.18	3.17	3.18	3.17
	4	4.18	4.13	4.14	4.13	4.14
	5	4.61	4.56	4.59	4.56	4.54
296059	2	2.67	2.66	2.67	2.63	2.65
(481×321)	3	4.53	4.48	4.49	4.49	4.52

	4	5.11	5.06	5.07	5.05	5.08
	5	5.48	5.42	5.43	5.42	5.41
299086	2	2.41	2.39	2.40	2.37	2.39
(481×321)	3	4.50	4.44	4.45	4.43	4.49
	4	5.29	5.23	5.24	5.23	5.24
	5	5.67	5.62	5.63	5.57	5.60
302008	2	2.47	2.46	2.46	2.42	2.45
(321×481)	3	4.87	4.84	4.83	4.83	4.84
	4	5.25	5.21	5.23	5.21	5.20
	5	5.47	5.42	5.43	5.40	5.43
304074	2	3.13	3.12	3.10	3.14	3.13
(321×481)	3	4.09	4.07	4.06	4.08	4.09
	4	4.76	4.70	4.71	4.73	4.73
	5	5.21	5.16	5.15	5.15	5.18
351093	2	2.39	2.37	2.36	2.36	2.38
(481×321)	3	4.57	4.52	4.51	4.51	4.56
	4	5.58	5.54	5.53	5.51	5.55
	5	6.12	6.07	6.08	6.02	6.07
361010	2	2.50	2.47	2.47	2.46	2.48
(481×321)	3	4.96	4.91	4.90	4.90	4.95
	4	5.72	5.68	5.68	5.68	5.67
	5	6.15	6.09	6.07	6.09	6.10
37073	2	2.64	2.62	2.63	2.59	2.64
(481×321)	3	4.30	4.26	4.25	4.26	4.28
	4	4.95	4.93	4.92	4.91	4.90
	5	5.28	5.25	5.23	5.18	5.24
385039	2	2.61	2.59	2.58	2.58	2.60
(481×321)	3	4.38	4.35	4.36	4.34	4.36
	4	5.20	5.17	5.16	5.17	5.15
	5	5.50	5.43	5.42	5.41	5.43
42012	2	2.27	2.26	2.25	2.22	2.25
(321×481)	3	4.00	3.98	3.99	3.97	3.97
	4	4.62	4.56	4.56	4.56	4.58
	5	5.07	5.00	4.99	4.98	5.01
55073	2	2.20	2.17	2.16	2.16	2.18
(321×481)	3	3.67	3.64	3.65	3.64	3.67
	4	4.46	4.42	4.42	4.41	4.41
	5	4.75	4.69	4.67	4.69	4.71
65033	2	2.02	1.99	1.99	1.99	2.02
(481×321)	3	3.98	3.94	3.94	3.93	3.95
	4	4.55	4.49	4.48	4.48	4.52
	5	4.79	4.73	4.72	4.71	4.75
66053	2	3.16	3.15	3.14	3.15	3.15
(481×321)	3	4.56	4.51	4.51	4.52	4.51

	4	5.43	5.38	5.37	5.39	5.39
	5	6.19	6.12	6.13	6.12	6.14
69020	2	2.52	2.51	2.50	2.51	2.50
(481×321)	3	4.61	4.58	4.57	4.59	4.60
	4	5.16	5.12	5.11	5.12	5.12
	5	5.60	5.55	5.55	5.55	5.53
85048	2	2.21	2.20	2.20	2.20	2.20
(481×321)	3	4.47	4.43	4.44	4.44	4.45
	4	5.28	5.23	5.22	5.23	5.23
	5	5.46	5.40	5.41	5.40	5.42
87046	2	2.10	2.09	2.08	2.09	2.10
(481×321)	3	3.77	3.73	3.71	3.72	3.74
	4	4.58	4.54	4.54	4.54	4.54
	5	5.18	5.13	5.12	5.13	5.14

Table 3 Root Mean Squared Error (RMSE) of different segmented images using various algorithm

Image ID	level	Our algorithm	BA	MMSA	IBA	OTSU
101085	2	17.92	17.93	17.95	17.93	17.93
(321×481)	3	16.80	16.89	16.94	16.84	16.84
	4	16.27	16.42	16.49	16.29	16.29
	5	15.85	15.94	15.97	15.90	15.90
119082	2	17.56	17.57	17.58	17.59	17.59
(481×321)	3	16.70	16.77	16.82	16.72	16.72
	4	16.19	16.29	16.31	16.23	16.23
	5	15.73	15.86	15.90	15.77	15.77
126007	2	17.67	17.75	17.78	17.68	17.68
(481×321)	3	16.86	16.92	16.97	16.91	16.91
	4	16.22	16.36	16.41	16.24	16.24
	5	15.78	15.85	15.87	15.81	15.81
156065	2	18.01	18.02	18.05	18.04	18.04
(481×321)	3	17.16	17.23	17.28	17.20	17.20
	4	16.48	16.64	16.71	16.55	16.55
	5	16.17	16.31	16.34	16.24	16.24
157055	2	18.74	18.81	18.83	18.77	18.77
(481×321)	3	18.28	18.39	18.44	18.32	18.32
	4	17.82	17.97	18.01	17.89	17.89
	5	17.62	17.80	17.83	17.65	17.65
16077	2	18.01	18.08	18.11	18.03	18.03
(481×321)	3	17.14	17.22	17.24	17.16	17.16
	4	16.49	16.61	16.63	16.56	16.56
	5	16.07	16.16	16.20	16.11	16.11
163085	2	18.09	18.12	18.13	18.10	18.10
(481×321)	3	17.32	17.38	17.44	17.35	17.35
	4	16.87	16.93	16.96	16.91	16.91

	5	16.64	16.71	16.77	16.71	16.71
167062	2	16.24	16.26	16.29	16.27	16.27
(481×321)	3	15.44	15.47	15.49	15.48	15.48
	4	15.23	15.32	15.37	15.26	15.26
	5	15.03	15.17	15.25	15.05	15.05
170057	2	18.70	18.74	18.75	18.73	18.73
(481×321)	3	17.97	18.04	18.09	18.01	18.01
	4	17.33	17.46	17.50	17.38	17.38
	5	17.00	17.08	17.15	17.08	17.08
175032	2	17.56	17.58	17.60	17.58	17.58
(321×481)	3	17.16	17.28	17.32	17.20	17.20
	4	16.82	16.92	16.94	16.88	16.88
	5	16.68	16.75	16.80	16.75	16.75
219090	2	18.50	18.58	18.60	18.53	18.53
(481×321)	3	17.97	18.01	18.07	18.03	18.03
	4	17.53	17.68	17.72	17.57	17.57
	5	17.32	17.41	17.44	17.40	17.40
220075	2	18.59	18.60	18.61	18.60	18.60
(481×321)	3	17.83	17.91	17.93	17.88	17.88
	4	17.40	17.51	17.56	17.43	17.43
	5	17.26	17.34	17.40	17.30	17.30
24077	2	17.21	17.24	17.25	17.21	17.22
(481×321)	3	16.92	17.05	17.10	16.96	16.95
	4	16.82	16.94	16.99	16.87	16.85
	5	16.56	16.63	16.79	16.66	16.63
295087	2	18.73	18.75	18.76	18.75	18.75
(481×321)	3	18.02	18.10	18.12	18.08	18.08
	4	17.52	17.60	17.67	17.54	17.54
	5	17.40	17.52	17.59	17.47	17.47
296007	2	18.08	18.09	18.12	18.11	18.11
(481×321)	3	17.69	17.75	17.77	17.74	17.74
	4	17.40	17.53	17.58	17.44	17.44
	5	17.29	17.43	17.50	17.33	17.33
300091	2	17.84	17.90	17.92	17.87	17.87
(481×321)	3	17.18	17.30	17.36	17.22	17.22
	4	16.80	16.87	16.92	16.86	16.86
	5	16.54	16.67	16.73	16.58	16.58
38092	2	18.03	18.11	18.12	18.06	18.06
(481×321)	3	17.53	17.62	17.66	17.58	17.58
	4	17.11	17.20	17.23	17.16	17.16
	5	16.82	17.98	18.00	16.88	16.88
42049	2	18.03	18.09	18.13	18.11	18.05
(481×321)	3	17.72	17.79	17.82	17.76	17.73
	4	16.72	16.71	16.72	16.73	16.73

	5	15.90	15.92	15.92	15.93	15.92
43074	2	18.54	18.57	18.59	18.56	18.56
(481×321)	3	17.86	17.94	18.00	17.91	17.91
	4	17.41	17.52	17.55	17.46	17.46
	5	17.18	17.34	17.40	17.22	17.22
45096	2	18.30	18.36	18.37	18.31	18.31
(481×321)	3	17.38	17.50	17.54	17.43	17.43
	4	16.86	16.93	17.00	16.90	16.90
	5	16.50	16.58	16.60	16.55	16.55
58060	2	18.39	18.45	18.47	18.40	18.40
(481×321)	3	17.31	17.35	17.39	17.35	17.35
	4	16.89	17.03	17.09	16.94	16.94
	5	16.51	16.65	16.67	16.58	16.58
76053	2	17.60	17.66	17.67	17.62	17.62
(481×321)	3	16.44	16.56	16.58	16.49	16.49
	4	16.10	16.16	16.20	16.12	16.12
	5	15.90	16.00	16.08	15.98	15.98
78004	2	18.42	18.45	18.47	18.45	18.45
(321×481)	3	17.48	17.59	17.61	17.51	17.51
	4	16.88	16.92	16.96	16.95	16.95
	5	16.45	16.61	16.68	16.48	16.48
86000	2	18.38	18.46	18.48	18.39	18.39
(321×481)	3	17.98	18.07	18.11	18.02	18.02
	4	17.68	17.84	17.87	17.74	17.74
	5	17.41	17.54	17.59	17.49	17.49
89072	2	18.10	18.11	18.12	18.10	18.11
(321×481)	3	18.02	18.00	18.08	18.01	18.03
	4	17.34	17.38	17.43	17.40	17.34
	5	16.96	17.12	17.19	17.17	17.05
103070	2	18.11	18.19	18.20	18.13	18.13
(481×321)	3	17.72	17.79	17.81	17.74	17.74
	4	17.26	17.31	17.36	17.28	17.28
	5	17.13	17.24	17.31	17.16	17.16
108082	2	18.69	18.72	18.74	18.71	18.71
(481×321)	3	17.35	17.45	17.49	17.38	17.38
	4	16.88	17.03	17.09	16.92	16.92
	5	16.36	16.46	16.54	16.40	16.40
109053	2	17.96	17.99	18.01	17.97	17.97
(481×321)	3	16.63	16.73	16.79	16.65	16.65
	4	15.91	15.99	16.03	15.96	15.96
	5	15.65	15.74	15.81	15.69	15.69
12084	2	18.21	18.24	18.26	18.23	18.23
(481×321)	3	17.42	17.53	17.59	17.48	17.48
	4	16.90	16.96	16.99	16.92	16.92

	5	16.35	16.51	16.58	16.38	16.38
130026	2	18.20	18.27	18.28	18.23	18.23
(481×321)	3	17.61	17.67	17.69	17.67	17.67
	4	17.48	17.60	17.66	17.52	17.52
	5	17.34	17.47	17.51	17.38	17.38
14037	2	18.42	18.50	18.52	18.43	18.43
(481×321)	3	17.53	17.61	17.67	17.55	17.55
	4	17.22	17.35	17.42	17.27	17.27
	5	17.92	18.04	18.07	18.00	18.00
147091	2	18.10	18.16	18.19	18.13	18.13
(481×321)	3	17.51	17.61	17.67	17.53	17.53
	4	17.16	17.28	17.30	17.20	17.20
	5	16.90	17.04	17.12	16.93	16.93
148089	2	18.44	18.45	18.48	18.47	18.47
(481×321)	3	18.18	18.22	18.24	18.21	18.21
	4	17.85	17.95	17.97	17.92	17.92
	5	17.75	17.85	17.90	17.81	17.81
167083	2	17.90	17.94	17.96	17.93	17.93
(321×481)	3	17.44	17.49	17.51	17.49	17.49
	4	17.36	17.52	17.56	17.38	17.38
	5	17.29	17.45	17.51	17.33	17.33
189080	2	17.98	18.04	18.07	17.99	17.99
(321×481)	3	16.94	16.97	17.03	16.96	16.96
	4	16.64	16.73	16.77	16.68	16.68
	5	16.43	16.59	16.64	16.48	16.48
229036	2	17.80	17.83	17.84	17.82	17.82
(481×321)	3	17.18	17.29	17.32	17.24	17.24
	4	16.72	16.83	16.86	16.75	16.75
	5	16.58	16.72	16.74	16.60	16.60
241004	2	17.73	17.81	17.82	17.76	17.76
(481×321)	3	16.20	16.30	16.35	16.22	16.22
	4	15.67	15.81	15.88	15.69	15.69
	5	15.37	15.52	15.55	15.45	15.45
253027	2	17.18	17.22	17.25	17.20	17.20
(481×321)	3	16.69	16.79	16.81	16.75	16.75
	4	16.30	16.43	16.49	16.36	16.36
	5	16.17	16.30	16.38	16.23	16.23
260058	2	18.01	18.06	18.07	18.03	18.03
(481×321)	3	17.54	17.62	17.66	17.58	17.58
	4	17.34	17.47	17.51	17.38	17.38
	5	17.18	17.30	17.34	17.24	17.24
271035	2	18.07	18.09	18.11	18.10	18.10
(321×481)	3	17.20	17.32	17.35	17.25	17.25
	4	16.45	16.50	16.52	16.48	16.48

	5	16.04	16.19	16.27	16.08	16.08
285079	2	18.77	18.79	18.82	18.78	18.78
(321×481)	3	18.32	18.39	18.43	18.38	18.38
	4	18.15	18.19	18.25	18.20	18.20
	5	18.04	18.11	18.17	18.07	18.07
291000	2	17.72	17.74	17.77	17.74	17.74
(481×321)	3	17.09	17.17	17.21	17.15	17.15
	4	16.44	16.48	16.53	16.47	16.47
	5	15.95	16.04	16.09	15.98	15.98
304034	2	17.84	17.85	17.88	17.87	17.87
(481×321)	3	17.18	17.23	17.29	17.23	17.23
	4	16.79	16.84	16.87	16.82	16.82
	5	16.38	16.46	16.52	16.46	16.46
41033	2	18.31	18.37	18.38	18.33	18.33
(481×321)	3	18.04	18.13	18.16	18.09	18.09
	4	19.98	20.09	20.12	20.02	20.02
	5	17.88	18.03	18.08	17.96	17.96
54082	2	17.92	17.95	18.00	18.00	17.92
(321×481)	3	17.11	17.14	17.16	17.14	17.13
	4	15.33	15.49	15.67	15.51	15.33
	5	14.76	14.80	14.96	14.89	14.80
62096	2	17.30	17.38	17.41	17.32	17.32
(481×321)	3	17.15	17.26	17.32	17.18	17.18
	4	17.10	17.15	17.17	17.15	17.15
	5	16.95	17.04	17.12	16.99	16.99
69015	2	17.33	17.38	17.41	17.35	17.35
(321×481)	3	16.84	16.92	16.98	16.88	16.88
	4	16.68	16.84	16.86	16.72	16.72
	5	16.66	16.81	16.87	16.71	16.71
69040	2	18.12	18.13	18.14	18.13	18.13
(481×321)	3	17.79	17.90	17.94	17.81	17.81
	4	17.64	17.71	17.77	17.68	17.68
	5	17.60	17.77	17.80	17.66	17.66
8023	2	18.76	18.79	18.80	18.78	18.78
(481×321)	3	18.35	18.42	18.48	18.39	18.39
	4	17.93	17.97	18.01	18.00	18.00
	5	17.52	17.66	17.70	17.57	17.57
86016	2	18.00	18.00	18.02	18.00	18.02
(481×321)	3	17.45	17.57	17.58	17.56	17.46
	4	17.21	17.31	17.31	17.25	17.22
	5	15.69	15.81	15.78	15.83	15.74
108005	2	18.23	18.31	18.33	18.25	18.25
(481×321)	3	18.04	18.11	18.13	18.08	18.08
	4	17.85	17.93	17.98	17.89	17.89

	5	17.73	17.85	17.89	17.79	17.79
108070	2	18.47	18.49	18.52	18.48	18.48
(481×321)	3	18.28	18.31	18.35	18.33	18.33
	4	17.85	17.94	17.98	17.92	17.92
	5	17.67	17.76	17.83	17.73	17.73
123074	2	18.53	18.59	18.60	18.54	18.54
(481×321)	3	17.25	17.29	17.32	17.31	17.31
	4	16.62	16.74	16.79	16.64	16.64
	5	16.23	16.36	16.40	16.28	16.28
134035	2	18.59	18.64	18.65	18.61	18.61
(481×321)	3	18.33	18.40	18.45	18.37	18.37
	4	18.05	18.21	18.26	18.11	18.11
	5	17.89	18.05	18.12	17.95	17.95
145086	2	18.07	18.14	18.16	18.10	18.10
(481×321)	3	17.68	17.74	17.77	17.71	17.71
	4	17.36	17.51	17.58	17.43	17.43
	5	16.89	17.02	17.08	16.94	16.94
148026	2	18.65	18.73	18.75	18.66	18.66
(321×481)	3	18.42	18.47	18.49	18.48	18.48
	4	18.27	18.32	18.35	18.29	18.29
	5	18.07	18.23	18.30	18.11	18.11
160068	2	18.21	18.23	18.24	18.24	18.22
(481×321)	3	17.89	17.95	17.98	19.96	17.89
	4	16.61	16.74	16.79	16.78	16.71
	5	15.59	15.62	15.81	15.65	15.59
182053	2	18.25	18.26	18.28	18.27	18.27
(481×321)	3	17.49	17.55	17.60	17.52	17.52
	4	17.08	17.22	17.28	17.13	17.13
	5	16.79	16.95	17.01	16.82	16.82
19021	2	18.19	18.21	18.22	18.22	18.22
(481×321)	3	17.79	17.84	17.89	17.82	17.82
	4	17.57	17.62	17.68	17.60	17.60
	5	17.52	17.63	17.68	17.58	17.58
196073	2	18.11	18.14	18.17	18.13	18.13
(481×321)	3	16.71	16.80	16.86	16.76	16.76
	4	15.59	15.73	15.76	15.65	15.65
	5	15.23	15.39	15.47	15.27	15.27
208001	2	18.37	18.45	18.48	18.38	18.38
(321×481)	3	17.92	18.01	18.06	17.97	17.97
	4	17.57	17.73	17.75	17.64	17.64
	5	17.41	17.54	17.59	17.44	17.44
210088	2	18.34	18.36	18.37	18.37	18.37
(321×481)	3	17.88	17.99	18.02	17.90	17.90
	4	17.34	17.44	17.51	17.36	17.36



	5	16.98	17.11	17.16	17.06	17.06
21077	2	17.06	17.17	17.22	17.12	17.12
(481×321)	3	16.35	16.53	16.56	16.48	16.41
	4	16.12	16.17	16.22	16.19	16.12
	5	15.15	15.21	15.29	15.22	15.17
216081	2	18.36	18.39	18.41	18.37	18.37
(481×321)	3	18.04	18.13	18.18	18.10	18.10
	4	18.77	18.88	18.95	18.84	18.84
	5	17.48	17.61	17.67	17.54	17.54
223061	2	18.22	18.30	18.33	18.25	18.25
(481×321)	3	17.85	17.89	17.91	17.88	17.88
	4	17.43	17.54	17.56	17.45	17.45
	5	17.00	17.07	17.10	17.04	17.04
227092	2	18.63	18.66	18.67	18.64	18.64
(321×481)	3	17.62	17.69	17.73	17.68	17.68
	4	16.74	16.79	16.84	16.81	16.81
	5	16.24	16.31	16.39	16.30	16.30
253055	2	15.92	15.99	16.01	15.95	15.95
(481×321)	3	15.54	15.59	15.63	15.57	15.57
	4	15.20	15.28	15.34	15.22	15.22
	5	15.12	15.28	15.36	15.15	15.15
306005	2	16.59	16.66	16.68	16.62	16.62
(481×321)	3	16.12	16.18	16.22	16.18	16.18
	4	15.92	16.08	16.13	15.97	15.97
	5	15.80	15.89	15.96	15.85	15.85
3096	2	18.92	18.99	19.02	18.93	18.93
(481×321)	3	16.94	16.98	17.01	16.99	16.99
	4	15.74	15.90	15.93	15.76	15.76
	5	14.71	14.85	14.92	14.76	14.76
33039	2	18.56	18.57	18.60	18.57	18.57
(321×481)	3	17.91	18.01	18.03	17.93	17.93
	4	17.46	17.59	17.63	17.51	17.51
	5	17.08	17.22	17.28	17.14	17.14
376043	2	17.38	17.42	17.44	17.39	17.39
(321×481)	3	16.94	16.98	17.02	16.97	16.97
	4	16.64	16.71	16.73	16.70	16.70
	5	16.42	16.53	16.57	16.47	16.47
38082	2	18.12	18.14	18.16	18.13	18.13
(481×321)	3	17.81	17.87	17.91	17.83	17.83
	4	17.60	17.71	17.78	17.66	17.66
	5	16.89	16.99	17.06	16.97	16.97
41069	2	17.58	17.59	17.60	17.59	17.59
(481×321)	3	17.02	17.07	17.13	17.04	17.04
	4	16.88	16.99	17.04	16.93	16.93

	5	16.75	16.90	16.97	16.79	16.79
86068	2	18.59	18.66	18.67	18.60	18.60
(481×321)	3	17.42	17.46	17.52	17.47	17.47
	4	16.95	17.02	17.09	16.97	16.97
	5	16.63	16.79	16.82	16.70	16.70
97033	2	17.35	17.42	17.45	17.36	17.36
(481×321)	3	17.00	17.03	17.07	17.05	17.05
	4	16.69	16.82	16.87	16.71	16.71
	5	16.58	16.71	16.75	16.60	16.60
101087	2	14.99	15.02	15.05	15.02	15.02
(321×481)	3	14.49	14.57	14.60	14.53	14.53
	4	14.05	14.17	14.23	14.08	14.08
	5	13.80	13.91	13.96	13.85	13.85
102061	2	17.95	17.99	18.02	17.96	17.96
(321×481)	3	17.59	17.64	17.68	17.63	17.63
	4	17.21	17.30	17.34	17.28	17.28
	5	17.00	17.10	17.18	17.05	17.05
105025	2	17.11	17.17	17.20	17.13	17.13
(481×321)	3	16.22	16.34	16.40	16.27	16.27
	4	15.43	15.59	15.64	15.46	15.46
	5	14.82	14.94	14.97	14.88	14.88
106024	2	17.64	17.68	17.71	17.65	17.65
(481×321)	3	17.21	17.31	17.35	17.24	17.24
	4	17.19	17.26	17.30	17.23	17.23
	5	16.87	17.01	17.05	16.91	16.91
143090	2	18.14	18.22	18.24	18.15	18.15
(481×321)	3	17.64	17.74	17.76	17.66	17.66
	4	17.29	17.42	17.44	17.31	17.31
	5	16.95	17.09	17.13	17.01	17.01
159008	2	18.86	18.94	18.96	18.87	18.87
(481×321)	3	18.58	18.65	18.71	18.62	18.62
	4	18.30	18.44	18.47	18.32	18.32
	5	18.04	18.19	18.22	18.09	18.09
175043	2	18.50	18.52	18.53	18.52	18.52
(481×321)	3	17.54	17.59	17.64	17.59	17.59
	4	16.94	17.02	17.07	17.00	17.00
	5	16.34	16.42	16.45	16.38	16.38
197017	2	18.48	18.53	18.55	18.50	18.50
(481×321)	3	17.97	18.03	18.06	18.02	18.02
	4	17.54	17.58	17.64	17.60	17.60
	5	17.22	17.37	17.40	17.29	17.29
236037	2	18.89	18.91	18.93	18.90	18.90
(481×321)	3	17.76	17.85	17.90	17.78	17.78
	4	16.92	17.02	17.05	16.94	16.94

	5	16.40	16.48	16.54	16.45	16.45
241048	2	17.78	17.81	17.84	17.79	17.79
(481×321)	3	17.42	17.53	17.55	17.44	17.44
	4	17.08	17.15	17.18	17.14	17.14
	5	16.92	17.05	17.10	16.97	16.97
296059	2	18.26	18.32	18.33	18.29	18.29
(481×321)	3	17.79	17.90	17.95	17.83	17.83
	4	17.46	17.57	17.60	17.51	17.51
	5	17.16	17.27	17.32	17.24	17.24
299086	2	18.71	18.79	18.80	18.73	18.73
(481×321)	3	17.45	17.52	17.58	17.49	17.49
	4	16.87	17.01	17.07	16.94	16.94
	5	16.56	16.73	16.76	16.59	16.59
302008	2	16.61	16.67	16.68	16.63	16.63
(321×481)	3	16.54	16.61	16.65	16.60	16.60
	4	16.49	16.55	16.58	16.52	16.52
	5	16.47	16.60	16.65	16.52	16.51
304074	2	17.72	17.74	17.76	17.73	17.72
(321×481)	3	17.28	17.35	17.47	17.31	17.28
	4	16.30	16.38	16.46	16.44	16.35
	5	16.01	16.04	16.09	16.04	16.02
351093	2	16.54	16.56	16.58	16.57	16.57
(481×321)	3	16.31	16.35	16.37	16.36	16.36
	4	16.23	16.27	16.33	16.30	16.30
	5	16.12	16.32	16.40	16.17	16.17
361010	2	18.16	18.21	18.24	18.19	18.19
(481×321)	3	17.42	17.53	17.56	17.48	17.48
	4	17.12	17.25	17.28	17.17	17.17
	5	16.80	16.96	17.01	16.85	16.85
37073	2	18.50	18.53	18.55	18.53	18.50
(481×321)	3	18.09	18.16	18.21	18.12	18.09
	4	16.27	16.38	16.48	16.37	16.27
	5	15.41	15.81	15.92	15.70	15.40
385039	2	18.78	18.81	18.84	18.80	18.80
(481×321)	3	17.83	17.90	17.96	17.86	17.86
	4	17.41	17.48	17.55	17.48	17.48
	5	17.10	17.26	17.30	17.15	17.15
42012	2	18.26	18.30	18.31	18.29	18.29
(321×481)	3	17.89	17.97	18.01	17.92	17.92
	4	17.61	17.76	17.81	17.68	17.68
	5	17.52	17.64	17.68	17.55	17.55
55073	2	18.29	18.35	18.38	18.32	18.32
(321×481)	3	18.00	18.04	18.06	18.06	18.06
	4	17.79	17.95	17.99	17.84	17.84

	5	17.63	17.76	17.83	17.70	17.70
65033	2	18.01	18.03	18.05	18.04	18.04
(481×321)	3	17.79	17.90	17.96	17.85	17.85
	4	17.40	17.46	17.49	17.47	17.47
	5	17.17	17.31	17.37	17.23	17.23
66053	2	18.47	18.50	18.52	18.50	18.49
(481×321)	3	18.01	18.07	18.05	18.06	18.02
	4	16.89	16.97	17.13	17.03	16.94
	5	16.31	16.42	16.51	16.46	16.33
69020	2	17.98	18.02	18.03	18.00	18.00
(481×321)	3	16.94	17.05	17.08	16.97	16.97
	4	16.20	16.30	16.35	16.22	16.22
	5	15.64	15.78	15.80	15.68	15.68
85048	2	17.92	17.97	18.00	17.95	17.95
(481×321)	3	17.37	17.46	17.52	17.41	17.41
	4	16.79	16.92	16.98	16.81	16.81
	5	16.28	16.35	16.41	16.33	16.33
87046	2	18.66	18.72	18.74	18.67	18.67
(481×321)	3	17.75	17.78	17.83	17.79	17.79
	4	16.86	16.97	17.03	16.92	16.92
	5	16.10	16.22	16.25	16.13	16.13

Table 4 Peak Signal to Noise Ratio (PSNR) of different segmented images using various algorithm

Image ID	level	Our algorithm	BA	MMSA	IBA	OTSU
101085	2	23.06	23.06	23.05	23.06	23.06
(321×481)	3	23.62	23.58	23.55	23.60	23.60
	4	23.90	23.82	23.79	23.89	23.89
	5	24.13	24.08	24.06	24.10	24.10
119082	2	23.24	23.24	23.23	23.23	23.23
(481×321)	3	23.68	23.64	23.61	23.67	23.67
	4	23.95	23.89	23.88	23.92	23.92
	5	24.20	24.12	24.10	24.17	24.17
126007	2	23.19	23.15	23.13	23.18	23.18
(481×321)	3	23.59	23.56	23.54	23.57	23.57
	4	23.93	23.86	23.83	23.92	23.92
	5	24.17	24.13	24.12	24.15	24.15
156065	2	23.02	23.02	23.00	23.01	23.01
(481×321)	3	23.44	23.41	23.38	23.42	23.42
	4	23.79	23.71	23.67	23.75	23.75
	5	23.96	23.88	23.87	23.92	23.92
157055	2	22.68	22.64	22.63	22.66	22.66
(481×321)	3	22.89	22.84	22.82	22.87	22.87
	4	23.11	23.04	23.02	23.08	23.08

	5	23.21	23.12	23.11	23.20	23.20
16077	2	23.02	22.99	22.97	23.01	23.01
(481×321)	3	23.45	23.41	23.40	23.44	23.44
	4	23.79	23.72	23.71	23.75	23.75
	5	24.01	23.96	23.94	23.99	23.99
163085	2	22.98	22.97	22.96	22.98	22.98
(481×321)	3	23.36	23.33	23.30	23.34	23.34
	4	23.59	23.56	23.54	23.57	23.57
	5	23.71	23.67	23.64	23.67	23.67
167062	2	23.92	23.91	23.89	23.90	23.90
(481×321)	3	24.36	24.34	24.33	24.34	24.34
	4	24.48	24.43	24.40	24.46	24.46
	5	24.59	24.51	24.47	24.58	24.58
170057	2	22.69	22.68	22.67	22.68	22.68
(481×321)	3	23.04	23.01	22.98	23.02	23.02
	4	23.35	23.29	23.27	23.33	23.33
	5	23.52	23.48	23.45	23.48	23.48
175032	2	23.24	23.23	23.22	23.23	23.23
(321×481)	3	23.44	23.38	23.36	23.42	23.42
	4	23.61	23.56	23.55	23.58	23.58
	5	23.69	23.65	23.62	23.65	23.65
219090	2	22.79	22.75	22.74	22.77	22.77
(481×321)	3	23.04	23.02	22.99	23.01	23.01
	4	23.26	23.18	23.16	23.24	23.24
	5	23.36	23.31	23.30	23.32	23.32
220075	2	22.75	22.74	22.74	22.74	22.74
(481×321)	3	23.11	23.07	23.06	23.08	23.08
	4	23.32	23.27	23.24	23.30	23.30
	5	23.39	23.35	23.32	23.37	23.37
24077	2	23.01	23.40	23.40	23.42	23.41
(481×321)	3	23.44	23.50	23.47	23.54	23.55
	4	23.75	23.55	23.53	23.59	23.60
	5	23.99	23.71	23.63	23.70	23.71
295087	2	22.68	22.67	22.67	22.67	22.67
(481×321)	3	23.02	22.98	22.97	22.99	22.99
	4	23.26	23.22	23.19	23.25	23.25
	5	23.32	23.26	23.23	23.28	23.28
296007	2	22.99	22.98	22.97	22.97	22.97
(481×321)	3	23.18	23.15	23.14	23.15	23.15
	4	23.32	23.26	23.23	23.30	23.30
	5	23.37	23.30	23.27	23.35	23.35
300091	2	23.06	23.06	23.05	23.06	23.06
(481×321)	3	23.62	23.58	23.55	23.60	23.60
	4	23.90	23.82	23.79	23.89	23.89

	5	24.13	24.08	24.06	24.10	24.10
38092	2	23.24	23.24	23.23	23.23	23.23
(481×321)	3	23.68	23.64	23.61	23.67	23.67
	4	23.95	23.89	23.88	23.92	23.92
	5	24.20	24.12	24.10	24.17	24.17
42049	2	23.90	22.98	22.96	22.97	23.00
(481×321)	3	24.34	23.13	23.11	23.14	23.16
	4	24.46	23.67	23.67	23.66	23.66
	5	24.58	24.09	24.09	24.09	24.09
43074	2	23.02	23.02	23.00	23.01	23.01
(481×321)	3	23.44	23.41	23.38	23.42	23.42
	4	23.79	23.71	23.67	23.75	23.75
	5	23.96	23.88	23.87	23.92	23.92
45096	2	22.68	22.64	22.63	22.66	22.66
(481×321)	3	22.89	22.84	22.82	22.87	22.87
	4	23.11	23.04	23.02	23.08	23.08
	5	23.21	23.12	23.11	23.20	23.20
58060	2	23.02	22.99	22.97	23.01	23.01
(481×321)	3	23.45	23.41	23.40	23.44	23.44
	4	23.79	23.72	23.71	23.75	23.75
	5	24.01	23.96	23.94	23.99	23.99
76053	2	22.98	22.97	22.96	22.98	22.98
(481×321)	3	23.36	23.33	23.30	23.34	23.34
	4	23.59	23.56	23.54	23.57	23.57
	5	23.71	23.67	23.64	23.67	23.67
78004	2	23.92	23.91	23.89	23.90	23.90
(321×481)	3	24.36	24.34	24.33	24.34	24.34
	4	24.48	24.43	24.40	24.46	24.46
	5	24.59	24.51	24.47	24.58	24.58
86000	2	22.69	22.68	22.67	22.68	22.68
(321×481)	3	23.04	23.01	22.98	23.02	23.02
	4	23.35	23.29	23.27	23.33	23.33
	5	23.52	23.48	23.45	23.48	23.48
89072	2	22.98	22.97	22.97	22.98	22.97
(321×481)	3	23.34	23.03	22.99	23.02	23.01
	4	23.57	23.33	23.30	23.32	23.35
	5	23.67	23.46	23.43	23.44	23.50
103070	2	22.79	22.75	22.74	22.77	22.77
(481×321)	3	23.04	23.02	22.99	23.01	23.01
	4	23.26	23.18	23.16	23.24	23.24
	5	23.36	23.31	23.30	23.32	23.32
108082	2	22.75	22.74	22.74	22.74	22.74
(481×321)	3	23.11	23.07	23.06	23.08	23.08
	4	23.32	23.27	23.24	23.30	23.30

	5	23.39	23.35	23.32	23.37	23.37
109053	2	23.42	23.41	23.40	23.41	23.41
(481×321)	3	23.69	23.67	23.66	23.68	23.68
	4	23.83	23.80	23.79	23.82	23.82
	5	23.91	23.86	23.82	23.87	23.87
12084	2	22.68	22.67	22.67	22.67	22.67
(481×321)	3	23.02	22.98	22.97	22.99	22.99
	4	23.26	23.22	23.19	23.25	23.25
	5	23.32	23.26	23.23	23.28	23.28
130026	2	22.99	22.98	22.97	22.97	22.97
(481×321)	3	23.18	23.15	23.14	23.15	23.15
	4	23.32	23.26	23.23	23.30	23.30
	5	23.37	23.30	23.27	23.35	23.35
14037	2	23.06	23.06	23.05	23.06	23.06
(481×321)	3	23.62	23.58	23.55	23.60	23.60
	4	23.90	23.82	23.79	23.89	23.89
	5	24.13	24.08	24.06	24.10	24.10
147091	2	23.24	23.24	23.23	23.23	23.23
(481×321)	3	23.68	23.64	23.61	23.67	23.67
	4	23.95	23.89	23.88	23.92	23.92
	5	24.20	24.12	24.10	24.17	24.17
148089	2	23.19	23.15	23.13	23.18	23.18
(481×321)	3	23.59	23.56	23.54	23.57	23.57
	4	23.93	23.86	23.83	23.92	23.92
	5	24.17	24.13	24.12	24.15	24.15
167083	2	23.02	23.02	23.00	23.01	23.01
(321×481)	3	23.44	23.41	23.38	23.42	23.42
	4	23.79	23.71	23.67	23.75	23.75
	5	23.96	23.88	23.87	23.92	23.92
189080	2	22.68	22.64	22.63	22.66	22.66
(321×481)	3	22.89	22.84	22.82	22.87	22.87
	4	23.11	23.04	23.02	23.08	23.08
	5	23.21	23.12	23.11	23.20	23.20
229036	2	23.02	22.99	22.97	23.01	23.01
(481×321)	3	23.45	23.41	23.40	23.44	23.44
	4	23.79	23.72	23.71	23.75	23.75
	5	24.01	23.96	23.94	23.99	23.99
241004	2	22.98	22.97	22.96	22.98	22.98
(481×321)	3	23.36	23.33	23.30	23.34	23.34
	4	23.59	23.56	23.54	23.57	23.57
	5	23.71	23.67	23.64	23.67	23.67
253027	2	23.92	23.91	23.89	23.90	23.90
(481×321)	3	24.36	24.34	24.33	24.34	24.34
	4	24.48	24.43	24.40	24.46	24.46

	5	24.59	24.51	24.47	24.58	24.58
260058	2	22.69	22.68	22.67	22.68	22.68
(481×321)	3	23.04	23.01	22.98	23.02	23.02
	4	23.35	23.29	23.27	23.33	23.33
	5	23.52	23.48	23.45	23.48	23.48
271035	2	23.24	23.23	23.22	23.23	23.23
(321×481)	3	23.44	23.38	23.36	23.42	23.42
	4	23.61	23.56	23.55	23.58	23.58
	5	23.69	23.65	23.62	23.65	23.65
285079	2	22.79	22.75	22.74	22.77	22.77
(321×481)	3	23.04	23.02	22.99	23.01	23.01
	4	23.26	23.18	23.16	23.24	23.24
	5	23.36	23.31	23.30	23.32	23.32
291000	2	22.75	22.74	22.74	22.74	22.74
(481×321)	3	23.11	23.07	23.06	23.08	23.08
	4	23.32	23.27	23.24	23.30	23.30
	5	23.39	23.35	23.32	23.37	23.37
304034	2	23.42	23.41	23.40	23.41	23.41
(481×321)	3	23.69	23.67	23.66	23.68	23.68
	4	23.83	23.80	23.79	23.82	23.82
	5	23.91	23.86	23.82	23.87	23.87
41033	2	22.68	22.67	22.67	22.67	22.67
(481×321)	3	23.02	22.98	22.97	22.99	22.99
	4	23.26	23.22	23.19	23.25	23.25
	5	23.32	23.26	23.23	23.28	23.28
54082	2	23.23	23.05	23.03	23.03	23.06
(321×481)	3	23.42	23.45	23.44	23.45	23.46
	4	23.58	24.33	24.23	24.32	24.42
	5	23.65	24.73	24.63	24.67	24.73
62096	2	23.06	23.06	23.05	23.06	23.06
(481×321)	3	23.62	23.58	23.55	23.60	23.60
	4	23.90	23.82	23.79	23.89	23.89
	5	24.13	24.08	24.06	24.10	24.10
69015	2	23.24	23.24	23.23	23.23	23.23
(321×481)	3	23.68	23.64	23.61	23.67	23.67
	4	23.95	23.89	23.88	23.92	23.92
	5	24.20	24.12	24.10	24.17	24.17
69040	2	23.19	23.15	23.13	23.18	23.18
(481×321)	3	23.59	23.56	23.54	23.57	23.57
	4	23.93	23.86	23.83	23.92	23.92
	5	24.17	24.13	24.12	24.15	24.15
8023	2	23.02	23.02	23.00	23.01	23.01
(481×321)	3	23.44	23.41	23.38	23.42	23.42
	4	23.79	23.71	23.67	23.75	23.75



	5	23.96	23.88	23.87	23.92	23.92
86016	2	22.68	23.03	23.02	23.03	23.02
(481×321)	3	23.02	23.24	23.23	23.24	23.29
	4	23.33	23.36	23.36	23.40	23.41
	5	23.48	24.15	24.17	24.14	24.19
108005	2	23.02	22.99	22.97	23.01	23.01
(481×321)	3	23.45	23.41	23.40	23.44	23.44
	4	23.79	23.72	23.71	23.75	23.75
	5	24.01	23.96	23.94	23.99	23.99
108070	2	22.98	22.97	22.96	22.98	22.98
(481×321)	3	23.36	23.33	23.30	23.34	23.34
	4	23.59	23.56	23.54	23.57	23.57
	5	23.71	23.67	23.64	23.67	23.67
123074	2	23.92	23.91	23.89	23.90	23.90
(481×321)	3	24.36	24.34	24.33	24.34	24.34
	4	24.48	24.43	24.40	24.46	24.46
	5	24.59	24.51	24.47	24.58	24.58
134035	2	22.69	22.68	22.67	22.68	22.68
(481×321)	3	23.04	23.01	22.98	23.02	23.02
	4	23.35	23.29	23.27	23.33	23.33
	5	23.52	23.48	23.45	23.48	23.48
145086	2	23.24	23.23	23.22	23.23	23.23
(481×321)	3	23.44	23.38	23.36	23.42	23.42
	4	23.61	23.56	23.55	23.58	23.58
	5	23.69	23.65	23.62	23.65	23.65
148026	2	22.79	22.75	22.74	22.77	22.77
(321×481)	3	23.04	23.02	22.99	23.01	23.01
	4	23.26	23.18	23.16	23.24	23.24
	5	23.36	23.31	23.30	23.32	23.32
160068	2	22.74	22.92	22.91	22.91	22.92
(481×321)	3	23.08	23.05	23.04	22.13	23.08
	4	23.30	23.66	23.63	23.63	23.67
	5	23.37	24.26	24.15	24.24	24.27
182053	2	23.42	23.41	23.40	23.41	23.41
(481×321)	3	23.69	23.67	23.66	23.68	23.68
	4	23.83	23.80	23.79	23.82	23.82
	5	23.91	23.86	23.82	23.87	23.87
19021	2	22.68	22.67	22.67	22.67	22.67
(481×321)	3	23.02	22.98	22.97	22.99	22.99
	4	23.26	23.22	23.19	23.25	23.25
	5	23.32	23.26	23.23	23.28	23.28
196073	2	22.99	22.98	22.97	22.97	22.97
(481×321)	3	23.18	23.15	23.14	23.15	23.15
	4	23.32	23.26	23.23	23.30	23.30

	5	23.37	23.30	23.27	23.35	23.35
208001	2	23.06	23.06	23.05	23.06	23.06
(321×481)	3	23.62	23.58	23.55	23.60	23.60
	4	23.90	23.82	23.79	23.89	23.89
	5	24.13	24.08	24.06	24.10	24.10
210088	2	23.24	23.24	23.23	23.23	23.23
(321×481)	3	23.68	23.64	23.61	23.67	23.67
	4	23.95	23.89	23.88	23.92	23.92
	5	24.20	24.12	24.10	24.17	24.17
21077	2	22.77	23.44	23.41	23.46	23.46
(481×321)	3	23.01	23.77	23.75	23.79	23.83
	4	23.24	23.96	23.93	23.95	23.98
	5	23.32	24.49	24.44	24.48	24.51
216081	2	23.02	23.02	23.00	23.01	23.01
(481×321)	3	23.44	23.41	23.38	23.42	23.42
	4	23.79	23.71	23.67	23.75	23.75
	5	23.96	23.88	23.87	23.92	23.92
223061	2	22.68	22.64	22.63	22.66	22.66
(481×321)	3	22.89	22.84	22.82	22.87	22.87
	4	23.11	23.04	23.02	23.08	23.08
	5	23.21	23.12	23.11	23.20	23.20
227092	2	23.02	22.99	22.97	23.01	23.01
(321×481)	3	23.45	23.41	23.40	23.44	23.44
	4	23.79	23.72	23.71	23.75	23.75
	5	24.01	23.96	23.94	23.99	23.99
253055	2	22.98	22.97	22.96	22.98	22.98
(481×321)	3	23.36	23.33	23.30	23.34	23.34
	4	23.59	23.56	23.54	23.57	23.57
	5	23.71	23.67	23.64	23.67	23.67
306005	2	23.92	23.91	23.89	23.90	23.90
(481×321)	3	24.36	24.34	24.33	24.34	24.34
	4	24.48	24.43	24.40	24.46	24.46
	5	24.59	24.51	24.47	24.58	24.58
3096	2	22.69	22.68	22.67	22.68	22.68
(481×321)	3	23.04	23.01	22.98	23.02	23.02
	4	23.35	23.29	23.27	23.33	23.33
	5	23.52	23.48	23.45	23.48	23.48
33039	2	23.24	23.23	23.22	23.23	23.23
(321×481)	3	23.44	23.38	23.36	23.42	23.42
	4	23.61	23.56	23.55	23.58	23.58
	5	23.69	23.65	23.62	23.65	23.65
376043	2	22.79	22.75	22.74	22.77	22.77
(321×481)	3	23.04	23.02	22.99	23.01	23.01
	4	23.26	23.18	23.16	23.24	23.24

	5	23.36	23.31	23.30	23.32	23.32
38082	2	22.75	22.74	22.74	22.74	22.74
(481×321)	3	23.11	23.07	23.06	23.08	23.08
	4	23.32	23.27	23.24	23.30	23.30
	5	23.39	23.35	23.32	23.37	23.37
41069	2	23.42	23.41	23.40	23.41	23.41
(481×321)	3	23.69	23.67	23.66	23.68	23.68
	4	23.83	23.80	23.79	23.82	23.82
	5	23.91	23.86	23.82	23.87	23.87
86068	2	22.68	22.67	22.67	22.67	22.67
(481×321)	3	23.02	22.98	22.97	22.99	22.99
	4	23.26	23.22	23.19	23.25	23.25
	5	23.32	23.26	23.23	23.28	23.28
97033	2	22.99	22.98	22.97	22.97	22.97
(481×321)	3	23.18	23.15	23.14	23.15	23.15
	4	23.32	23.26	23.23	23.30	23.30
	5	23.37	23.30	23.27	23.35	23.35
101087	2	23.06	23.06	23.05	23.06	23.06
(321×481)	3	23.62	23.58	23.55	23.60	23.60
	4	23.90	23.82	23.79	23.89	23.89
	5	24.13	24.08	24.06	24.10	24.10
102061	2	23.24	23.24	23.23	23.23	23.23
(321×481)	3	23.68	23.64	23.61	23.67	23.67
	4	23.95	23.89	23.88	23.92	23.92
	5	24.20	24.12	24.10	24.17	24.17
105025	2	23.19	23.15	23.13	23.18	23.18
(481×321)	3	23.59	23.56	23.54	23.57	23.57
	4	23.93	23.86	23.83	23.92	23.92
	5	24.17	24.13	24.12	24.15	24.15
106024	2	23.02	23.02	23.00	23.01	23.01
(481×321)	3	23.44	23.41	23.38	23.42	23.42
	4	23.79	23.71	23.67	23.75	23.75
	5	23.96	23.88	23.87	23.92	23.92
143090	2	22.68	22.64	22.63	22.66	22.66
(481×321)	3	22.89	22.84	22.82	22.87	22.87
	4	23.11	23.04	23.02	23.08	23.08
	5	23.21	23.12	23.11	23.20	23.20
159008	2	23.02	22.99	22.97	23.01	23.01
(481×321)	3	23.45	23.41	23.40	23.44	23.44
	4	23.79	23.72	23.71	23.75	23.75
	5	24.01	23.96	23.94	23.99	23.99
175043	2	22.98	22.97	22.96	22.98	22.98
(481×321)	3	23.36	23.33	23.30	23.34	23.34
	4	23.59	23.56	23.54	23.57	23.57

	5	23.71	23.67	23.64	23.67	23.67
197017	2	23.92	23.91	23.89	23.90	23.90
(481×321)	3	24.36	24.34	24.33	24.34	24.34
	4	24.48	24.43	24.40	24.46	24.46
	5	24.59	24.51	24.47	24.58	24.58
236037	2	22.69	22.68	22.67	22.68	22.68
(481×321)	3	23.04	23.01	22.98	23.02	23.02
	4	23.35	23.29	23.27	23.33	23.33
	5	23.52	23.48	23.45	23.48	23.48
241048	2	23.24	23.23	23.22	23.23	23.23
(481×321)	3	23.44	23.38	23.36	23.42	23.42
	4	23.61	23.56	23.55	23.58	23.58
	5	23.69	23.65	23.62	23.65	23.65
296059	2	22.79	22.75	22.74	22.77	22.77
(481×321)	3	23.04	23.02	22.99	23.01	23.01
	4	23.26	23.18	23.16	23.24	23.24
	5	23.36	23.31	23.30	23.32	23.32
299086	2	22.75	22.74	22.74	22.74	22.74
(481×321)	3	23.11	23.07	23.06	23.08	23.08
	4	23.32	23.27	23.24	23.30	23.30
	5	23.39	23.35	23.32	23.37	23.37
302008	2	23.42	23.41	23.40	23.41	23.41
(321×481)	3	23.69	23.67	23.66	23.68	23.68
	4	23.83	23.80	23.79	23.82	23.82
	5	23.91	23.86	23.82	23.87	23.87
304074	2	22.97	23.15	23.14	23.16	23.16
(321×481)	3	23.15	23.34	23.28	23.36	23.38
	4	23.30	23.84	23.80	23.81	23.86
	5	23.35	24.03	24.00	24.03	24.04
351093	2	22.99	22.98	22.97	22.97	22.97
(481×321)	3	23.18	23.15	23.14	23.15	23.15
	4	23.32	23.26	23.23	23.30	23.30
	5	23.37	23.30	23.27	23.35	23.35
361010	2	23.06	23.06	23.05	23.06	23.06
(481×321)	3	23.62	23.58	23.55	23.60	23.60
	4	23.90	23.82	23.79	23.89	23.89
	5	24.13	24.08	24.06	24.10	24.10
37073	2	23.41	22.77	22.76	22.77	22.79
(481×321)	3	23.68	22.95	22.92	22.97	22.98
	4	23.82	23.84	23.79	23.85	23.90
	5	23.87	24.15	24.09	24.21	24.38
385039	2	23.19	23.15	23.13	23.18	23.18
(481×321)	3	23.59	23.56	23.54	23.57	23.57
	4	23.93	23.86	23.83	23.92	23.92

	5	24.17	24.13	24.12	24.15	24.15
42012	2	23.02	23.02	23.00	23.01	23.01
(321×481)	3	23.44	23.41	23.38	23.42	23.42
	4	23.79	23.71	23.67	23.75	23.75
	5	23.96	23.88	23.87	23.92	23.92
55073	2	22.68	22.64	22.63	22.66	22.66
(321×481)	3	22.89	22.84	22.82	22.87	22.87
	4	23.11	23.04	23.02	23.08	23.08
	5	23.21	23.12	23.11	23.20	23.20
65033	2	23.02	22.99	22.97	23.01	23.01
(481×321)	3	23.45	23.41	23.40	23.44	23.44
	4	23.79	23.72	23.71	23.75	23.75
	5	24.01	23.96	23.94	23.99	23.99
66053	2	22.67	22.79	22.78	22.79	22.79
(481×321)	3	22.99	22.99	23.00	23.00	23.02
	4	23.25	23.54	23.46	23.51	23.55
	5	23.28	23.82	23.78	23.80	23.87
69020	2	23.92	23.91	23.89	23.90	23.90
(481×321)	3	24.36	24.34	24.33	24.34	24.34
	4	24.48	24.43	24.40	24.46	24.46
	5	24.59	24.51	24.47	24.58	24.58
85048	2	22.69	22.68	22.67	22.68	22.68
(481×321)	3	23.04	23.01	22.98	23.02	23.02
	4	23.35	23.29	23.27	23.33	23.33
	5	23.52	23.48	23.45	23.48	23.48
87046	2	23.24	23.23	23.22	23.23	23.23
(481×321)	3	23.44	23.38	23.36	23.42	23.42
	4	23.61	23.56	23.55	23.58	23.58
	5	23.69	23.65	23.62	23.65	23.65

Table 5 Structural Similarity Index (SSIM) of different segmented images using various algorithm

Image ID	level	Our algorithm	BA	MMSA	IBA	OTSU
101085	2	0.50	0.48	0.47	0.49	0.48
(321×481)	3	0.75	0.73	0.74	0.72	0.74
	4	0.86	0.83	0.85	0.85	0.83
	5	0.89	0.86	0.87	0.86	0.88
119082	2	0.73	0.70	0.71	0.72	0.72
(481×321)	3	0.82	0.80	0.81	0.81	0.82
	4	0.88	0.87	0.86	0.87	0.88
	5	0.91	0.89	0.88	0.88	0.90
126007	2	0.41	0.39	0.40	0.39	0.41
(481×321)	3	0.66	0.63	0.64	0.65	0.66
	4	0.72	0.69	0.69	0.70	0.71
	5	0.80	0.78	0.78	0.79	0.79

156065	2	0.59	0.57	0.57	0.58	0.57
(481×321)	3	0.69	0.67	0.68	0.67	0.68
	4	0.76	0.72	0.73	0.75	0.74
	5	0.87	0.83	0.85	0.86	0.86
157055	2	0.70	0.68	0.68	0.69	0.70
(481×321)	3	0.75	0.74	0.73	0.73	0.74
	4	0.80	0.77	0.77	0.78	0.78
	5	0.86	0.84	0.83	0.83	0.85
16077	2	0.65	0.63	0.64	0.64	0.64
(481×321)	3	0.80	0.78	0.79	0.77	0.78
	4	0.88	0.85	0.85	0.87	0.86
	5	0.96	0.92	0.92	0.95	0.96
163085	2	0.39	0.38	0.38	0.38	0.38
(481×321)	3	0.48	0.45	0.47	0.46	0.48
	4	0.56	0.52	0.52	0.51	0.55
	5	0.74	0.72	0.71	0.73	0.73
167062	2	0.78	0.76	0.75	0.75	0.76
(481×321)	3	0.86	0.84	0.83	0.85	0.84
	4	0.94	0.91	0.91	0.92	0.93
	5	0.96	0.96	0.95	0.96	0.96
170057	2	0.42	0.40	0.40	0.40	0.42
(481×321)	3	0.50	0.48	0.48	0.48	0.48
	4	0.67	0.63	0.65	0.63	0.64
	5	0.74	0.70	0.69	0.72	0.70
175032	2	0.47	0.44	0.46	0.46	0.47
(321×481)	3	0.57	0.55	0.55	0.55	0.56
	4	0.69	0.67	0.67	0.67	0.68
	5	0.73	0.70	0.71	0.72	0.72
219090	2	0.62	0.59	0.60	0.60	0.60
(481×321)	3	0.66	0.64	0.63	0.65	0.64
	4	0.78	0.74	0.76	0.75	0.78
	5	0.87	0.83	0.83	0.85	0.85
220075	2	0.60	0.59	0.59	0.58	0.60
(481×321)	3	0.64	0.63	0.62	0.62	0.64
	4	0.73	0.71	0.72	0.71	0.71
	5	0.80	0.76	0.79	0.77	0.77
24077	2	0.79	0.79	0.78	0.78	0.78
(481×321)	3	0.84	0.83	0.83	0.84	0.82
	4	0.88	0.86	0.86	0.85	0.86
	5	0.94	0.93	0.93	0.92	0.93
295087	2	0.43	0.41	0.40	0.42	0.42
(481×321)	3	0.53	0.52	0.51	0.51	0.53
	4	0.58	0.55	0.56	0.55	0.58
	5	0.71	0.68	0.70	0.70	0.70

296007	2	0.38	0.36	0.37	0.37	0.37
(481×321)	3	0.44	0.43	0.43	0.42	0.44
	4	0.56	0.54	0.54	0.53	0.55
	5	0.68	0.65	0.65	0.65	0.66
300091	2	0.50	0.47	0.49	0.46	0.50
(481×321)	3	0.63	0.61	0.61	0.62	0.63
	4	0.75	0.72	0.74	0.71	0.74
	5	0.82	0.80	0.81	0.81	0.81
38092	2	0.68	0.65	0.66	0.65	0.68
(481×321)	3	0.86	0.83	0.85	0.84	0.84
	4	0.93	0.89	0.88	0.92	0.91
	5	0.95	0.91	0.92	0.93	0.94
42049	2	0.76	0.75	0.76	0.76	0.76
(481×321)	3	0.83	0.82	0.81	0.82	0.83
	4	0.92	0.92	0.91	0.92	0.92
	5	0.97	0.95	0.96	0.96	0.97
43074	2	0.38	0.37	0.36	0.36	0.37
(481×321)	3	0.60	0.59	0.58	0.59	0.60
	4	0.64	0.62	0.62	0.62	0.62
	5	0.76	0.72	0.71	0.71	0.73
45096	2	0.66	0.63	0.62	0.64	0.65
(481×321)	3	0.77	0.74	0.75	0.76	0.77
	4	0.83	0.81	0.82	0.81	0.82
	5	0.88	0.86	0.87	0.85	0.87
58060	2	0.62	0.61	0.61	0.60	0.61
(481×321)	3	0.78	0.77	0.76	0.77	0.78
	4	0.86	0.83	0.82	0.85	0.85
	5	0.95	0.93	0.94	0.93	0.94
76053	2	0.43	0.42	0.41	0.42	0.43
(481×321)	3	0.65	0.62	0.62	0.63	0.62
	4	0.72	0.69	0.71	0.68	0.70
	5	0.74	0.70	0.73	0.73	0.72
78004	2	0.74	0.71	0.71	0.72	0.72
(321×481)	3	0.82	0.81	0.81	0.81	0.82
	4	0.87	0.85	0.86	0.86	0.86
	5	0.92	0.88	0.87	0.89	0.88
86000	2	0.51	0.48	0.49	0.47	0.50
(321×481)	3	0.59	0.56	0.58	0.56	0.59
	4	0.64	0.61	0.60	0.61	0.61
	5	0.67	0.63	0.65	0.65	0.67
89072	2	0.62	0.62	0.62	0.62	0.62
(321×481)	3	0.76	0.75	0.74	0.75	0.74
	4	0.82	0.81	0.80	0.81	0.82
	5	0.88	0.87	0.86	0.87	0.87

103070	2	0.55	0.52	0.51	0.54	0.53
(481×321)	3	0.62	0.59	0.58	0.60	0.61
	4	0.68	0.65	0.66	0.67	0.68
	5	0.72	0.68	0.70	0.70	0.69
108082	2	0.54	0.51	0.52	0.50	0.54
(481×321)	3	0.78	0.75	0.76	0.74	0.78
	4	0.84	0.81	0.83	0.83	0.82
	5	0.91	0.87	0.90	0.88	0.91
109053	2	0.42	0.40	0.40	0.41	0.42
(481×321)	3	0.57	0.55	0.55	0.56	0.57
	4	0.69	0.65	0.65	0.65	0.66
	5	0.75	0.71	0.73	0.70	0.71
12084	2	0.40	0.39	0.39	0.38	0.40
(481×321)	3	0.61	0.58	0.60	0.59	0.61
	4	0.76	0.74	0.74	0.74	0.76
	5	0.84	0.81	0.82	0.82	0.84
130026	2	0.62	0.60	0.59	0.59	0.61
(481×321)	3	0.78	0.77	0.77	0.77	0.77
	4	0.87	0.84	0.85	0.83	0.85
	5	0.92	0.88	0.88	0.87	0.90
14037	2	0.52	0.49	0.49	0.48	0.50
(481×321)	3	0.85	0.84	0.84	0.83	0.85
	4	0.90	0.86	0.89	0.87	0.90
	5	0.93	0.91	0.91	0.91	0.93
147091	2	0.68	0.65	0.64	0.64	0.66
(481×321)	3	0.87	0.84	0.83	0.83	0.87
	4	0.92	0.90	0.90	0.89	0.91
	5	0.94	0.91	0.91	0.91	0.93
148089	2	0.70	0.68	0.68	0.68	0.69
(481×321)	3	0.81	0.79	0.78	0.79	0.79
	4	0.85	0.83	0.84	0.84	0.84
	5	0.88	0.86	0.87	0.87	0.86
167083	2	0.64	0.62	0.62	0.63	0.64
(321×481)	3	0.75	0.72	0.73	0.72	0.73
	4	0.88	0.86	0.85	0.87	0.88
	5	0.95	0.92	0.93	0.94	0.94
189080	2	0.76	0.75	0.75	0.75	0.76
(321×481)	3	0.88	0.86	0.85	0.86	0.86
	4	0.91	0.88	0.88	0.87	0.90
	5	0.94	0.90	0.92	0.91	0.94
229036	2	0.46	0.43	0.43	0.45	0.43
(481×321)	3	0.79	0.76	0.77	0.76	0.78
	4	0.84	0.81	0.83	0.83	0.84
	5	0.89	0.87	0.87	0.88	0.88



241004	2	0.68	0.65	0.65	0.67	0.67
(481×321)	3	0.74	0.71	0.71	0.70	0.74
	4	0.89	0.86	0.88	0.88	0.88
	5	0.92	0.88	0.90	0.87	0.89
253027	2	0.43	0.42	0.41	0.41	0.43
(481×321)	3	0.79	0.77	0.77	0.76	0.79
	4	0.83	0.81	0.82	0.82	0.83
	5	0.86	0.84	0.83	0.84	0.84
260058	2	0.38	0.37	0.37	0.37	0.37
(481×321)	3	0.59	0.58	0.58	0.58	0.59
	4	0.71	0.68	0.69	0.69	0.69
	5	0.80	0.76	0.79	0.76	0.77
271035	2	0.59	0.58	0.57	0.57	0.59
(321×481)	3	0.77	0.75	0.74	0.75	0.77
	4	0.83	0.79	0.79	0.79	0.81
	5	0.90	0.87	0.87	0.88	0.88
285079	2	0.59	0.56	0.56	0.58	0.57
(321×481)	3	0.70	0.69	0.69	0.69	0.70
	4	0.77	0.73	0.75	0.74	0.74
	5	0.82	0.79	0.81	0.79	0.80
291000	2	0.49	0.48	0.48	0.47	0.48
(481×321)	3	0.69	0.67	0.67	0.68	0.68
	4	0.80	0.77	0.78	0.78	0.80
	5	0.89	0.85	0.88	0.84	0.89
304034	2	0.41	0.40	0.40	0.40	0.41
(481×321)	3	0.65	0.64	0.64	0.64	0.64
	4	0.77	0.75	0.76	0.76	0.75
	5	0.86	0.84	0.85	0.83	0.85
41033	2	0.70	0.69	0.68	0.69	0.70
(481×321)	3	0.73	0.70	0.72	0.71	0.70
	4	0.82	0.78	0.78	0.80	0.82
	5	0.85	0.81	0.82	0.81	0.84
54082	2	0.32	0.31	0.31	0.31	0.30
(321×481)	3	0.38	0.37	0.37	0.37	0.36
	4	0.60	0.59	0.59	0.58	0.56
	5	0.92	0.91	0.91	0.91	0.90
62096	2	0.81	0.78	0.80	0.79	0.78
(481×321)	3	0.89	0.87	0.88	0.87	0.87
	4	0.94	0.90	0.91	0.92	0.94
	5	0.95	0.91	0.93	0.92	0.92
69015	2	0.44	0.42	0.43	0.41	0.44
(321×481)	3	0.73	0.71	0.70	0.70	0.71
	4	0.80	0.76	0.78	0.79	0.80
	5	0.83	0.80	0.82	0.81	0.82

69040	2	0.38	0.36	0.36	0.37	0.38
(481×321)	3	0.55	0.53	0.52	0.52	0.53
	4	0.66	0.64	0.63	0.63	0.66
	5	0.73	0.69	0.71	0.70	0.71
8023	2	0.32	0.30	0.31	0.30	0.31
(481×321)	3	0.54	0.51	0.52	0.50	0.54
	4	0.62	0.58	0.61	0.60	0.62
	5	0.64	0.60	0.62	0.63	0.60
86016	2	0.54	0.54	0.54	0.54	0.54
(481×321)	3	0.66	0.65	0.64	0.64	0.66
	4	0.73	0.73	0.71	0.71	0.73
	5	0.92	0.90	0.91	0.90	0.89
108005	2	0.51	0.49	0.49	0.48	0.50
(481×321)	3	0.65	0.62	0.62	0.63	0.63
	4	0.72	0.68	0.68	0.71	0.72
	5	0.77	0.74	0.74	0.73	0.74
108070	2	0.54	0.53	0.53	0.53	0.53
(481×321)	3	0.69	0.66	0.66	0.68	0.69
	4	0.78	0.75	0.76	0.77	0.78
	5	0.82	0.78	0.79	0.78	0.79
123074	2	0.50	0.47	0.48	0.47	0.50
(481×321)	3	0.66	0.63	0.62	0.65	0.63
	4	0.76	0.74	0.75	0.74	0.74
	5	0.78	0.76	0.76	0.75	0.78
134035	2	0.66	0.65	0.64	0.64	0.65
(481×321)	3	0.70	0.69	0.68	0.69	0.69
	4	0.76	0.74	0.75	0.73	0.74
	5	0.78	0.76	0.75	0.77	0.77
145086	2	0.63	0.60	0.62	0.60	0.62
(481×321)	3	0.84	0.81	0.83	0.82	0.83
	4	0.90	0.86	0.88	0.85	0.90
	5	0.93	0.91	0.91	0.92	0.91
148026	2	0.80	0.79	0.78	0.78	0.80
(321×481)	3	0.83	0.80	0.81	0.80	0.81
	4	0.92	0.88	0.90	0.90	0.88
	5	0.95	0.92	0.94	0.92	0.94
160068	2	0.61	0.60	0.59	0.59	0.60
(481×321)	3	0.67	0.65	0.64	0.64	0.64
	4	0.72	0.69	0.69	0.69	0.68
	5	0.77	0.74	0.73	0.73	0.73
182053	2	0.58	0.56	0.56	0.57	0.58
(481×321)	3	0.85	0.84	0.84	0.83	0.84
	4	0.92	0.90	0.90	0.90	0.91
	5	0.97	0.93	0.94	0.93	0.97

19021	2	0.50	0.47	0.49	0.46	0.47
(481×321)	3	0.70	0.67	0.69	0.68	0.69
	4	0.82	0.78	0.78	0.78	0.81
	5	0.87	0.83	0.85	0.84	0.83
196073	2	0.39	0.38	0.37	0.38	0.39
(481×321)	3	0.56	0.54	0.54	0.54	0.55
	4	0.69	0.67	0.68	0.68	0.69
	5	0.77	0.73	0.72	0.72	0.73
208001	2	0.47	0.45	0.46	0.46	0.46
(321×481)	3	0.77	0.75	0.74	0.75	0.75
	4	0.83	0.79	0.81	0.81	0.82
	5	0.86	0.82	0.81	0.82	0.86
210088	2	0.47	0.45	0.45	0.45	0.47
(321×481)	3	0.61	0.59	0.60	0.59	0.61
	4	0.68	0.66	0.67	0.66	0.66
	5	0.73	0.70	0.69	0.72	0.72
21077	2	0.48	0.48	0.48	0.47	0.47
(481×321)	3	0.73	0.72	0.71	0.71	0.71
	4	0.89	0.88	0.88	0.87	0.87
	5	0.93	0.92	0.92	0.91	0.91
216081	2	0.66	0.65	0.64	0.64	0.65
(481×321)	3	0.72	0.70	0.69	0.69	0.70
	4	0.85	0.83	0.84	0.82	0.83
	5	0.91	0.87	0.87	0.90	0.87
223061	2	0.69	0.68	0.68	0.68	0.69
(481×321)	3	0.77	0.75	0.76	0.75	0.76
	4	0.85	0.83	0.83	0.82	0.85
	5	0.93	0.91	0.92	0.90	0.93
227092	2	0.36	0.33	0.34	0.33	0.36
(321×481)	3	0.57	0.54	0.56	0.54	0.57
	4	0.66	0.63	0.62	0.62	0.63
	5	0.70	0.67	0.69	0.69	0.68
253055	2	0.41	0.38	0.40	0.39	0.39
(481×321)	3	0.77	0.74	0.76	0.76	0.74
	4	0.91	0.88	0.90	0.90	0.88
	5	0.94	0.92	0.93	0.92	0.94
306005	2	0.69	0.66	0.68	0.68	0.67
(481×321)	3	0.84	0.83	0.83	0.83	0.83
	4	0.87	0.84	0.86	0.86	0.85
	5	0.91	0.87	0.89	0.88	0.88
3096	2	0.47	0.45	0.45	0.45	0.47
(481×321)	3	0.65	0.64	0.64	0.64	0.65
	4	0.75	0.72	0.74	0.72	0.72
	5	0.83	0.79	0.82	0.79	0.81

33039	2	0.64	0.61	0.63	0.63	0.64
(321×481)	3	0.75	0.72	0.72	0.72	0.72
	4	0.82	0.79	0.81	0.79	0.82
	5	0.86	0.82	0.83	0.82	0.82
376043	2	0.45	0.44	0.43	0.43	0.45
(321×481)	3	0.68	0.65	0.64	0.66	0.66
	4	0.79	0.77	0.76	0.77	0.79
	5	0.81	0.78	0.79	0.80	0.81
38082	2	0.41	0.38	0.40	0.38	0.41
(481×321)	3	0.61	0.60	0.59	0.60	0.61
	4	0.72	0.68	0.71	0.71	0.69
	5	0.78	0.75	0.76	0.77	0.78
41069	2	0.49	0.47	0.46	0.46	0.49
(481×321)	3	0.69	0.68	0.68	0.68	0.69
	4	0.85	0.82	0.82	0.82	0.85
	5	0.89	0.85	0.84	0.88	0.85
86068	2	0.37	0.34	0.34	0.35	0.36
(481×321)	3	0.69	0.67	0.67	0.67	0.68
	4	0.77	0.76	0.75	0.75	0.77
	5	0.81	0.79	0.78	0.78	0.79
97033	2	0.66	0.65	0.64	0.65	0.66
(481×321)	3	0.81	0.79	0.78	0.80	0.81
	4	0.86	0.84	0.85	0.83	0.84
	5	0.93	0.90	0.92	0.92	0.92
101087	2	0.70	0.69	0.68	0.68	0.70
(321×481)	3	0.83	0.80	0.82	0.80	0.81
	4	0.90	0.88	0.89	0.87	0.89
	5	0.94	0.92	0.93	0.92	0.94
102061	2	0.62	0.61	0.61	0.61	0.61
(321×481)	3	0.78	0.77	0.77	0.76	0.77
	4	0.85	0.82	0.82	0.82	0.83
	5	0.88	0.85	0.87	0.85	0.85
105025	2	0.63	0.60	0.61	0.60	0.61
(481×321)	3	0.74	0.72	0.73	0.71	0.73
	4	0.84	0.81	0.82	0.82	0.83
	5	0.90	0.86	0.89	0.87	0.86
106024	2	0.68	0.66	0.66	0.67	0.66
(481×321)	3	0.77	0.76	0.76	0.76	0.77
	4	0.82	0.78	0.81	0.78	0.81
	5	0.85	0.82	0.82	0.82	0.83
143090	2	0.50	0.48	0.47	0.49	0.49
(481×321)	3	0.66	0.63	0.65	0.64	0.65
	4	0.78	0.76	0.76	0.77	0.77
	5	0.81	0.77	0.80	0.78	0.78

159008	2	0.74	0.72	0.73	0.73	0.74
(481×321)	3	0.81	0.79	0.79	0.80	0.81
	4	0.89	0.85	0.87	0.85	0.88
	5	0.93	0.90	0.91	0.92	0.90
175043	2	0.43	0.42	0.42	0.41	0.43
(481×321)	3	0.65	0.64	0.63	0.63	0.64
	4	0.72	0.70	0.71	0.71	0.72
	5	0.75	0.71	0.74	0.74	0.73
197017	2	0.71	0.69	0.70	0.69	0.71
(481×321)	3	0.78	0.76	0.75	0.76	0.76
	4	0.86	0.84	0.83	0.85	0.85
	5	0.91	0.88	0.90	0.90	0.90
236037	2	0.42	0.40	0.41	0.41	0.42
(481×321)	3	0.57	0.56	0.56	0.56	0.57
	4	0.69	0.65	0.67	0.67	0.69
	5	0.76	0.72	0.72	0.72	0.75
241048	2	0.59	0.58	0.57	0.58	0.58
(481×321)	3	0.71	0.69	0.68	0.70	0.69
	4	0.82	0.80	0.81	0.80	0.82
	5	0.90	0.88	0.88	0.87	0.88
296059	2	0.53	0.52	0.52	0.52	0.52
(481×321)	3	0.69	0.67	0.68	0.68	0.69
	4	0.76	0.72	0.75	0.74	0.76
	5	0.79	0.76	0.77	0.75	0.76
299086	2	0.29	0.28	0.28	0.28	0.29
(481×321)	3	0.43	0.41	0.40	0.41	0.43
	4	0.52	0.48	0.48	0.47	0.52
	5	0.61	0.59	0.60	0.59	0.61
302008	2	0.78	0.77	0.76	0.76	0.77
(321×481)	3	0.83	0.82	0.81	0.82	0.83
	4	0.86	0.83	0.85	0.84	0.84
	5	0.88	0.84	0.84	0.87	0.88
304074	2	0.55	0.54	0.55	0.54	0.54
(321×481)	3	0.69	0.65	0.66	0.65	0.66
	4	0.78	0.75	0.77	0.76	0.77
	5	0.86	0.82	0.83	0.82	0.82
351093	2	0.85	0.83	0.84	0.82	0.83
(481×321)	3	0.90	0.87	0.89	0.89	0.89
	4	0.92	0.88	0.91	0.89	0.92
	5	0.93	0.89	0.92	0.89	0.89
361010	2	0.34	0.31	0.31	0.32	0.32
(481×321)	3	0.47	0.45	0.45	0.46	0.47
	4	0.63	0.59	0.61	0.61	0.61
	5	0.81	0.77	0.80	0.79	0.77

37073	2	0.33	0.32	0.32	0.31	0.32
(481×321)	3	0.66	0.65	0.64	0.64	0.65
	4	0.82	0.80	0.80	0.80	0.81
	5	0.89	0.87	0.87	0.87	0.88
385039	2	0.72	0.69	0.68	0.68	0.72
(481×321)	3	0.82	0.81	0.81	0.81	0.82
	4	0.85	0.83	0.84	0.84	0.83
	5	0.88	0.87	0.87	0.87	0.87
42012	2	0.63	0.61	0.62	0.61	0.61
(321×481)	3	0.81	0.80	0.79	0.79	0.80
	4	0.85	0.82	0.82	0.83	0.84
	5	0.87	0.84	0.84	0.84	0.87
55073	2	0.59	0.56	0.56	0.57	0.57
(321×481)	3	0.77	0.74	0.73	0.75	0.75
	4	0.82	0.80	0.80	0.80	0.82
	5	0.85	0.83	0.84	0.82	0.85
65033	2	0.54	0.52	0.52	0.51	0.52
(481×321)	3	0.68	0.66	0.67	0.66	0.68
	4	0.79	0.76	0.77	0.77	0.78
	5	0.83	0.80	0.82	0.81	0.83
66053	2	0.47	0.44	0.44	0.44	0.45
(481×321)	3	0.79	0.77	0.77	0.77	0.78
	4	0.84	0.82	0.82	0.81	0.83
	5	0.88	0.86	0.86	0.85	0.87
69020	2	0.35	0.33	0.33	0.33	0.34
(481×321)	3	0.58	0.57	0.56	0.56	0.57
	4	0.71	0.67	0.70	0.67	0.71
	5	0.81	0.77	0.76	0.78	0.79
85048	2	0.62	0.61	0.60	0.60	0.62
(481×321)	3	0.80	0.77	0.79	0.76	0.77
	4	0.87	0.84	0.84	0.85	0.84
	5	0.93	0.90	0.90	0.89	0.91
87046	2	0.58	0.55	0.57	0.55	0.56
(481×321)	3	0.69	0.67	0.68	0.68	0.68
	4	0.83	0.79	0.79	0.79	0.81
	5	0.92	0.89	0.89	0.88	0.90

Table 6 time cost of diffident methods (unit: millisecond)

Image ID	level	Our algorithm	BA	MMSA	IBA	OTSU
101085	2	1.54	1.91	1.79	1.84	1.67
(321×481)	3	2.61	3.04	2.84	2.93	2.76
	4	29.48	33.70	31.97	32.84	30.84
	5	186.32	204.92	199.20	200.88	195.82
119082	2	1.36	1.75	1.55	1.67	1.44

(481×321)	3	2.53	2.96	2.78	2.84	2.71
	4	26.13	30.42	28.17	29.20	26.89
	5	164.25	181.78	178.32	179.83	175.58
126007	2	1.29	1.66	1.51	1.57	1.38
(481×321)	3	2.47	2.90	2.64	2.71	2.57
	4	25.18	29.51	26.95	28.46	26.04
	5	159.25	177.10	173.55	175.37	165.08
156065	2	1.43	1.91	1.67	1.83	1.51
(481×321)	3	2.59	3.13	2.87	3.02	2.80
	4	28.36	33.23	30.37	32.21	29.08
	5	176.54	203.21	185.13	190.86	181.29
157055	2	1.21	1.76	1.44	1.62	1.36
(481×321)	3	2.39	2.86	2.56	2.65	2.50
	4	25.67	30.42	27.55	28.49	26.69
	5	165.64	185.36	179.24	181.51	174.49
16077	2	1.89	2.29	2.13	2.20	2.06
(481×321)	3	2.92	3.43	3.16	3.25	3.02
	4	31.24	36.02	33.18	34.39	32.05
	5	192.31	219.01	205.69	207.32	198.66
163085	2	1.76	2.16	1.90	2.00	1.82
(481×321)	3	2.83	3.40	3.04	3.17	2.97
	4	29.68	34.62	32.08	33.90	30.66
	5	189.65	208.48	197.77	204.65	193.19
167062	2	1.56	1.94	1.75	1.83	1.62
(481×321)	3	2.63	3.08	2.86	2.93	2.75
	4	29.35	34.17	31.62	33.67	30.15
	5	181.87	206.57	194.11	199.23	190.13
170057	2	1.35	1.74	1.54	1.63	1.47
(481×321)	3	2.66	3.08	2.87	3.00	2.77
	4	27.91	31.96	30.35	31.49	29.02
	5	184.76	203.99	197.09	200.98	193.03
175032	2	1.33	1.73	1.57	1.68	1.43
(321×481)	3	2.61	3.06	2.80	2.94	2.73
	4	26.86	30.88	29.03	29.96	27.88
	5	180.42	208.47	194.70	200.35	187.80
219090	2	1.29	1.79	1.53	1.58	1.43
(481×321)	3	2.54	2.95	2.76	2.91	2.66
	4	25.91	30.08	27.63	29.10	26.62
	5	176.54	193.85	187.45	189.64	182.34
220075	2	1.67	2.09	1.90	1.95	1.82
(481×321)	3	2.75	3.32	2.95	3.17	2.85
	4	28.61	32.69	30.51	32.17	29.42
	5	187.73	205.62	199.19	204.46	194.24
24077	2	1.51	1.83	1.69	1.77	1.59

(481×321)	3	2.43	2.90	2.73	2.79	2.63
	4	29.43	34.12	31.43	32.64	30.57
	5	176.89	193.19	186.27	182.57	179.95
295087	2	1.27	1.65	1.52	1.58	1.41
(481×321)	3	2.48	2.89	2.68	2.82	2.60
	4	24.19	28.67	26.63	28.04	25.36
	5	173.86	189.62	181.97	185.10	177.38
296007	2	1.63	2.06	1.81	1.94	1.71
(481×321)	3	2.69	3.24	2.86	3.06	2.79
	4	27.44	32.52	29.39	30.64	28.18
	5	185.93	207.38	196.96	198.68	193.01
300091	2	1.13	1.66	1.28	1.36	1.19
(481×321)	3	2.01	2.62	2.21	2.41	2.15
	4	19.65	23.63	21.57	23.04	20.49
	5	137.24	161.88	145.88	147.99	143.04
38092	2	1.21	1.72	1.45	1.52	1.38
(481×321)	3	2.19	2.68	2.46	2.52	2.38
	4	29.66	34.68	32.14	33.30	30.42
	5	186.58	202.86	197.68	199.61	193.86
42049	2	1.25	1.53	1.42	1.47	1.35
(481×321)	3	2.16	2.47	2.31	2.38	2.23
	4	23.14	27.06	25.42	26.71	24.58
	5	154.12	168.22	162.59	164.36	158.71
43074	2	1.37	1.89	1.60	1.84	1.45
(481×321)	3	2.61	3.15	2.83	3.05	2.71
	4	25.73	30.23	28.21	29.13	26.89
	5	173.56	198.79	186.53	196.45	179.00
45096	2	1.43	1.81	1.65	1.75	1.51
(481×321)	3	2.42	2.99	2.64	2.74	2.57
	4	24.37	29.44	26.70	28.15	25.69
	5	197.84	217.38	212.18	216.15	206.88
58060	2	1.53	1.97	1.73	1.89	1.60
(481×321)	3	2.89	3.33	3.11	3.23	3.01
	4	31.66	36.09	33.32	34.62	32.32
	5	231.83	258.70	246.79	255.78	243.16
76053	2	1.21	1.60	1.44	1.57	1.29
(481×321)	3	2.29	2.83	2.48	2.55	2.39
	4	20.54	25.16	22.62	24.68	21.74
	5	141.95	160.54	150.39	159.17	145.61
78004	2	1.38	1.88	1.55	1.75	1.44
(321×481)	3	2.34	2.80	2.53	2.60	2.44
	4	33.64	38.31	35.43	37.35	34.39
	5	229.12	251.70	237.15	249.67	232.81
86000	2	1.46	1.97	1.69	1.94	1.58



(321×481)	3	2.51	2.93	2.79	2.85	2.68
	4	28.93	33.16	31.07	32.41	30.07
	5	192.54	217.79	200.53	207.85	197.28
89072	2	1.46	1.81	1.64	1.76	1.55
(321×481)	3	2.41	2.84	2.69	2.76	2.61
	4	29.67	34.12	31.49	32.68	30.41
	5	166.84	183.96	176.66	179.91	173.09
103070	2	1.86	2.40	2.06	2.35	1.99
(481×321)	3	3.01	3.52	3.20	3.30	3.15
	4	32.64	37.54	34.51	35.72	33.43
	5	247.35	268.62	258.97	261.13	253.18
108082	2	1.35	1.72	1.56	1.68	1.42
(481×321)	3	2.27	2.77	2.45	2.63	2.38
	4	26.34	31.20	28.15	30.36	27.02
	5	179.65	206.00	193.12	203.56	186.00
109053	2	1.51	1.96	1.73	1.91	1.58
(481×321)	3	2.59	3.13	2.87	3.05	2.75
	4	29.31	34.22	31.46	33.29	30.41
	5	184.83	204.27	193.37	202.34	190.59
12084	2	1.12	1.60	1.26	1.42	1.18
(481×321)	3	2.09	2.57	2.27	2.50	2.20
	4	19.54	24.52	21.97	23.86	20.78
	5	141.32	164.57	152.88	160.86	149.78
130026	2	1.35	1.86	1.55	1.73	1.45
(481×321)	3	2.33	2.82	2.56	2.67	2.45
	4	24.36	28.78	26.00	28.04	25.00
	5	166.43	191.54	180.50	184.02	169.68
14037	2	1.46	1.98	1.68	1.78	1.55
(481×321)	3	2.57	3.13	2.80	3.03	2.70
	4	21.66	25.90	23.55	24.42	22.58
	5	156.39	179.15	168.31	174.08	162.40
147091	2	1.45	1.97	1.63	1.78	1.54
(481×321)	3	2.77	3.35	2.93	3.13	2.88
	4	31.25	36.27	33.63	35.51	32.29
	5	236.45	259.39	248.70	257.00	241.15
148089	2	1.29	1.75	1.48	1.62	1.41
(481×321)	3	2.43	2.84	2.65	2.74	2.54
	4	26.79	31.82	28.96	30.36	27.73
	5	221.36	239.51	231.42	234.85	226.69
167083	2	1.74	2.14	1.89	2.10	1.81
(321×481)	3	2.94	3.50	3.20	3.41	3.11
	4	30.21	35.26	32.54	34.75	31.16
	5	229.34	255.02	239.16	251.32	233.75
189080	2	1.18	1.72	1.42	1.59	1.29

(321×481)	3	2.11	2.53	2.31	2.48	2.23
	4	21.35	26.35	23.10	25.68	22.16
	5	145.62	169.27	157.27	159.53	154.25
229036	2	1.35	1.88	1.57	1.63	1.43
(481×321)	3	2.40	2.92	2.62	2.77	2.55
	4	26.12	30.97	27.88	28.80	26.86
	5	175.39	198.17	188.53	193.90	184.09
241004	2	1.43	1.85	1.64	1.71	1.54
(481×321)	3	2.61	3.19	2.85	3.01	2.74
	4	25.39	29.79	26.89	28.51	26.05
	5	171.23	195.95	183.95	186.25	174.47
253027	2	1.63	2.07	1.83	1.92	1.74
(481×321)	3	2.89	3.41	3.11	3.36	3.04
	4	22.36	26.38	24.40	25.50	23.35
	5	151.04	172.38	163.88	169.28	159.02
260058	2	1.26	1.81	1.41	1.52	1.33
(481×321)	3	2.19	2.68	2.44	2.51	2.29
	4	24.92	29.40	27.09	28.58	26.08
	5	155.34	179.95	167.30	173.11	162.81
271035	2	1.31	1.81	1.45	1.59	1.38
(321×481)	3	2.47	2.97	2.68	2.75	2.62
	4	26.19	30.21	28.64	29.72	27.01
	5	164.18	190.32	177.16	179.90	173.85
285079	2	1.67	2.07	1.87	1.94	1.80
(321×481)	3	2.76	3.26	2.97	3.09	2.88
	4	28.31	33.05	30.28	32.55	29.04
	5	176.21	196.34	185.42	192.20	179.72
291000	2	2.01	2.55	2.21	2.27	2.13
(481×321)	3	3.16	3.67	3.42	3.53	3.35
	4	33.54	38.27	35.39	36.87	34.26
	5	224.31	244.99	239.13	243.45	236.43
304034	2	1.31	1.68	1.51	1.60	1.39
(481×321)	3	2.40	2.83	2.61	2.73	2.51
	4	29.08	33.38	30.61	32.55	29.71
	5	180.51	207.02	194.64	205.37	191.48
41033	2	1.07	1.55	1.23	1.37	1.14
(481×321)	3	1.78	2.29	1.97	2.06	1.88
	4	17.25	22.17	19.77	21.67	18.00
	5	134.39	155.91	142.72	146.17	138.05
54082	2	1.41	1.76	1.61	1.68	1.52
(321×481)	3	2.34	2.79	2.63	2.70	2.52
	4	28.62	32.55	30.06	31.43	29.59
	5	164.59	180.64	174.01	177.39	170.42
62096	2	1.34	1.83	1.58	1.67	1.43

(481×321)	3	2.47	2.89	2.73	2.82	2.61
	4	26.34	30.72	27.90	29.57	27.07
	5	176.48	201.16	187.21	195.06	179.60
69015	2	1.23	1.76	1.42	1.60	1.30
(321×481)	3	2.33	2.90	2.50	2.85	2.44
	4	24.35	29.01	25.89	28.16	25.03
	5	165.58	188.07	178.29	182.36	170.36
69040	2	1.56	1.98	1.73	1.86	1.62
(481×321)	3	2.70	3.27	2.94	3.19	2.87
	4	28.94	33.94	31.12	33.23	29.75
	5	188.11	215.90	197.62	212.91	191.96
8023	2	1.54	2.09	1.68	1.94	1.60
(481×321)	3	2.62	3.09	2.82	2.99	2.73
	4	26.87	31.68	29.27	30.30	28.20
	5	190.76	214.80	203.38	212.62	193.98
86016	2	1.34	1.61	1.48	1.51	1.40
(481×321)	3	2.21	2.51	2.37	2.43	2.31
	4	25.16	29.45	27.64	28.85	26.74
	5	159.54	176.21	167.66	171.65	164.39
108005	2	1.28	1.64	1.45	1.52	1.38
(481×321)	3	2.19	2.62	2.35	2.43	2.30
	4	22.34	27.32	24.74	26.21	23.08
	5	154.14	172.92	166.55	169.69	163.46
108070	2	1.35	1.89	1.56	1.77	1.42
(481×321)	3	2.20	2.77	2.42	2.58	2.33
	4	23.70	28.53	25.77	27.53	24.84
	5	173.01	199.32	185.80	193.78	181.83
123074	2	1.49	1.90	1.68	1.80	1.57
(481×321)	3	2.34	2.95	2.58	2.64	2.46
	4	27.64	32.30	30.03	31.25	28.50
	5	196.24	219.02	210.37	216.74	200.52
134035	2	1.37	1.82	1.56	1.66	1.48
(481×321)	3	2.31	2.80	2.47	2.71	2.42
	4	26.87	30.88	29.06	30.03	27.84
	5	185.40	204.89	193.38	199.53	190.23
145086	2	1.41	1.89	1.61	1.78	1.51
(481×321)	3	2.38	2.83	2.54	2.65	2.49
	4	24.38	29.25	26.36	27.56	25.53
	5	160.91	179.26	172.77	177.97	165.16
148026	2	1.59	2.09	1.76	1.99	1.65
(321×481)	3	2.63	3.12	2.86	2.95	2.74
	4	30.14	35.04	31.73	32.98	30.81
	5	217.01	243.18	226.54	231.38	223.81
160068	2	1.49	1.79	1.63	1.72	1.54

(481×321)	3	2.38	2.81	2.66	2.72	2.58
	4	29.14	33.45	30.94	32.09	30.17
	5	166.01	182.73	176.10	178.93	172.23
182053	2	1.51	1.94	1.74	1.84	1.65
(481×321)	3	2.66	3.07	2.82	2.88	2.76
	4	28.47	33.46	30.44	32.51	29.13
	5	209.80	229.32	218.15	226.91	214.83
19021	2	1.28	1.75	1.48	1.58	1.41
(481×321)	3	2.31	2.87	2.47	2.77	2.42
	4	25.64	30.48	27.86	28.84	26.34
	5	174.35	198.05	185.69	189.83	178.66
196073	2	1.47	1.85	1.64	1.72	1.54
(481×321)	3	2.40	2.95	2.60	2.77	2.51
	4	26.58	31.19	28.10	29.48	27.27
	5	185.91	201.18	197.43	198.94	193.44
208001	2	1.64	2.12	1.87	1.94	1.80
(321×481)	3	2.57	3.16	2.81	3.01	2.67
	4	26.64	31.41	28.64	29.79	27.64
	5	189.14	216.67	203.75	214.29	197.84
210088	2	1.54	2.02	1.70	1.84	1.62
(321×481)	3	2.55	3.03	2.73	2.86	2.68
	4	24.34	29.02	25.94	27.70	24.98
	5	160.64	176.40	173.18	174.97	167.57
21077	2	1.55	1.89	1.71	1.83	1.62
(481×321)	3	2.49	2.99	2.76	2.83	2.69
	4	30.09	35.07	32.16	33.18	31.55
	5	167.46	185.03	178.14	182.67	173.24
216081	2	1.43	1.98	1.61	1.80	1.53
(481×321)	3	2.51	2.94	2.67	2.88	2.62
	4	26.64	30.75	28.16	29.60	27.33
	5	183.81	206.07	196.22	198.15	192.82
223061	2	1.55	1.97	1.69	1.85	1.62
(481×321)	3	2.64	3.22	2.82	3.05	2.74
	4	27.34	31.63	29.28	30.70	28.04
	5	194.11	212.11	205.49	209.22	201.24
227092	2	1.73	2.26	1.92	1.97	1.79
(321×481)	3	2.61	3.03	2.86	2.95	2.78
	4	28.64	33.26	31.08	32.59	29.81
	5	206.20	226.16	220.14	223.05	210.09
253055	2	1.68	2.15	1.90	2.01	1.82
(481×321)	3	2.70	3.17	2.93	3.11	2.87
	4	30.14	34.50	32.32	33.97	31.41
	5	223.04	239.12	232.99	235.10	226.33
306005	2	1.40	1.77	1.59	1.69	1.52

(481×321)	3	2.52	3.10	2.69	2.89	2.62
	4	27.68	32.45	29.17	30.74	28.33
	5	199.29	216.98	210.79	213.37	204.90
3096	2	1.61	1.96	1.80	1.87	1.70
(481×321)	3	2.73	3.20	2.92	3.05	2.83
	4	29.78	34.87	31.98	33.76	30.67
	5	208.46	232.93	218.53	221.79	215.34
33039	2	1.31	1.76	1.55	1.64	1.41
(321×481)	3	2.43	2.89	2.68	2.77	2.59
	4	25.67	29.66	27.40	28.93	26.42
	5	171.42	197.45	181.74	186.64	178.99
376043	2	1.36	1.86	1.52	1.79	1.42
(321×481)	3	2.38	2.81	2.62	2.76	2.48
	4	26.34	30.69	28.15	29.27	27.31
	5	176.47	192.61	185.68	187.94	180.84
38082	2	1.27	1.72	1.43	1.55	1.36
(481×321)	3	2.36	2.86	2.54	2.70	2.46
	4	24.68	29.71	26.54	29.09	25.66
	5	172.76	198.50	181.19	185.97	176.34
41069	2	1.71	2.19	1.94	2.07	1.81
(481×321)	3	2.92	3.48	3.19	3.35	3.12
	4	30.54	35.58	33.04	33.96	31.77
	5	222.94	250.17	234.18	241.77	229.28
86068	2	1.66	2.01	1.86	1.97	1.74
(481×321)	3	2.63	3.20	2.82	2.90	2.74
	4	28.34	32.70	30.63	31.92	29.65
	5	195.55	211.26	204.30	207.91	201.15
97033	2	1.57	2.03	1.78	1.97	1.67
(481×321)	3	2.76	3.25	3.00	3.15	2.86
	4	29.42	33.51	31.31	32.29	30.22
	5	197.11	221.43	211.89	215.10	205.98
101087	2	1.26	1.65	1.42	1.56	1.33
(321×481)	3	2.52	3.11	2.76	3.06	2.66
	4	26.87	31.11	29.01	30.59	27.65
	5	177.34	198.37	186.45	192.19	183.82
102061	2	1.43	1.94	1.64	1.80	1.50
(321×481)	3	2.66	3.15	2.92	3.06	2.78
	4	28.30	32.35	30.51	31.74	29.04
	5	198.10	219.87	209.17	216.67	205.79
105025	2	1.52	1.99	1.74	1.81	1.61
(481×321)	3	2.64	3.24	2.90	3.00	2.77
	4	28.45	33.20	30.31	32.52	29.34
	5	184.92	203.92	195.56	202.39	188.58
106024	2	1.35	1.71	1.55	1.62	1.45

(481×321)	3	2.33	2.79	2.54	2.69	2.43
	4	26.32	30.70	28.15	29.34	27.12
	5	186.88	213.22	197.59	202.20	191.21
143090	2	1.43	1.93	1.58	1.71	1.49
(481×321)	3	2.35	2.79	2.57	2.67	2.45
	4	27.64	32.56	29.95	31.14	28.43
	5	201.77	222.23	214.64	217.18	208.87
159008	2	1.50	2.04	1.65	1.90	1.58
(481×321)	3	2.34	2.85	2.55	2.78	2.45
	4	26.51	31.37	28.90	30.48	27.28
	5	186.38	205.76	200.58	203.06	193.70
175043	2	1.41	1.88	1.64	1.80	1.48
(481×321)	3	2.50	3.02	2.72	2.87	2.64
	4	28.34	32.65	30.28	31.63	29.43
	5	192.712	215.94	201.70	203.51	197.20
197017	2	1.38	1.89	1.58	1.67	1.52
(481×321)	3	2.44	2.95	2.66	2.86	2.59
	4	27.37	32.34	29.83	31.49	28.54
	5	188.85	212.14	202.00	205.73	194.49
236037	2	1.64	2.05	1.86	2.01	1.74
(481×321)	3	2.76	3.18	2.96	3.11	2.90
	4	28.64	33.49	30.14	31.48	29.28
	5	217.80	232.64	227.74	229.28	221.93
241048	2	1.24	1.71	1.44	1.66	1.32
(481×321)	3	2.39	2.85	2.63	2.71	2.55
	4	25.08	30.06	27.44	28.38	26.19
	5	170.54	186.99	182.23	184.85	179.38
296059	2	1.36	1.72	1.52	1.65	1.42
(481×321)	3	2.34	2.84	2.61	2.78	2.54
	4	25.69	30.16	27.38	29.33	26.45
	5	169.55	194.73	180.65	182.23	173.32
299086	2	1.47	1.82	1.61	1.72	1.54
(481×321)	3	2.61	3.11	2.84	3.03	2.71
	4	29.64	33.81	31.88	32.75	30.91
	5	210.44	233.15	219.42	224.70	213.56
302008	2	1.41	1.96	1.63	1.77	1.55
(321×481)	3	2.36	2.86	2.57	2.79	2.47
	4	26.54	31.62	28.91	30.89	27.99
	5	185.51	209.34	198.11	199.75	191.15
304074	2	1.62	2.03	1.82	1.96	2.74
(321×481)	3	2.61	3.18	2.93	3.06	2.82
	4	33.18	38.69	35.18	36.87	34.18
	5	231.64	264.31	252.34	249.23	240.17
351093	2	1.35	1.71	1.50	1.56	1.41

(481×321)	3	2.37	2.97	2.62	2.74	2.49
	4	28.25	32.44	30.27	31.26	29.27
	5	206.23	232.56	217.47	226.56	214.31
361010	2	1.51	1.94	1.66	1.77	1.58
(481×321)	3	2.57	3.00	2.82	2.93	2.72
	4	28.73	33.59	30.99	32.74	30.14
	5	179.86	198.63	192.38	195.48	183.25
37073	2	1.39	1.71	1.58	1.64	1.44
(481×321)	3	2.36	2.80	2.61	2.73	2.55
	4	29.04	33.01	30.58	31.91	29.91
	5	165.04	182.36	175.10	178.27	171.34
385039	2	1.62	2.17	1.86	2.09	1.79
(481×321)	3	2.64	3.23	2.88	3.10	2.78
	4	26.79	30.90	28.96	29.82	28.12
	5	181.69	202.08	194.14	200.20	190.45
42012	2	1.29	1.69	1.53	1.61	1.43
(321×481)	3	2.36	2.84	2.60	2.72	2.48
	4	22.35	26.92	24.69	25.71	23.11
	5	143.27	171.33	156.62	162.60	148.25
55073	2	1.62	2.07	1.86	1.92	1.77
(321×481)	3	2.71	3.23	2.95	3.04	2.89
	4	29.47	33.64	31.14	32.40	30.28
	5	210.71	231.79	224.19	227.40	219.06
65033	2	1.42	1.81	1.56	1.77	1.48
(481×321)	3	2.87	3.48	3.13	3.20	2.98
	4	30.65	35.44	32.84	34.55	31.61
	5	210.58	232.25	225.15	227.62	214.91
66053	2	1.58	1.93	1.76	1.88	1.65
(481×321)	3	2.53	3.08	2.81	2.92	2.75
	4	30.59	35.89	32.77	33.81	31.98
	5	198.47	227.55	211.13	221.34	206.23
69020	2	1.57	2.07	1.75	1.98	1.64
(481×321)	3	2.52	3.02	2.79	2.91	2.65
	4	29.74	34.10	32.04	33.46	31.20
	5	199.25	223.36	213.33	218.88	206.58
85048	2	1.15	1.53	1.36	1.45	1.25
(481×321)	3	2.02	2.63	2.26	2.57	2.12
	4	19.31	24.43	21.34	22.28	20.12
	5	142.67	158.82	152.15	155.47	148.74
87046	2	1.32	1.87	1.56	1.74	1.38
(481×321)	3	2.31	2.93	2.49	2.88	2.42
	4	24.97	29.77	27.26	28.15	26.33
	5	174.79	195.18	188.92	190.49	182.07