

PEg TRAnsfer Workflow recognition challenge report: Do multi-modal data improve recognition? Supplementary Material

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Abstract

Background and Objective: Context-aware computer-assisted surgical systems require real-time automatic and accurate surgical workflow recognition. Since several years, video has been the most commonly used modality to develop surgical workflow recognition systems. With the democratization of robotic-assisted surgery and segmentation methods, new modalities are now accessible, such as kinematics. Some previous works used these new modalities as input of their models, but their added value has been rarely studied. This paper presents the design and results of the “PEg TRAnsfer Workflow recognition” (PETRAW) challenge whose objective was to develop surgical workflow recognition methods based on one or several modalities and to study their added value.

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Methods: The PETRAW challenge provided a data set of 150 peg transfer sequences performed on a virtual simulator. This data set included videos, kinematic data, semantic segmentation data, and workflow annotations that described the sequences at three granularity levels: phase, step, and activity. Five tasks were proposed to the participants: three were related to the recognition of all granularities using one of the available modalities, and the other two addressed the recognition with a combination of modalities. The mean application-dependent balanced accuracy (AD-Accuracy) value was used as evaluation metric to take unbalanced classes into account and because it is more clinically relevant than a frame-by-frame score.

Results: Seven teams participated in at least one task and four of them in all tasks. The best results were obtained by combining video and the kinematic data (AD-Accuracy between 93% and 90% for the four teams who participated in all tasks).

Conclusion: The improvement of video/kinematic-based surgical workflow recognition methods compared with uni-modality methods was significant for all teams. However, the longer testing execution time for video/kinematic-based than kinematic-based methods must be taken into account. Indeed, it could be asked whether it is relevant to spend 20 to 200 times more computing time to increase accuracy by 3% only. The PETRAW data set is publicly available at www.synapse.org/PETRAW to encourage further research in surgical workflow recognition.

Keywords: Surgical Process Model, Workflow recognition, Multi-modality, OR of the future

A. Authors' contributions

A. Huauhmé was the challenge coordinator, the primary contact with the participant teams, and a member of the MediCIS team. He acquired the dataset, collected, computed, and analyzed the results, and wrote the paper. K. Harada and M. Mitsuishi were member of the challenge organizers and supervised the development of the peg transfer simulator. P. Jannin was the challenge supervisor.

Q-M. Nguyen was a member of the MediCIS team. B. Park, S. Hong and M-K Choi were members of the Hutom team. M. Peven was a member of the JHU-CIRL team. Y. Li, Y. Long and Q. Dou were members of the MedAIR team. S. Kumar, S Lalithkumar and R. Hongliang were members of the MMLAB Team. H. Matsizaki, Y. Ishikawa and Y. Harai were members of NCC Next team. S. Kondo was a member of the SK team. All co-authors participated in the proofreading of the parts concerning their work.

B. Data sets characteristics

The following tables present the numerical value of the vocabulary term distribution in training and test data set.

Phase	Training	Test
Transfer Left to Right (L2R)	48.54 %	47.35%
Transfer Right to Left (R2L)	47.87 %	49.05%
Idle	3.59 %	3.60 %

Table 1: Phase distribution in training and test data sets

Step	Training	Test
Block 1 L2R	8.29 %	8.96 %
Block 1 R2L	8.50 %	8.51 %
Block 2 L2R	8.03 %	8.12 %
Block 2 R2L	7.58 %	8.41 %
Block 3 L2R	8.42 %	7.72 %
Block 3 R2L	8.14 %	8.04 %
Block 4 L2R	7.82 %	7.40 %
Block 4 R2L	7.49 %	7.34 %
Block 5 L2R	7.91 %	7.65 %
Block 5 R2L	7.48 %	7.83 %
Block 6 L2R	8.07 %	7.51 %
Block 6 R2L	8.69 %	8.92 %
Idle	3.59 %	3.60 %

Table 2: Step distribution in training and test data sets

Verb Left	Training	Test
Catch	8.97 %	8.99 %
Drop	2.15 %	1.91 %
Extract	5.32 %	5.43 %
Hold	26.33 %	25.90 %
Insert	3.66 %	3.61 %
Touch	0.59 %	0.60 %
Idle	52.98 %	53.56 %

Table 3: Verb Left distribution in training and test data sets

Verb Right	Training	Test
Catch	7.65 %	7.64 %
Drop	1.68 %	1.76 %
Extract	4.75 %	5.01 %
Hold	26.42 %	26.53 %
Insert	3.75 %	3.66 %
Touch	0.62 %	0.48 %
Idle	55.14 %	54.91 %

Table 4: Verb Right distribution in training and test data sets

C. Detailed results for each team

The results for each team by sequence and task are presented on the following pages. Eight balanced scores were computed, the frame-by-frame and application-dependent version of the accuracy, precision, recall, and F1. To limit the amount of results, we only present here the ones for all granularities, as used during the challenge. The results for each granularity independently are available at <https://www.synapse.org/PETRAW> on files section.

C.1 Hutom

Table 5: Results of team Hutom for task1 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	85.80	95.45	94.88	94.95	88.51	96.53	95.95	96.03
004	86.28	96.39	96.40	96.30	89.69	97.38	97.35	97.29
006	86.23	96.45	96.34	96.34	90.35	97.34	97.28	97.25
009	89.03	96.08	95.93	95.91	90.85	96.95	96.81	96.78
012	83.62	94.13	93.92	93.87	86.19	94.86	94.71	94.64
015	83.17	93.48	92.64	92.84	86.05	94.18	93.52	93.64
019	83.01	93.36	93.09	93.00	85.20	94.25	94.06	93.90

Table 5: Results of team Hutom for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
020	87.17	95.38	95.25	95.18	90.05	96.39	96.27	96.20
022	83.70	93.85	93.16	93.19	87.26	95.04	94.36	94.39
023	92.63	97.03	96.87	96.91	95.27	98.08	97.99	98.00
029	87.20	95.10	94.69	94.77	90.58	96.33	96.00	96.04
030	82.44	92.67	92.11	92.10	84.63	93.61	93.14	93.09
031	86.74	96.13	96.04	96.05	89.60	97.25	97.21	97.19
032	85.47	95.27	94.97	94.95	88.63	96.41	96.24	96.20
036	91.66	96.13	95.86	95.91	94.17	97.23	97.00	97.02
040	86.02	95.45	94.76	94.90	88.31	96.32	95.77	95.84
043	87.72	95.75	95.90	95.70	90.12	96.89	97.08	96.89
044	89.83	96.98	96.80	96.78	94.98	98.52	98.37	98.39
046	85.81	94.48	93.96	93.95	88.24	95.74	95.18	95.18
049	88.03	95.30	94.47	94.49	90.84	96.45	95.68	95.68
053	84.86	93.50	93.33	93.21	88.50	94.64	94.48	94.42
054	68.61	81.64	80.25	79.53	71.25	82.85	81.28	80.61
056	91.97	96.34	95.88	96.01	94.77	97.21	96.83	96.93
059	90.01	94.97	94.35	94.39	94.02	96.06	95.50	95.51
063	84.30	93.39	93.16	92.97	87.46	94.76	94.48	94.32
064	85.75	92.52	92.86	92.55	88.02	93.47	93.86	93.53
069	87.95	94.29	93.95	93.91	91.48	95.65	95.41	95.32
070	88.65	96.08	95.77	95.83	93.02	97.45	97.13	97.20
072	87.21	95.08	94.70	94.71	90.29	96.32	96.06	96.03
073	88.33	94.65	94.15	94.12	91.01	95.70	95.21	95.19
077	86.86	96.81	96.91	96.82	88.97	97.91	98.01	97.92
079	77.33	87.19	87.05	86.28	80.95	88.54	88.32	87.58
083	85.42	93.27	93.38	93.19	89.03	94.70	94.76	94.58

Table 5: Results of team Hutom for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
085	89.54	96.74	96.57	96.60	92.97	97.81	97.69	97.69
086	87.05	96.87	97.02	96.91	89.27	98.04	98.22	98.10
089	89.55	97.10	96.68	96.84	92.86	98.02	97.66	97.79
091	90.96	96.27	96.16	96.17	95.91	97.72	97.65	97.66
093	86.88	95.94	95.86	95.78	89.82	97.30	97.22	97.13
097	88.68	96.68	96.75	96.69	92.48	98.25	98.32	98.26
098	92.08	97.70	97.69	97.66	94.60	98.89	98.92	98.88
101	85.33	95.51	95.38	95.29	89.76	96.70	96.58	96.50
104	92.58	97.16	96.95	97.01	96.55	98.58	98.39	98.46
106	89.04	96.88	96.71	96.72	92.06	98.04	97.86	97.88
108	93.60	97.73	97.54	97.61	96.49	98.68	98.56	98.60
112	91.47	97.37	97.07	97.18	95.33	98.45	98.30	98.35
113	86.19	95.16	94.79	94.81	88.20	96.05	95.84	95.81
116	84.78	93.46	93.73	93.29	87.46	94.61	94.80	94.45
117	91.06	97.14	97.09	96.99	94.47	98.47	98.45	98.35
121	86.63	96.79	96.48	96.53	89.54	97.75	97.51	97.53
123	90.79	96.25	95.91	96.01	94.05	97.44	97.18	97.25
126	86.33	96.12	96.06	96.05	89.53	97.17	97.15	97.13
129	90.34	96.17	96.05	96.04	94.72	97.55	97.39	97.40
134	88.82	97.32	97.12	97.08	93.84	98.52	98.30	98.27
135	90.48	96.97	96.98	96.94	93.68	98.28	98.36	98.29
138	85.22	95.26	94.99	95.00	88.11	96.27	96.06	96.07
139	89.94	97.02	96.96	96.89	92.67	98.35	98.32	98.26
142	90.58	97.21	97.24	97.21	93.41	98.49	98.56	98.52
145	89.44	95.58	95.41	95.27	91.96	96.70	96.53	96.37
148	88.39	95.10	95.01	94.96	90.87	96.28	96.24	96.18

Table 5: Results of team Hutom for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
150	89.15	95.30	94.58	94.45	91.56	96.39	95.77	95.62
Mean	87.40	95.29	95.04	94.99	90.51	96.43	96.22	96.16

Table 6: Results of team Hutom for task2 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	78.64	88.98	88.27	88.02	80.48	89.89	89.24	88.97
004	80.43	91.61	90.34	90.30	82.20	92.40	91.16	91.11
006	78.53	90.03	88.81	88.79	80.39	91.08	89.98	89.95
009	83.24	90.82	89.79	89.78	85.02	91.98	91.01	90.97
012	74.15	83.17	82.82	82.72	76.04	83.93	83.68	83.52
015	73.37	83.97	83.05	82.92	75.55	84.64	83.91	83.71
019	70.92	80.46	79.25	78.37	72.25	81.16	80.00	79.09
020	82.68	91.97	91.49	91.44	85.08	92.90	92.53	92.44
022	78.26	86.39	86.21	85.67	80.48	87.45	87.24	86.72
023	84.75	91.43	91.29	91.19	86.84	92.41	92.35	92.24
029	82.41	89.36	88.11	88.13	84.25	90.33	89.34	89.26
030	72.78	82.23	81.01	80.33	75.03	83.01	81.89	81.16
031	75.09	83.15	81.75	81.65	77.07	84.07	82.85	82.69
032	81.18	90.69	90.60	90.48	83.09	91.79	91.80	91.62
036	85.98	91.17	90.25	90.30	88.30	92.34	91.58	91.55
040	82.37	89.68	88.51	88.59	84.43	90.60	89.68	89.67
043	83.36	91.04	90.55	90.43	85.64	92.28	91.81	91.66
044	86.21	91.70	91.34	91.33	88.49	92.76	92.53	92.48
046	77.57	85.37	85.11	84.90	79.66	86.51	86.27	86.05
049	81.97	90.57	90.25	90.11	83.67	91.44	91.22	91.04

Table 6: Results of team Hutom for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
053	76.25	86.85	86.58	86.43	78.11	87.65	87.43	87.24
054	67.58	75.91	75.13	75.05	70.24	77.03	76.36	76.25
056	84.63	91.52	90.33	90.52	87.25	92.51	91.56	91.66
059	87.63	91.00	90.41	90.50	90.46	91.99	91.56	91.59
063	82.87	90.83	89.90	89.70	85.04	91.98	91.17	90.93
064	76.79	84.83	83.47	83.13	79.40	85.96	84.68	84.28
069	79.76	87.05	86.31	86.15	82.38	88.18	87.58	87.37
070	79.87	89.44	88.09	88.21	82.48	90.55	89.34	89.37
072	85.45	92.56	91.37	91.59	88.17	93.88	92.91	93.02
073	83.99	92.20	91.03	91.13	86.87	93.29	92.17	92.25
077	84.48	93.96	93.59	93.57	86.55	95.12	94.93	94.86
079	71.27	82.20	82.21	82.08	74.24	83.62	83.58	83.49
083	77.87	85.92	85.03	84.82	79.82	86.90	86.09	85.83
085	81.93	92.72	91.89	91.55	83.58	93.63	92.93	92.55
086	77.57	91.73	91.32	91.12	80.10	93.10	92.78	92.52
089	88.28	94.39	93.71	93.67	90.60	95.46	94.90	94.83
091	85.59	93.84	93.46	93.38	88.95	95.35	94.98	94.92
093	84.63	93.64	93.28	93.20	86.72	94.88	94.51	94.38
097	88.89	94.29	93.75	93.77	91.25	95.45	95.03	95.01
098	82.73	92.70	91.91	91.81	85.27	93.79	93.06	92.95
101	81.75	91.56	91.00	91.00	83.77	92.50	92.16	92.08
104	88.04	91.84	90.61	90.77	90.55	92.94	91.78	91.92
106	86.36	92.51	91.91	91.98	87.99	93.37	92.94	92.97
108	91.38	94.12	93.27	93.47	93.70	95.18	94.51	94.64
112	87.44	94.54	93.78	93.92	91.13	95.67	95.07	95.14
113	80.19	90.55	89.88	90.04	82.28	91.40	90.85	90.95

Table 6: Results of team Hutom for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
116	77.92	88.35	87.30	86.99	80.56	89.65	88.54	88.24
117	86.58	93.49	93.12	93.08	89.35	94.62	94.36	94.28
121	78.40	89.21	88.84	88.79	81.33	90.24	89.94	89.85
123	86.41	91.09	90.22	90.35	89.22	92.12	91.29	91.39
126	82.36	92.89	91.67	91.84	85.47	93.88	92.92	92.99
129	88.90	93.03	92.32	92.43	92.16	94.20	93.53	93.61
134	79.39	90.22	89.39	89.50	82.37	91.57	90.78	90.88
135	88.27	94.99	94.80	94.79	91.22	96.14	96.05	96.00
138	83.51	93.20	92.62	92.64	85.46	94.27	93.83	93.78
139	87.47	93.88	93.74	93.72	90.56	95.38	95.36	95.32
142	84.95	93.31	92.77	92.80	87.75	94.49	94.02	94.02
145	83.62	92.98	92.99	92.78	86.51	94.23	94.31	94.06
148	84.00	91.61	90.12	90.26	86.06	92.81	91.40	91.51
150	86.11	91.87	91.40	91.19	89.42	92.94	92.58	92.34
Mean	81.92	90.11	89.39	89.32	84.31	91.18	90.56	90.45

Table 7: Results of team Hutom for task3 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	55.95	84.67	84.49	81.66	57.93	85.10	84.96	82.20
004	57.98	87.05	86.56	83.61	59.88	87.49	87.04	84.14
006	56.44	86.43	86.45	84.18	58.55	86.97	87.06	84.97
009	60.72	83.95	85.74	83.04	62.23	84.61	86.35	83.79
012	54.60	85.06	84.68	82.23	56.71	85.49	85.10	82.67
015	54.90	85.01	83.94	81.81	57.96	85.67	84.42	82.38
019	54.71	83.61	83.15	81.09	55.86	84.00	83.53	81.56

Table 7: Results of team Hutom for task3 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
020	58.28	83.46	85.31	82.05	59.95	83.98	85.81	82.65
022	57.48	83.15	84.29	81.26	59.12	83.63	84.89	81.92
023	61.12	86.70	85.80	83.35	63.94	87.24	86.45	84.05
029	59.96	86.24	86.54	84.20	61.96	86.93	87.08	84.88
030	58.02	85.19	85.62	82.78	59.31	85.59	86.09	83.31
031	56.84	86.33	86.07	83.64	58.03	86.70	86.53	84.12
032	56.68	83.76	85.47	82.55	58.21	84.79	86.06	83.31
036	58.97	85.23	86.44	83.97	60.32	86.34	86.99	84.54
040	56.94	86.60	87.39	84.92	58.25	86.94	87.86	85.45
043	58.79	86.06	87.10	84.62	60.92	86.89	88.00	85.61
044	59.90	85.59	87.01	84.56	62.45	86.35	87.86	85.58
046	56.78	86.92	86.38	83.76	59.09	87.54	87.08	84.61
049	57.44	85.82	86.51	83.36	59.71	86.61	87.31	84.36
053	54.23	82.17	82.32	79.36	55.44	82.42	82.64	79.66
054	40.67	71.71	71.60	68.31	41.91	72.19	71.98	68.78
056	57.08	84.77	84.41	81.23	59.81	85.49	84.97	81.88
059	59.17	84.81	85.52	83.19	61.96	85.36	85.98	83.66
063	56.33	86.60	85.67	82.58	57.78	87.09	86.14	83.06
064	55.68	85.82	84.63	82.12	58.35	86.33	85.25	82.84
069	58.59	86.05	85.78	82.87	61.10	86.52	86.31	83.49
070	61.13	86.86	88.28	85.72	63.80	88.00	89.15	86.84
072	58.42	85.82	84.94	82.34	60.77	86.66	85.60	83.12
073	58.61	84.91	84.65	82.53	60.51	85.66	85.37	83.39
077	58.40	86.68	87.64	84.85	60.74	87.25	88.30	85.72
079	47.43	77.42	78.48	73.77	48.93	78.08	78.95	74.48
083	58.41	85.53	85.99	83.11	60.28	86.25	86.64	83.82

Table 7: Results of team Hutom for task3 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
085	57.63	88.45	87.42	84.62	60.98	89.10	88.26	85.78
086	58.43	86.67	86.43	84.08	60.81	87.51	87.16	84.97
089	60.54	88.46	88.41	85.90	62.55	88.95	88.92	86.56
091	60.72	86.14	87.07	84.58	63.77	87.12	87.97	85.70
093	56.37	84.55	84.27	81.47	58.88	85.54	85.27	82.66
097	62.27	87.49	89.04	86.58	64.99	88.38	89.93	87.73
098	61.72	85.43	86.19	83.07	63.38	85.87	86.80	83.86
101	58.92	86.54	87.71	84.98	61.44	87.39	88.42	85.81
104	61.27	86.14	86.57	82.70	63.64	86.86	87.29	83.62
106	59.54	86.19	87.39	84.64	61.79	87.04	88.16	85.59
108	62.73	88.64	88.65	86.48	66.44	89.56	89.52	87.43
112	61.41	86.50	87.52	84.83	63.51	87.42	88.25	85.70
113	55.20	85.87	85.74	83.16	57.77	86.45	86.26	83.80
116	55.59	85.72	86.05	82.46	56.89	86.18	86.49	83.03
117	61.55	86.84	87.86	84.93	64.37	87.64	88.69	85.94
121	57.97	86.69	87.50	84.19	59.71	87.29	87.88	84.60
123	60.31	86.66	87.28	84.66	61.93	87.35	87.81	85.27
126	56.99	85.67	86.60	84.01	58.73	86.25	87.11	84.60
129	61.56	88.09	86.76	83.86	64.76	88.68	87.36	84.61
134	60.25	89.46	89.37	86.67	62.26	90.19	90.14	87.74
135	61.18	85.92	87.43	84.52	62.91	86.57	88.06	85.29
138	58.41	86.10	87.37	84.75	60.61	87.18	88.37	86.00
139	61.72	87.63	88.62	85.83	63.78	88.73	89.47	86.88
142	61.43	87.14	88.05	85.03	64.08	88.00	88.93	86.11
145	57.17	83.94	85.39	82.31	59.72	84.85	86.15	83.22
148	61.35	85.44	87.09	84.05	63.62	86.23	87.90	85.00

Table 7: Results of team Hutom for task3 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
150	59.44	85.98	86.38	83.54	61.61	86.70	87.09	84.46
Mean	58.14	85.57	85.98	83.21	60.28	86.25	86.62	83.98

Table 8: Results of team Hutom for task4 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	87.10	95.70	95.19	95.28	89.51	96.60	96.09	96.19
004	88.12	96.89	96.51	96.60	89.48	97.56	97.20	97.28
006	87.89	97.71	97.40	97.50	89.56	98.46	98.22	98.28
009	88.08	95.60	95.29	95.28	89.62	96.45	96.21	96.18
012	84.68	94.27	94.21	94.15	86.53	94.99	95.00	94.92
015	81.36	92.88	92.01	92.12	83.50	93.55	92.83	92.86
019	82.78	93.62	93.06	93.16	84.53	94.41	93.95	94.00
020	89.12	97.05	97.19	97.08	90.79	97.82	98.03	97.90
022	89.42	95.80	95.44	95.45	91.28	96.69	96.36	96.35
023	93.58	97.55	97.36	97.41	95.46	98.31	98.15	98.19
029	88.97	96.41	95.89	96.06	90.53	97.28	96.96	97.06
030	87.03	93.44	92.53	92.63	89.74	94.30	93.49	93.54
031	90.32	95.21	94.66	94.75	91.75	96.16	95.76	95.79
032	88.32	96.87	97.06	96.93	89.88	97.77	98.02	97.86
036	91.39	96.66	96.41	96.49	93.18	97.70	97.59	97.62
040	89.09	96.04	95.53	95.59	90.53	96.84	96.45	96.47
043	90.18	96.85	97.08	96.92	94.31	97.99	98.30	98.11
044	91.58	96.66	96.39	96.44	92.98	97.63	97.52	97.52
046	89.26	94.47	94.14	94.07	92.25	95.60	95.32	95.22
049	91.45	97.16	97.21	97.12	93.48	98.06	98.24	98.11

Table 8: Results of team Hutom for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
053	86.44	95.32	94.97	94.97	88.21	96.03	95.75	95.71
054	73.36	83.83	82.81	81.99	76.91	84.55	83.57	82.72
056	92.60	97.02	96.69	96.75	94.08	97.82	97.60	97.62
059	94.27	97.17	96.98	97.02	96.84	98.10	98.00	98.02
063	88.21	95.48	94.84	94.89	90.30	96.38	95.88	95.89
064	86.63	94.17	93.62	93.66	88.89	94.99	94.53	94.54
069	89.55	95.57	95.43	95.41	92.22	96.61	96.48	96.46
070	89.29	95.81	95.16	95.34	92.21	96.84	96.30	96.44
072	93.75	96.68	96.31	96.38	95.73	97.44	97.23	97.24
073	91.34	97.34	96.86	96.92	92.86	97.99	97.54	97.60
077	89.34	97.77	97.64	97.67	90.66	98.49	98.41	98.42
079	80.91	89.45	89.17	88.86	83.03	90.51	90.17	89.89
083	86.97	93.89	93.57	93.61	89.84	94.96	94.73	94.72
085	86.94	97.24	97.36	97.28	89.06	98.05	98.24	98.13
086	82.27	96.08	95.99	95.70	83.98	96.77	96.75	96.45
089	94.59	98.00	97.78	97.86	97.61	98.95	98.83	98.86
091	91.05	97.99	98.01	97.98	93.64	98.95	98.97	98.94
093	89.14	97.06	97.10	97.01	91.21	97.97	98.06	97.96
097	93.65	98.09	97.82	97.87	95.28	98.93	98.78	98.79
098	87.98	96.77	96.68	96.50	89.93	97.59	97.54	97.34
101	88.91	97.31	97.28	97.25	90.72	98.29	98.35	98.29
104	95.07	97.46	97.32	97.34	97.45	98.42	98.35	98.36
106	90.35	96.62	96.36	96.41	92.05	97.47	97.31	97.32
108	94.97	97.91	97.68	97.73	97.01	98.63	98.49	98.52
112	92.35	98.00	97.79	97.86	94.71	99.02	98.92	98.95
113	87.27	96.07	95.48	95.62	88.82	96.96	96.51	96.60

Table 8: Results of team Hutom for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
116	86.19	94.33	94.04	93.87	88.42	95.44	95.20	95.02
117	92.48	97.66	97.78	97.66	93.78	98.41	98.64	98.49
121	88.71	96.98	96.78	96.84	92.20	97.94	97.85	97.87
123	93.93	97.31	96.80	96.97	96.33	98.17	97.75	97.89
126	87.49	97.09	96.90	96.93	89.67	97.93	97.89	97.87
129	93.59	97.23	96.92	97.04	96.33	98.19	97.96	98.05
134	90.71	97.28	97.29	97.25	93.58	98.23	98.30	98.23
135	92.01	97.76	97.77	97.72	93.99	98.59	98.69	98.61
138	88.08	96.54	96.20	96.19	90.55	97.56	97.28	97.26
139	92.28	97.76	97.69	97.68	93.78	98.52	98.48	98.47
142	90.75	97.47	97.52	97.47	93.49	98.52	98.62	98.56
145	88.67	96.67	96.59	96.51	91.12	97.75	97.76	97.65
148	90.17	96.70	96.60	96.60	91.68	97.56	97.48	97.47
150	91.09	95.55	95.71	95.52	93.36	96.41	96.66	96.45
Mean	89.22	96.12	95.86	95.85	91.34	97.00	96.83	96.79

Table 9: Results of team Hutom for task5 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	85.19	95.08	94.27	94.41	87.23	96.01	95.29	95.41
004	90.82	96.14	95.72	95.81	93.32	97.04	96.66	96.72
006	88.27	96.48	96.11	96.21	91.30	97.32	97.07	97.12
009	90.57	95.97	95.57	95.62	91.92	96.83	96.54	96.54
012	83.17	91.88	90.25	90.53	85.21	92.61	91.17	91.37
015	83.57	92.19	90.19	90.77	85.46	92.71	91.05	91.50
019	85.55	92.64	91.49	91.65	88.57	93.50	92.60	92.64

Table 9: Results of team Hutom for task5 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
020	88.56	95.81	95.41	95.47	91.31	96.77	96.47	96.50
022	85.76	93.80	92.36	92.59	87.98	94.80	93.61	93.77
023	92.66	96.79	96.34	96.48	95.26	97.75	97.47	97.55
029	89.17	95.50	94.47	94.78	91.54	96.53	95.75	95.96
030	83.19	92.94	91.74	92.05	84.80	93.59	92.64	92.85
031	90.25	94.95	93.66	93.86	93.42	95.77	94.64	94.78
032	84.74	94.59	93.72	93.90	86.89	95.54	95.00	95.06
036	92.18	95.53	94.61	94.85	93.90	96.44	95.69	95.87
040	87.10	94.73	93.47	93.71	88.69	95.44	94.45	94.60
043	88.26	95.18	94.52	94.55	90.46	96.32	95.88	95.84
044	93.26	97.19	96.86	96.95	96.23	98.47	98.28	98.32
046	86.44	94.16	93.23	93.39	90.04	95.31	94.47	94.61
049	89.72	95.68	94.76	94.99	91.79	96.62	95.94	96.08
053	86.89	93.93	93.29	93.40	89.76	94.97	94.43	94.52
054	74.24	82.57	80.68	80.27	77.04	83.54	81.85	81.37
056	91.40	95.42	94.25	94.54	93.71	96.25	95.33	95.54
059	91.28	95.71	94.82	95.01	94.16	96.52	95.88	95.98
063	87.49	94.37	93.84	93.94	90.66	95.63	95.23	95.28
064	85.78	92.81	92.27	92.22	87.26	93.54	93.23	93.10
069	89.21	94.57	94.12	94.16	91.97	95.60	95.29	95.27
070	90.32	96.09	95.36	95.59	93.94	97.33	96.80	96.94
072	89.52	95.97	95.33	95.46	91.56	96.96	96.55	96.58
073	88.07	94.90	93.75	93.97	90.22	95.77	94.80	94.95
077	88.13	97.13	97.04	97.05	89.88	98.16	98.17	98.14
079	76.84	85.58	85.93	85.08	78.99	86.75	87.23	86.32
083	86.75	93.55	92.60	92.61	89.55	94.70	93.81	93.77

Table 9: Results of team Hutom for task5 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
085	91.41	97.15	96.77	96.88	93.64	98.01	97.81	97.85
086	87.80	96.81	96.73	96.70	90.17	97.91	97.96	97.89
089	89.92	96.72	95.59	96.02	92.51	97.52	96.56	96.91
091	92.24	96.37	95.92	96.02	96.82	97.68	97.44	97.47
093	87.39	94.97	94.22	94.30	89.52	96.01	95.47	95.48
097	89.59	96.83	96.67	96.69	92.03	97.97	97.96	97.92
098	93.73	97.66	97.41	97.48	96.47	98.72	98.63	98.65
101	87.88	96.16	95.72	95.77	90.16	97.14	96.82	96.83
104	94.23	97.22	97.02	97.09	97.19	98.41	98.30	98.34
106	90.16	96.71	96.25	96.38	92.67	97.76	97.38	97.49
108	94.07	97.40	96.95	97.09	96.72	98.36	98.12	98.19
112	91.57	97.23	96.38	96.58	93.84	98.16	97.60	97.70
113	88.65	95.36	94.06	94.38	90.59	96.12	95.10	95.32
116	85.09	93.73	93.63	93.51	86.80	94.87	94.84	94.70
117	93.51	97.47	97.19	97.25	96.35	98.61	98.44	98.47
121	87.11	96.03	95.48	95.62	89.02	96.92	96.53	96.62
123	92.42	96.54	95.83	96.06	95.04	97.62	97.09	97.26
126	89.12	96.39	95.79	95.98	91.30	97.23	96.97	97.03
129	91.91	96.70	96.42	96.52	95.69	97.99	97.77	97.83
134	91.56	96.93	96.50	96.62	95.11	98.00	97.72	97.78
135	90.96	97.08	96.83	96.86	93.69	98.16	98.08	98.06
138	89.58	95.36	94.76	94.88	92.10	96.49	96.12	96.16
139	90.51	96.95	96.78	96.80	93.00	98.26	98.17	98.15
142	94.45	97.01	96.53	96.67	97.31	98.18	97.87	97.95
145	90.34	96.17	95.66	95.62	92.28	97.17	96.79	96.69
148	88.69	95.01	94.27	94.36	90.78	96.11	95.49	95.55

Table 9: Results of team Hutom for task5 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
150	89.07	95.13	93.80	93.80	91.37	96.13	94.95	94.91
Mean	88.79	95.22	94.52	94.63	91.27	96.21	95.69	95.73

C.2 JHU CIRL

Table 10: Results of team JHU_CIRL for task2 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	83.56	95.46	95.82	95.60	85.70	96.35	96.67	96.47
004	81.71	94.33	94.42	94.31	83.80	95.18	95.19	95.09
006	82.33	96.04	96.05	95.97	85.14	97.16	97.11	97.05
009	85.46	95.33	95.41	95.18	87.85	96.25	96.28	96.09
012	80.88	93.19	93.25	93.08	83.10	93.88	93.96	93.77
015	74.66	88.49	85.84	85.31	76.58	89.03	86.44	85.91
019	79.44	93.38	93.97	93.41	81.41	94.28	94.72	94.22
020	83.88	95.84	96.35	96.03	87.13	96.90	97.36	97.06
022	81.42	94.10	94.18	93.90	84.00	95.14	95.11	94.91
023	79.06	89.89	90.38	89.83	82.33	91.03	91.41	90.93
029	83.86	94.61	94.63	94.48	88.19	95.92	95.87	95.79
030	80.13	92.99	93.45	93.16	82.38	93.81	94.23	93.95
031	82.34	94.28	93.81	93.80	85.58	95.49	95.02	95.02
032	80.67	94.15	94.55	94.23	83.39	95.39	95.74	95.46
036	82.64	91.98	90.73	90.62	85.48	93.32	91.95	91.84
040	82.82	93.93	93.42	93.44	85.94	95.04	94.58	94.56
043	83.62	94.23	94.52	94.25	86.83	95.44	95.70	95.48
044	85.65	95.41	95.53	95.38	88.84	96.78	96.84	96.74
046	82.15	93.52	93.95	93.54	85.37	94.66	95.04	94.70

Table 10: Results of team JHU_CIRL for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
049	85.27	95.29	95.64	95.39	87.72	96.49	96.84	96.60
053	80.99	94.42	94.85	94.43	83.58	95.47	95.80	95.47
054	78.56	92.30	91.47	90.95	81.14	93.33	92.46	91.97
056	84.48	95.72	95.54	95.50	87.76	96.73	96.52	96.48
059	90.24	97.07	96.94	96.92	93.80	98.22	98.08	98.07
063	84.07	94.87	95.21	94.85	86.16	95.81	96.14	95.82
064	73.99	86.61	83.26	82.66	77.16	87.67	84.25	83.72
069	83.39	93.24	93.55	93.25	86.46	94.53	94.78	94.51
070	84.05	94.40	94.36	94.19	87.09	95.52	95.40	95.29
072	88.05	96.36	96.42	96.38	91.13	97.65	97.69	97.64
073	87.45	96.03	95.86	95.83	91.13	97.29	97.09	97.10
077	84.52	96.04	96.20	96.04	87.42	97.42	97.47	97.33
079	76.26	90.86	88.39	86.75	78.84	92.08	89.49	87.93
083	84.28	93.70	93.97	93.68	88.87	95.25	95.41	95.21
085	82.74	95.71	96.05	95.77	86.41	96.89	97.16	96.93
086	82.76	94.98	95.21	95.04	86.21	96.40	96.58	96.44
089	85.44	95.26	95.29	95.11	88.87	96.27	96.25	96.11
091	85.97	96.42	96.66	96.46	90.08	97.93	97.99	97.91
093	81.59	94.99	95.40	95.06	83.85	96.13	96.47	96.17
097	85.52	95.28	95.42	95.24	89.35	96.80	96.78	96.65
098	83.33	95.41	95.42	95.17	86.55	96.67	96.57	96.39
101	83.61	95.87	96.24	96.00	86.55	97.04	97.33	97.14
104	86.11	94.87	95.00	94.74	89.58	96.29	96.32	96.19
106	85.79	95.19	95.03	95.07	88.53	96.21	96.05	96.08
108	89.58	96.67	96.32	96.40	92.52	97.78	97.47	97.53
112	87.89	96.82	96.69	96.71	90.92	97.89	97.87	97.84

Table 10: Results of team JHU_CIRL for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
113	82.14	95.01	94.82	94.75	85.22	95.90	95.75	95.69
116	81.30	93.06	91.67	91.36	83.80	94.38	92.75	92.54
117	87.19	96.01	96.06	95.92	89.15	96.83	96.87	96.73
121	79.59	94.48	94.06	94.12	82.17	95.49	95.11	95.14
123	88.93	95.92	95.52	95.58	91.60	96.96	96.60	96.67
126	82.35	95.38	95.28	95.25	85.68	96.55	96.49	96.43
129	87.98	95.32	95.23	95.18	91.81	96.69	96.50	96.51
134	81.23	94.57	94.55	94.41	85.53	96.10	96.02	95.92
135	86.11	96.12	96.25	96.14	89.43	97.35	97.43	97.36
138	82.59	94.99	94.93	94.75	85.41	96.08	96.04	95.89
139	85.56	95.25	95.58	95.25	88.52	96.69	96.90	96.64
142	84.46	95.20	95.25	95.15	88.14	96.64	96.63	96.56
145	82.39	94.62	95.20	94.80	85.46	95.87	96.38	96.04
148	85.49	94.49	94.45	94.25	88.19	95.78	95.65	95.53
150	86.13	95.19	95.58	95.24	90.05	96.51	96.84	96.56
Mean	83.43	94.52	94.42	94.19	86.45	95.68	95.52	95.33

C.3 MedAIR

Table 11: Results of team MedAIR for task1 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	79.26	93.65	93.38	92.86	81.80	94.45	94.15	93.69
004	82.85	96.31	96.23	95.90	84.89	96.98	96.93	96.64
006	79.67	95.28	95.30	94.84	81.61	96.08	96.02	95.62
009	82.09	94.36	94.07	93.53	84.19	95.14	94.87	94.39
012	78.92	94.45	94.03	93.70	81.21	95.17	94.67	94.39

Table 11: Results of team MedAIR for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
015	77.64	92.95	92.97	92.54	80.36	93.47	93.52	93.09
019	76.80	92.73	92.69	92.00	77.98	93.25	93.21	92.56
020	79.74	93.80	93.81	93.12	82.43	94.54	94.51	93.90
022	79.92	94.70	94.39	93.81	81.98	95.50	95.23	94.69
023	85.04	95.38	95.25	94.66	87.35	96.15	96.07	95.53
029	83.64	95.13	94.79	94.12	86.97	96.08	95.72	95.11
030	77.89	93.35	92.67	92.19	79.77	94.11	93.44	93.03
031	81.92	95.53	95.72	95.21	84.32	96.56	96.67	96.25
032	79.19	93.76	93.07	92.42	81.32	94.66	94.03	93.37
036	83.69	95.00	95.02	94.62	85.51	95.80	95.77	95.47
040	81.00	94.83	94.65	94.26	83.83	95.73	95.48	95.17
043	85.06	95.61	95.52	95.21	87.48	96.60	96.51	96.29
044	84.19	95.45	95.35	94.90	87.10	96.68	96.60	96.24
046	80.81	93.85	93.94	93.31	83.28	94.76	94.73	94.23
049	82.77	95.54	95.82	95.39	85.48	96.62	96.87	96.51
053	78.09	92.50	92.91	92.11	80.22	93.44	93.70	93.01
054	64.34	82.15	79.81	78.42	66.37	83.02	80.59	79.27
056	81.59	94.66	94.48	93.96	85.28	95.43	95.22	94.80
059	85.23	94.89	94.29	94.11	88.22	95.73	95.12	95.00
063	80.16	93.51	93.86	93.31	83.03	94.62	94.92	94.44
064	78.24	92.38	92.82	92.13	80.77	93.24	93.61	93.01
069	81.83	92.93	92.81	92.22	85.00	93.77	93.67	93.14
070	82.81	95.17	95.16	94.59	86.14	96.12	96.11	95.64
072	83.49	95.91	95.57	95.18	86.11	96.77	96.48	96.15
073	80.58	93.16	92.35	91.98	83.36	94.08	93.21	92.90
077	84.36	96.47	96.38	96.10	87.09	97.39	97.31	97.10

Table 11: Results of team MedAIR for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
079	69.02	83.24	84.52	82.76	71.12	84.25	85.42	83.79
083	77.39	92.57	92.91	92.07	79.70	93.43	93.71	92.96
085	80.72	94.99	95.05	94.55	84.13	95.88	95.91	95.52
086	81.22	95.21	95.40	94.81	84.14	96.27	96.36	95.88
089	82.67	95.39	95.06	94.71	86.76	96.24	95.88	95.60
091	83.41	95.52	95.38	94.95	87.71	96.81	96.66	96.32
093	80.22	94.14	94.13	93.48	82.51	95.04	95.08	94.45
097	84.04	95.81	95.67	95.27	87.61	96.82	96.69	96.37
098	83.83	95.90	95.69	95.26	86.70	96.86	96.62	96.26
101	81.38	95.08	95.05	94.81	84.38	96.02	96.02	95.79
104	88.29	95.79	95.52	95.10	90.94	96.73	96.50	96.13
106	84.24	95.88	95.54	95.34	86.24	96.65	96.35	96.16
108	87.02	97.02	96.88	96.67	90.47	97.81	97.70	97.52
112	86.48	96.55	96.17	96.04	88.96	97.43	97.09	96.98
113	81.67	95.93	95.76	95.60	84.18	96.80	96.76	96.61
116	81.73	93.48	93.88	93.34	84.28	94.45	94.78	94.33
117	83.64	95.47	95.44	94.97	87.63	96.58	96.50	96.04
121	80.06	95.19	94.87	94.42	81.41	95.72	95.45	94.98
123	86.18	95.94	95.38	94.86	88.90	96.88	96.28	95.80
126	79.79	95.32	94.91	94.66	82.80	96.34	95.97	95.72
129	85.12	95.37	95.16	94.79	87.54	96.30	96.09	95.77
134	81.05	95.66	95.60	95.15	84.89	96.80	96.77	96.43
135	82.32	95.94	95.80	95.33	85.03	96.93	96.76	96.37
138	81.12	94.50	94.51	94.23	83.49	95.47	95.44	95.22
139	84.93	95.68	95.58	95.27	87.97	96.86	96.80	96.60
142	86.87	95.95	95.78	95.43	91.07	97.29	97.02	96.78

Table 11: Results of team MedAIR for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
145	81.69	94.82	95.15	94.69	84.82	95.86	96.23	95.84
148	85.36	94.76	94.85	94.51	87.37	95.66	95.69	95.43
150	82.28	93.58	93.85	93.30	85.60	94.83	95.02	94.55
Mean	81.61	94.43	94.31	93.82	84.31	95.35	95.21	94.78

Table 12: Results of team MedAIR for task2 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	88.30	96.98	96.96	96.93	89.47	97.67	97.75	97.68
004	88.73	97.35	97.08	97.14	89.56	97.92	97.79	97.80
006	90.80	97.50	97.42	97.41	92.12	98.25	98.26	98.22
009	89.91	96.56	96.20	96.22	90.97	97.24	97.00	96.99
012	81.56	91.89	90.56	90.43	83.34	92.41	91.13	90.98
015	85.33	94.77	93.27	93.57	87.00	95.38	94.01	94.23
019	79.11	89.97	87.65	87.57	80.20	90.58	88.34	88.20
020	92.39	97.30	96.80	96.96	93.96	98.00	97.66	97.77
022	87.20	95.61	95.10	95.21	89.20	96.36	96.00	96.04
023	94.46	96.92	96.19	96.36	96.01	97.69	97.08	97.20
029	91.25	94.76	93.77	93.88	92.81	95.47	94.68	94.72
030	83.92	90.38	88.82	88.81	85.28	91.07	89.61	89.56
031	86.05	93.51	91.70	91.68	86.91	94.05	92.50	92.41
032	84.41	94.39	93.77	93.88	86.64	95.21	94.75	94.81
036	91.42	95.95	94.89	95.05	93.25	96.82	95.96	96.06
040	87.30	94.14	92.83	93.07	88.39	94.68	93.59	93.75
043	88.64	96.11	95.50	95.62	90.02	96.93	96.56	96.60
044	91.88	97.20	96.80	96.93	93.03	98.12	97.88	97.97

Table 12: Results of team MedAIR for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
046	91.55	96.35	96.52	96.34	93.21	97.02	97.26	97.06
049	89.94	96.79	96.31	96.42	91.88	97.78	97.50	97.53
053	85.92	96.56	95.65	95.80	87.48	97.29	96.45	96.58
054	70.97	80.35	78.92	79.18	72.21	81.05	79.81	80.01
056	92.31	97.14	96.10	96.39	93.72	97.75	97.04	97.22
059	96.12	98.38	97.83	98.02	97.69	99.11	98.83	98.93
063	90.64	96.21	95.62	95.64	92.62	97.27	96.59	96.60
064	84.66	91.51	88.02	87.49	85.74	92.06	88.72	88.10
069	91.96	96.85	96.53	96.62	93.63	97.66	97.45	97.50
070	89.81	95.93	95.06	95.30	91.77	96.62	95.91	96.07
072	91.31	97.69	96.88	97.18	92.57	98.17	97.65	97.83
073	91.05	96.56	95.63	95.72	92.37	97.19	96.36	96.41
077	88.57	97.76	97.61	97.65	89.91	98.48	98.41	98.43
079	76.59	87.63	85.90	85.84	77.81	88.34	86.69	86.61
083	88.33	94.13	93.54	93.56	90.01	95.08	94.61	94.57
085	87.19	96.02	95.60	95.48	88.89	96.70	96.49	96.29
086	81.30	95.73	95.44	94.99	82.65	96.54	96.40	95.91
089	92.26	97.95	97.66	97.78	93.40	98.53	98.29	98.39
091	92.86	97.77	97.56	97.61	94.29	98.64	98.59	98.59
093	86.86	96.17	95.73	95.77	88.52	96.97	96.74	96.70
097	93.09	97.94	97.50	97.66	94.61	98.80	98.50	98.61
098	93.20	98.03	97.92	97.93	94.92	98.83	98.81	98.80
101	88.04	96.87	96.69	96.69	90.06	97.82	97.58	97.55
104	94.63	97.46	97.16	97.23	96.30	98.28	98.03	98.08
106	92.27	97.50	96.91	97.12	93.94	98.10	97.64	97.81
108	96.29	98.09	97.44	97.66	97.99	98.75	98.35	98.47

Table 12: Results of team MedAIR for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
112	93.16	98.23	97.86	97.98	94.71	98.90	98.73	98.79
113	89.35	97.47	96.70	96.92	91.38	98.09	97.57	97.72
116	86.08	94.23	91.68	92.03	87.64	94.81	92.43	92.71
117	91.80	97.24	96.96	96.96	93.48	98.07	97.95	97.90
121	87.26	96.97	96.35	96.51	88.64	97.49	97.01	97.12
123	93.67	96.79	96.05	96.28	95.21	97.38	96.78	96.96
126	86.71	97.01	96.35	96.58	88.78	97.90	97.44	97.60
129	94.84	97.38	96.61	96.92	96.97	98.20	97.53	97.80
134	86.53	96.62	95.84	96.07	88.31	97.37	96.85	96.98
135	92.40	97.41	96.99	97.08	93.63	98.08	97.93	97.93
138	89.20	96.91	96.07	96.28	90.39	97.62	97.07	97.19
139	92.53	97.27	97.07	97.11	93.58	98.02	97.94	97.94
142	93.35	97.65	97.15	97.29	94.69	98.37	98.03	98.12
145	89.89	96.97	96.70	96.75	91.90	97.88	97.86	97.81
148	92.50	96.85	96.49	96.60	93.79	97.62	97.38	97.45
150	91.79	96.34	95.87	95.91	93.83	97.10	96.79	96.76
Mean	89.19	95.87	95.13	95.22	90.72	96.59	96.01	96.04

Table 13: Results of team MedAIR for task4 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	83.87	95.44	95.16	95.16	86.15	96.47	96.17	96.19
004	83.56	95.43	95.31	95.28	85.39	96.24	96.10	96.09
006	83.25	96.11	95.80	95.88	85.37	97.08	96.76	96.86
009	87.12	95.37	95.33	95.22	89.42	96.33	96.29	96.21
012	83.75	94.31	93.27	93.59	87.87	94.91	94.03	94.29

Table 13: Results of team MedAIR for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
015	79.91	93.64	91.74	92.22	81.39	94.14	92.45	92.86
019	79.96	92.62	92.21	92.09	81.20	93.41	92.99	92.84
020	84.58	95.17	95.14	95.02	86.17	96.18	96.23	96.09
022	84.09	94.64	94.33	94.37	86.16	95.67	95.47	95.47
023	87.18	96.02	95.24	95.51	89.73	97.03	96.36	96.61
029	85.78	95.51	94.89	95.08	87.77	96.44	95.90	96.07
030	80.45	93.03	92.40	92.43	82.39	93.75	93.20	93.21
031	82.23	95.75	95.16	95.31	83.80	96.68	96.18	96.32
032	83.55	94.95	94.54	94.71	85.11	95.93	95.61	95.74
036	85.25	95.46	95.36	95.31	87.61	96.69	96.55	96.51
040	84.72	93.99	92.95	93.22	86.80	94.85	93.96	94.17
043	81.79	92.57	92.32	92.25	84.29	93.88	93.66	93.59
044	86.48	95.04	94.68	94.71	88.78	96.22	95.84	95.85
046	83.52	93.12	92.51	92.46	85.93	94.24	93.63	93.56
049	82.40	94.04	93.87	93.77	85.04	95.17	95.04	94.91
053	80.49	94.37	94.91	94.50	82.15	95.41	95.77	95.40
054	74.35	85.02	85.34	83.96	75.89	85.82	86.20	84.80
056	87.97	95.83	95.12	95.21	89.94	96.61	96.00	96.08
059	90.60	96.88	96.19	96.45	92.88	97.74	97.21	97.42
063	83.26	94.32	94.32	94.15	85.42	95.24	95.21	95.06
064	83.16	93.88	93.88	93.73	85.33	94.73	94.84	94.66
069	85.80	93.39	92.63	92.60	88.93	94.54	93.86	93.83
070	85.46	95.17	94.85	94.96	88.11	96.14	95.86	95.96
072	87.02	96.47	96.39	96.38	88.71	97.48	97.48	97.44
073	87.04	95.98	95.64	95.70	89.92	97.21	96.95	96.99
077	84.41	96.08	95.94	95.95	86.69	97.12	96.98	97.00

Table 13: Results of team MedAIR for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
079	75.57	88.63	88.51	87.62	77.09	89.54	89.45	88.53
083	84.23	94.21	94.28	94.13	86.56	95.30	95.40	95.26
085	81.94	94.92	94.73	94.62	83.93	95.95	95.86	95.72
086	82.52	95.32	95.03	95.02	84.82	96.31	96.07	96.08
089	87.19	96.77	96.26	96.44	89.75	97.84	97.38	97.56
091	87.99	96.28	95.86	95.97	91.92	97.71	97.42	97.49
093	84.16	95.40	95.48	95.36	86.22	96.54	96.73	96.56
097	88.59	96.32	95.69	95.88	90.72	97.56	97.02	97.18
098	88.85	97.01	96.88	96.89	92.02	98.34	98.30	98.30
101	84.09	95.60	95.45	95.45	86.60	96.70	96.70	96.64
104	88.36	95.35	95.01	95.08	90.84	96.54	96.19	96.28
106	86.27	95.41	94.76	94.96	88.06	96.34	95.74	95.92
108	89.12	96.76	96.09	96.36	91.91	97.81	97.32	97.52
112	86.41	96.34	95.90	95.97	89.93	97.44	97.15	97.19
113	83.05	95.64	95.46	95.45	85.52	96.76	96.61	96.58
116	80.97	94.11	93.84	93.77	82.77	94.99	94.69	94.66
117	89.78	96.73	96.49	96.56	92.55	97.94	97.72	97.78
121	81.92	95.01	94.16	94.38	83.94	95.84	95.03	95.22
123	88.79	95.79	95.41	95.48	90.24	96.60	96.25	96.31
126	82.41	95.35	94.51	94.78	84.62	96.44	95.78	95.98
129	88.91	95.10	94.24	94.41	91.03	96.12	95.25	95.39
134	80.83	94.40	93.78	93.90	82.59	95.50	94.86	94.95
135	87.09	96.27	95.91	95.97	89.99	97.48	97.19	97.24
138	85.21	95.51	94.67	94.92	87.11	96.55	95.89	96.06
139	85.26	94.97	94.93	94.86	87.13	96.16	96.11	96.04
142	88.81	96.46	96.05	96.22	91.94	97.75	97.36	97.50

Table 13: Results of team MedAIR for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
145	85.31	94.95	94.59	94.65	87.48	95.95	95.69	95.69
148	89.20	95.91	95.46	95.60	91.09	96.97	96.58	96.69
150	87.00	94.99	94.42	94.38	89.83	96.17	95.65	95.64
Mean	84.71	94.92	94.52	94.54	86.98	95.94	95.60	95.60

C.4 MMLAB

Table 14: Results of team MMLAB for task4 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	82.34	93.42	93.12	92.95	84.80	94.31	93.94	93.84
004	83.66	94.86	94.85	94.73	85.98	95.77	95.72	95.66
006	80.34	94.78	94.66	94.52	82.35	95.62	95.36	95.27
009	81.20	92.87	92.84	92.37	83.80	93.87	93.66	93.29
012	79.78	91.22	90.75	90.63	84.21	91.86	91.41	91.28
015	76.61	90.11	89.88	89.62	78.06	90.74	90.51	90.23
019	78.75	92.23	92.49	92.00	80.96	93.12	93.18	92.77
020	82.75	94.86	95.12	94.87	85.11	95.69	95.87	95.66
022	81.69	93.47	92.96	92.71	83.20	94.16	93.63	93.41
023	86.34	96.46	96.49	96.32	88.88	97.25	97.19	97.07
029	84.61	95.54	95.56	95.39	87.78	96.45	96.42	96.27
030	78.45	90.37	88.48	88.55	80.35	91.08	89.20	89.25
031	81.15	92.48	92.07	91.79	83.04	93.35	92.92	92.70
032	82.56	94.44	94.64	94.29	84.54	95.34	95.42	95.10
036	87.00	95.09	95.02	94.92	89.72	96.26	96.16	96.12
040	82.27	94.09	93.83	93.59	84.72	94.97	94.64	94.44
043	84.41	94.20	94.31	93.92	86.95	95.31	95.41	95.12

Table 14: Results of team MMLAB for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
044	85.29	95.39	95.54	95.25	88.07	96.58	96.58	96.41
046	82.35	93.35	93.16	92.73	84.93	94.34	94.14	93.82
049	83.30	94.84	94.93	94.53	86.28	95.84	95.99	95.67
053	78.56	93.28	93.59	93.08	80.98	94.22	94.48	94.05
054	66.22	78.13	78.88	77.56	69.46	79.25	79.92	78.67
056	84.94	95.67	95.45	95.45	87.47	96.69	96.45	96.47
059	86.95	94.15	93.64	93.61	90.59	95.08	94.55	94.56
063	81.89	93.35	93.24	92.92	85.02	94.64	94.32	94.08
064	79.92	91.54	90.50	90.38	82.43	92.28	91.26	91.18
069	84.69	94.82	94.69	94.41	87.01	95.69	95.54	95.29
070	83.79	94.34	94.13	94.04	86.02	95.14	94.97	94.88
072	85.99	94.62	94.36	94.29	88.35	95.71	95.44	95.40
073	82.97	93.31	92.85	92.69	85.92	94.34	93.75	93.69
077	82.75	95.42	95.36	95.10	85.17	96.31	96.27	96.08
079	74.22	86.16	87.04	85.83	76.69	87.41	88.16	87.03
083	81.31	91.30	91.02	90.75	85.59	92.52	92.28	92.09
085	80.50	94.69	94.93	94.66	84.18	95.84	96.02	95.82
086	82.09	94.74	95.18	94.80	84.67	95.85	96.14	95.86
089	84.90	95.38	95.08	95.09	88.91	96.35	96.02	96.07
091	84.50	94.28	93.54	93.53	87.42	95.33	94.60	94.64
093	82.14	94.08	94.02	93.76	84.78	95.19	95.03	94.85
097	85.62	94.96	94.86	94.53	88.90	95.89	95.76	95.50
098	83.06	96.25	96.10	95.69	85.61	97.18	96.99	96.67
101	81.65	93.90	93.84	93.64	83.90	94.84	94.74	94.58
104	85.95	94.34	94.45	94.10	88.22	95.41	95.43	95.17
106	83.18	93.33	92.92	92.83	85.42	94.28	93.86	93.81

Table 14: Results of team MMLAB for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
108	86.34	93.92	93.45	93.43	89.97	94.97	94.51	94.52
112	83.71	94.62	94.50	94.38	86.51	95.62	95.44	95.36
113	79.36	93.14	92.88	92.67	81.63	94.15	93.82	93.66
116	74.67	89.20	87.58	87.28	77.43	90.51	88.60	88.39
117	85.20	94.51	94.46	94.29	88.29	95.60	95.54	95.41
121	78.66	93.68	93.88	93.54	81.80	94.75	94.82	94.57
123	85.34	93.31	92.84	92.68	88.09	94.24	93.75	93.64
126	79.45	94.03	93.96	93.78	81.98	95.00	94.93	94.79
129	86.03	94.04	93.87	93.73	88.92	95.25	94.99	94.90
134	78.09	91.31	91.49	91.16	82.53	92.53	92.61	92.31
135	83.84	93.51	93.41	93.27	87.56	94.80	94.66	94.53
138	79.79	92.25	92.27	92.05	82.59	93.28	93.23	93.06
139	83.54	93.83	93.62	93.26	86.08	95.17	94.83	94.58
142	81.51	93.74	93.48	93.33	85.52	95.11	94.77	94.68
145	79.81	92.58	92.50	92.00	83.03	93.73	93.68	93.23
148	81.91	92.84	92.64	92.28	84.15	93.88	93.58	93.33
150	82.07	92.82	92.74	92.31	85.50	94.02	93.82	93.53
Mean	82.03	93.32	93.17	92.90	84.80	94.33	94.11	93.91

C.5 NCC NEXT

Table 15: Results of team NCC_NEXT for task1 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	83.09	94.96	95.05	94.79	84.71	95.80	95.78	95.58
004	83.48	95.80	95.58	95.49	85.70	96.63	96.37	96.29
006	82.50	96.00	95.53	95.66	84.73	97.05	96.63	96.75

Table 15: Results of team NCC_NEXT for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
009	84.32	94.77	94.72	94.44	86.70	95.88	95.81	95.58
012	82.26	94.48	94.92	94.58	84.58	95.34	95.70	95.42
015	81.77	94.83	94.00	94.16	83.55	95.50	94.68	94.84
019	81.64	93.95	94.19	93.94	83.58	94.75	95.00	94.77
020	85.01	95.89	96.01	95.83	88.84	97.06	97.10	96.98
022	84.91	94.95	94.73	94.66	86.95	95.94	95.69	95.63
023	89.18	96.53	96.65	96.56	91.73	97.53	97.62	97.56
029	87.45	95.33	94.23	94.53	90.92	96.41	95.37	95.64
030	84.33	94.90	94.53	94.47	85.61	95.60	95.34	95.23
031	84.61	95.18	95.00	95.02	86.41	96.06	95.87	95.90
032	84.21	95.06	94.86	94.75	86.77	96.16	95.98	95.88
036	88.70	96.31	96.17	96.17	91.60	97.64	97.55	97.53
040	85.74	95.69	95.52	95.42	88.46	96.59	96.47	96.37
043	87.27	95.75	95.79	95.61	89.84	97.00	97.13	96.93
044	90.07	97.11	96.96	96.94	92.99	98.38	98.27	98.26
046	84.58	94.34	94.53	94.30	87.10	95.47	95.61	95.41
049	86.93	96.23	96.14	96.01	90.07	97.40	97.20	97.06
053	81.47	93.10	90.92	91.42	83.36	93.93	91.71	92.23
054	67.38	82.29	81.19	80.03	70.15	83.44	82.27	81.16
056	83.59	94.76	93.82	93.80	85.95	95.54	94.60	94.59
059	88.51	95.99	95.12	95.28	92.79	97.16	96.33	96.52
063	81.83	93.31	93.71	93.36	83.88	94.40	94.72	94.39
064	82.58	93.49	92.68	92.86	85.27	94.39	93.55	93.73
069	86.38	94.57	94.56	94.26	88.99	95.86	95.81	95.54
070	85.11	95.32	95.42	95.20	88.31	96.52	96.54	96.44
072	87.67	96.10	95.27	95.45	90.14	97.12	96.36	96.52

Table 15: Results of team NCC_NEXT for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
073	84.71	94.67	94.51	94.39	87.46	95.90	95.66	95.59
077	85.37	96.47	95.89	96.01	86.97	97.47	96.91	97.04
079	75.05	85.81	87.11	86.08	76.84	86.84	88.05	87.07
083	84.15	94.82	95.06	94.82	86.93	96.12	96.23	96.08
085	84.09	95.77	96.02	95.83	86.25	97.02	97.24	97.07
086	83.49	95.41	95.66	95.38	86.78	96.88	96.98	96.78
089	86.37	96.19	96.09	96.04	89.72	97.37	97.22	97.22
091	85.33	95.30	94.94	94.90	88.31	96.60	96.21	96.22
093	83.59	94.44	94.52	94.25	86.46	95.77	95.75	95.56
097	87.48	96.56	96.05	96.14	90.59	97.93	97.44	97.53
098	88.27	96.66	96.58	96.47	91.49	97.71	97.60	97.56
101	84.06	95.78	95.96	95.79	86.50	96.82	97.01	96.84
104	91.32	96.52	96.13	96.13	94.73	97.83	97.52	97.56
106	87.84	96.48	96.39	96.29	91.24	97.72	97.58	97.53
108	91.53	97.23	97.18	97.16	94.39	98.26	98.18	98.18
112	86.66	96.78	96.92	96.74	90.88	98.20	98.22	98.13
113	83.95	96.24	95.83	95.84	86.58	97.24	96.81	96.84
116	82.39	93.12	93.19	92.72	84.60	94.35	94.25	93.88
117	88.29	96.51	96.18	96.15	91.56	97.93	97.61	97.59
121	83.42	96.40	96.18	96.14	86.56	97.51	97.28	97.28
123	89.98	96.67	96.58	96.45	92.68	97.75	97.61	97.54
126	83.73	95.79	95.02	95.25	86.49	96.94	96.24	96.44
129	87.66	95.25	94.70	94.81	90.00	96.28	95.73	95.85
134	84.53	96.38	96.34	96.14	88.58	97.88	97.78	97.70
135	86.64	96.43	96.52	96.38	89.52	97.62	97.65	97.56
138	83.95	95.04	94.77	94.70	87.46	96.50	96.23	96.21

Table 15: Results of team NCC_NEXT for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
139	87.78	96.45	96.43	96.17	91.51	98.22	98.18	98.02
142	86.30	96.37	96.67	96.45	89.51	97.90	98.09	97.92
145	83.53	94.96	95.55	95.15	86.61	96.38	96.92	96.59
148	86.44	95.47	95.46	95.31	88.57	96.52	96.48	96.38
150	87.25	94.95	95.03	94.87	90.62	96.20	96.32	96.15
Mean	85.03	95.13	94.95	94.83	87.77	96.27	96.07	95.98

Table 16: Results of team NCC_NEXT for task2 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	83.79	90.86	87.72	88.17	84.97	91.66	88.77	89.13
004	78.99	84.75	79.57	80.29	81.30	85.28	80.34	80.95
006	82.27	93.73	90.26	90.79	83.88	94.56	91.32	91.77
009	86.10	93.56	91.70	92.20	87.50	94.44	92.98	93.32
012	80.25	88.75	84.36	85.28	81.48	89.17	84.94	85.76
015	83.64	90.83	87.27	88.46	85.60	91.33	88.09	89.15
019	76.84	86.51	81.03	81.56	78.02	87.02	81.74	82.19
020	87.49	92.70	90.22	90.99	89.14	93.42	91.26	91.90
022	85.17	91.44	88.01	88.95	87.09	92.13	89.04	89.85
023	89.74	94.36	91.81	92.60	91.24	95.09	92.76	93.44
029	91.59	94.67	91.91	92.77	93.37	95.29	92.96	93.63
030	81.46	89.45	84.53	85.95	82.64	89.87	85.25	86.54
031	90.50	92.84	89.87	90.78	91.70	93.39	90.66	91.50
032	87.56	93.95	91.34	92.18	89.96	94.71	92.50	93.17
036	90.93	92.71	89.36	90.36	92.25	93.39	90.33	91.22
040	89.80	92.16	89.58	90.40	91.34	92.78	90.60	91.26

Table 16: Results of team NCC_NEXT for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
043	85.62	88.90	86.29	86.76	87.18	89.66	87.35	87.71
044	87.75	90.12	87.67	87.54	88.94	90.81	88.68	88.43
046	88.63	91.86	89.02	89.63	90.64	92.71	90.15	90.66
049	90.07	93.58	91.29	92.01	92.17	94.61	92.73	93.29
053	88.67	92.58	90.38	90.77	90.59	93.66	91.87	92.17
054	77.78	84.67	81.85	82.28	80.51	85.66	83.20	83.49
056	92.37	95.28	92.70	93.58	94.25	95.91	93.70	94.44
059	90.89	95.04	92.79	93.50	93.07	95.76	93.81	94.40
063	90.75	93.70	90.99	91.55	92.92	94.68	92.40	92.78
064	86.53	91.10	87.20	87.76	87.94	91.61	88.09	88.49
069	89.97	94.11	91.45	92.15	92.02	94.78	92.44	93.02
070	92.15	95.92	94.12	94.70	94.69	96.68	95.18	95.64
072	91.15	95.70	93.55	94.30	93.07	96.50	94.89	95.44
073	87.80	94.13	91.90	92.50	91.43	94.84	93.01	93.44
077	88.45	96.15	94.45	95.10	91.10	97.00	95.60	96.13
079	84.60	89.51	86.66	87.03	86.36	90.50	87.98	88.24
083	89.61	92.59	90.72	91.32	91.47	93.38	91.86	92.32
085	91.40	96.47	94.65	95.29	94.97	97.34	96.00	96.44
086	89.81	93.88	92.35	92.90	91.52	94.63	93.45	93.86
089	90.46	96.15	93.75	94.64	92.86	97.18	95.01	95.82
091	84.39	89.63	86.86	87.34	86.65	90.73	88.50	88.74
093	91.79	96.08	94.12	94.80	93.50	96.91	95.52	95.99
097	89.78	93.66	91.30	91.62	92.20	94.44	92.48	92.66
098	90.75	96.38	95.13	95.58	93.19	97.29	96.42	96.72
101	89.78	94.65	92.53	93.18	91.46	95.44	93.81	94.28
104	90.48	93.89	91.66	92.31	92.45	94.84	92.91	93.47

Table 16: Results of team NCC_NEXT for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
106	92.88	95.75	93.53	94.36	94.77	96.59	94.73	95.43
108	91.93	94.91	92.67	93.43	93.42	95.66	93.87	94.45
112	91.08	95.56	93.14	94.00	93.25	96.31	94.32	95.00
113	90.22	94.26	91.33	92.31	92.27	95.10	92.62	93.42
116	85.02	90.92	88.10	88.78	86.47	91.79	89.24	89.82
117	92.19	94.77	92.73	93.38	93.78	95.70	93.97	94.50
121	86.20	92.77	89.68	90.19	90.21	93.56	90.70	91.10
123	85.19	88.01	85.26	85.95	86.91	88.61	86.22	86.78
126	90.90	96.12	93.97	94.75	94.25	97.00	95.05	95.73
129	90.44	95.35	92.60	93.73	93.37	96.47	93.95	94.97
134	83.95	92.59	90.22	90.91	86.10	93.53	91.51	92.07
135	91.97	95.96	94.17	94.78	94.01	96.78	95.43	95.86
138	93.45	95.23	92.86	93.67	95.86	96.25	94.30	94.96
139	91.06	93.86	91.84	92.27	93.53	95.15	93.51	93.80
142	92.16	95.80	93.28	94.18	94.33	96.71	94.48	95.26
145	89.73	95.32	93.59	94.15	92.19	96.38	95.17	95.54
148	92.40	95.22	92.47	93.27	94.61	96.22	93.92	94.58
150	88.59	93.83	91.78	92.33	90.95	94.78	93.34	93.65
Mean	88.28	93.09	90.45	91.14	90.32	93.89	91.61	92.16

Table 17: Results of team NCC_NEXT for task3 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	84.17	94.95	94.81	94.67	87.47	96.18	96.04	95.91
004	84.80	95.67	95.68	95.62	87.09	96.78	96.78	96.72
006	81.08	94.99	94.60	94.65	83.17	96.13	95.77	95.81

Table 17: Results of team NCC_NEXT for task3 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
009	83.70	94.50	94.18	94.08	87.33	96.11	95.80	95.69
012	81.11	94.94	94.52	94.66	84.48	95.98	95.51	95.64
015	80.69	93.93	92.84	93.05	83.28	94.66	93.71	93.86
019	82.46	93.87	93.95	93.73	84.47	94.72	94.77	94.56
020	84.73	95.11	94.75	94.65	88.33	96.52	96.18	96.10
022	84.09	94.69	94.35	94.36	86.06	95.70	95.42	95.39
023	87.13	95.39	95.10	95.12	91.24	96.65	96.43	96.44
029	82.83	94.18	93.16	93.39	87.14	95.52	94.56	94.76
030	81.06	92.71	91.60	91.74	83.25	93.67	92.63	92.75
031	82.54	94.56	94.37	94.38	84.55	95.50	95.29	95.33
032	80.99	93.36	92.80	92.84	83.78	94.50	94.00	94.02
036	88.26	95.82	95.56	95.59	90.92	97.13	96.91	96.93
040	83.35	94.23	93.52	93.69	86.50	95.53	94.91	95.03
043	85.84	95.35	95.35	95.17	89.18	96.75	96.86	96.66
044	87.84	96.16	95.88	95.88	91.18	97.47	97.30	97.28
046	83.88	93.84	93.73	93.58	86.87	95.25	95.12	94.99
049	85.18	95.19	95.30	95.16	88.53	96.51	96.63	96.49
053	81.25	93.42	93.31	93.11	83.85	94.50	94.40	94.21
054	70.23	82.83	84.63	82.97	72.63	83.90	85.66	84.04
056	83.93	94.21	93.88	93.74	86.43	95.28	94.94	94.82
059	88.87	96.02	95.72	95.70	93.22	97.03	96.69	96.72
063	82.23	94.38	93.94	93.76	85.53	95.71	95.33	95.16
064	81.56	92.49	92.46	92.33	85.28	93.65	93.66	93.50
069	85.18	93.22	93.16	92.99	88.98	94.64	94.59	94.41
070	83.64	94.81	94.68	94.63	87.02	96.11	95.95	95.91
072	85.93	95.57	94.78	95.00	89.41	96.92	96.26	96.42

Table 17: Results of team NCC_NEXT for task3 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
073	84.08	93.70	93.11	93.23	87.38	94.90	94.38	94.46
077	83.47	95.60	95.53	95.46	85.53	96.64	96.56	96.48
079	71.95	84.18	85.44	84.23	74.75	85.54	86.58	85.47
083	81.68	92.66	92.92	92.71	85.07	93.88	94.11	93.93
085	82.59	95.32	95.21	95.15	86.42	96.77	96.79	96.71
086	83.45	95.07	95.21	95.06	86.69	96.38	96.53	96.39
089	85.69	96.07	95.81	95.88	89.53	97.32	97.11	97.16
091	85.86	95.39	95.25	95.22	89.66	96.87	96.75	96.72
093	83.56	94.15	93.96	93.90	86.99	95.71	95.69	95.58
097	85.76	95.66	95.48	95.48	89.00	97.04	96.92	96.91
098	87.20	95.77	95.65	95.66	93.01	97.39	97.26	97.26
101	83.06	95.19	95.30	95.18	86.67	96.76	96.90	96.77
104	90.76	95.75	95.78	95.72	94.92	97.32	97.28	97.27
106	85.82	95.69	95.60	95.54	89.62	97.12	96.95	96.95
108	88.60	96.55	96.25	96.34	92.84	97.71	97.50	97.55
112	86.35	96.21	96.03	96.08	90.70	97.62	97.43	97.47
113	85.17	95.30	94.94	94.98	88.54	96.71	96.31	96.37
116	82.35	93.28	93.73	93.38	85.22	94.60	94.97	94.72
117	90.09	96.46	96.10	96.19	94.71	97.92	97.59	97.69
121	80.40	94.78	93.93	93.96	83.18	95.69	94.88	94.93
123	88.65	96.12	95.32	95.58	92.92	97.39	96.59	96.84
126	81.39	94.85	94.48	94.54	85.13	96.36	95.93	96.02
129	88.96	95.03	94.62	94.66	92.99	96.67	96.16	96.28
134	85.29	96.28	96.32	96.27	89.66	97.84	97.85	97.83
135	86.49	96.03	96.03	95.98	91.03	97.61	97.63	97.58
138	83.65	95.02	94.71	94.68	87.51	96.62	96.38	96.39

Table 17: Results of team NCC_NEXT for task3 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
139	87.88	95.85	95.77	95.69	93.28	97.77	97.72	97.69
142	86.94	96.21	96.15	96.01	91.30	97.84	97.73	97.65
145	83.58	94.23	94.52	94.23	88.36	95.84	96.08	95.88
148	87.96	95.13	94.85	94.88	91.00	96.55	96.22	96.27
150	87.31	94.08	94.15	93.99	91.53	95.62	95.75	95.56
Mean	84.24	94.53	94.35	94.27	87.71	95.85	95.68	95.61

Table 18: Results of team NCC_NEXT for task4 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	89.92	95.84	94.36	94.86	91.19	96.69	95.47	95.88
004	93.79	96.96	95.58	96.08	96.12	97.58	96.47	96.86
006	87.17	96.74	95.00	95.64	88.87	97.54	96.07	96.61
009	88.29	95.38	93.95	94.46	89.85	96.32	95.28	95.64
012	85.37	93.67	90.29	91.41	86.64	94.06	90.90	91.92
015	87.20	94.41	90.75	92.02	88.99	94.92	91.58	92.71
019	85.74	94.85	92.22	93.17	86.88	95.36	92.94	93.81
020	90.97	95.78	93.66	94.38	92.60	96.51	94.69	95.28
022	89.44	94.96	92.64	93.42	91.29	95.67	93.67	94.32
023	92.50	96.88	94.69	95.53	94.03	97.62	95.67	96.40
029	93.10	95.82	93.41	94.26	94.95	96.45	94.48	95.14
030	86.42	94.82	91.06	92.42	87.67	95.31	91.83	93.06
031	92.83	95.89	93.62	94.50	93.97	96.39	94.36	95.16
032	88.45	94.76	92.08	92.95	90.91	95.51	93.23	93.95
036	92.72	95.58	92.57	93.59	94.38	96.36	93.64	94.55
040	92.80	95.44	92.76	93.64	94.33	96.05	93.76	94.49

Table 18: Results of team NCC_NEXT for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
043	92.16	95.60	93.77	94.39	93.92	96.44	94.92	95.42
044	95.09	96.83	95.47	95.97	96.59	97.63	96.62	97.00
046	91.56	94.94	92.58	93.35	93.60	95.85	93.76	94.44
049	91.64	95.32	93.26	93.99	94.36	96.47	94.79	95.36
053	92.14	95.02	92.48	93.22	93.99	96.05	93.94	94.58
054	76.00	83.95	81.26	80.88	78.72	84.91	82.60	82.07
056	93.23	96.41	93.59	94.49	95.15	97.06	94.63	95.38
059	92.71	96.56	94.30	95.13	94.97	97.36	95.39	96.09
063	93.06	95.82	94.19	94.72	95.33	96.80	95.63	95.98
064	90.51	95.15	93.44	93.92	92.17	95.75	94.42	94.75
069	91.05	95.33	92.79	93.58	93.62	96.19	93.98	94.65
070	91.35	96.36	94.81	95.34	93.88	97.16	95.91	96.33
072	92.27	96.68	94.63	95.38	94.23	97.53	96.02	96.57
073	89.03	95.28	93.43	94.02	92.90	96.06	94.61	95.03
077	89.53	97.03	95.41	96.05	92.30	97.99	96.67	97.19
079	84.83	87.59	87.22	86.95	86.79	88.64	88.60	88.22
083	93.00	96.14	94.45	95.06	95.02	97.02	95.69	96.16
085	90.94	96.30	94.51	95.16	94.55	97.30	95.97	96.43
086	91.49	96.41	94.89	95.45	93.76	97.44	96.25	96.66
089	91.48	97.24	95.15	96.02	94.42	98.42	96.55	97.34
091	89.68	95.63	93.57	94.31	92.07	96.88	95.34	95.86
093	90.85	95.42	93.25	93.92	92.61	96.25	94.65	95.13
097	93.07	97.02	95.22	95.85	95.47	97.91	96.51	96.99
098	91.14	97.07	95.85	96.30	93.62	98.02	97.17	97.48
101	91.40	95.81	94.00	94.64	93.11	96.62	95.32	95.77
104	93.44	96.89	95.12	95.80	95.48	97.86	96.39	96.97

Table 18: Results of team NCC_NEXT for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
106	93.50	96.46	94.30	95.11	95.51	97.34	95.54	96.22
108	94.97	97.55	95.71	96.44	96.57	98.39	97.02	97.56
112	93.41	97.44	95.42	96.23	95.58	98.18	96.58	97.21
113	92.80	96.53	93.95	94.89	94.89	97.37	95.25	96.01
116	88.46	94.93	92.79	93.48	89.97	95.81	93.95	94.54
117	94.02	96.95	95.16	95.77	96.06	98.02	96.50	97.02
121	90.75	96.37	94.28	95.08	94.78	97.22	95.36	96.03
123	92.89	96.50	94.35	95.13	94.58	97.15	95.34	95.99
126	91.30	96.40	94.27	95.05	94.77	97.35	95.41	96.09
129	90.48	96.14	93.44	94.56	93.40	97.26	94.80	95.82
134	87.48	96.08	94.05	94.75	89.74	97.10	95.39	95.98
135	92.59	96.56	94.84	95.47	94.73	97.47	96.17	96.63
138	94.08	95.66	93.25	94.09	96.52	96.72	94.73	95.40
139	94.12	96.78	95.26	95.80	96.67	98.18	97.04	97.45
142	93.62	97.30	94.98	95.89	95.88	98.30	96.28	97.08
145	91.23	96.46	94.90	95.44	93.93	97.66	96.63	96.98
148	91.99	95.96	93.65	94.49	94.22	96.97	95.11	95.81
150	90.16	95.17	93.44	94.05	92.48	96.10	94.95	95.33
Mean	90.95	95.68	93.59	94.30	93.09	96.54	94.81	95.38

Table 19: Results of team NCC_NEXT for task5 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	90.16	95.93	94.58	95.05	91.42	96.78	95.70	96.07
004	93.63	96.83	95.46	95.95	95.99	97.48	96.39	96.77
006	86.85	96.39	94.62	95.26	88.51	97.16	95.66	96.20

Table 19: Results of team NCC_NEXT for task5 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
009	88.50	95.60	94.16	94.67	90.05	96.51	95.47	95.83
012	85.87	94.09	90.75	91.88	87.10	94.44	91.33	92.35
015	87.02	94.10	90.45	91.71	88.79	94.60	91.27	92.39
019	85.79	95.00	92.40	93.35	86.98	95.58	93.18	94.05
020	90.43	95.29	93.04	93.78	92.05	95.99	94.06	94.66
022	89.67	95.05	92.84	93.62	91.47	95.73	93.86	94.50
023	92.20	96.61	94.39	95.23	93.70	97.32	95.35	96.07
029	93.08	95.80	93.38	94.23	94.91	96.42	94.43	95.10
030	86.05	94.31	90.12	91.52	87.22	94.74	90.84	92.11
031	92.95	96.00	93.72	94.60	94.22	96.58	94.54	95.34
032	88.42	94.68	91.94	92.82	90.91	95.45	93.16	93.86
036	92.71	95.62	92.63	93.65	94.46	96.49	93.79	94.70
040	92.57	95.33	92.69	93.58	94.15	95.99	93.73	94.47
043	92.36	95.69	93.97	94.58	94.17	96.54	95.14	95.62
044	94.91	96.78	95.41	95.90	96.44	97.60	96.57	96.95
046	91.59	95.04	92.54	93.34	93.63	95.95	93.73	94.44
049	91.72	95.36	93.29	94.02	94.37	96.45	94.77	95.34
053	92.43	95.39	92.86	93.60	94.33	96.44	94.34	94.97
054	76.83	83.17	82.08	81.52	79.50	84.12	83.39	82.69
056	93.36	96.52	93.69	94.58	95.29	97.17	94.73	95.47
059	92.79	96.60	94.41	95.24	94.99	97.34	95.45	96.15
063	93.09	95.73	93.71	94.28	95.23	96.62	95.09	95.49
064	90.57	95.16	93.45	93.93	92.15	95.70	94.38	94.70
069	91.28	95.43	93.03	93.82	93.77	96.27	94.17	94.84
070	91.09	96.12	94.58	95.10	93.62	96.92	95.69	96.09
072	92.20	96.67	94.59	95.35	94.15	97.48	95.97	96.52

Table 19: Results of team NCC_NEXT for task5 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
073	88.94	94.99	93.26	93.82	92.79	95.74	94.42	94.81
077	89.48	96.97	95.35	95.99	92.22	97.90	96.58	97.10
079	84.20	87.59	86.61	86.49	86.12	88.65	87.97	87.74
083	92.35	95.42	93.71	94.30	94.41	96.27	94.92	95.38
085	91.07	96.46	94.65	95.30	94.64	97.40	96.07	96.52
086	91.86	96.69	95.23	95.79	93.99	97.58	96.47	96.88
089	91.71	97.51	95.43	96.30	94.56	98.59	96.73	97.52
091	90.16	96.08	94.03	94.77	92.44	97.22	95.69	96.22
093	90.69	95.26	93.14	93.84	92.48	96.15	94.60	95.08
097	93.07	97.03	95.23	95.86	95.41	97.86	96.45	96.93
098	91.25	97.19	96.01	96.46	93.77	98.20	97.39	97.69
101	91.34	95.81	93.99	94.64	93.11	96.67	95.35	95.80
104	93.25	96.68	94.89	95.58	95.22	97.61	96.13	96.71
106	93.64	96.59	94.47	95.29	95.49	97.35	95.59	96.28
108	95.20	97.78	95.94	96.67	96.76	98.58	97.21	97.76
112	93.35	97.41	95.38	96.20	95.61	98.23	96.63	97.26
113	92.68	96.43	93.81	94.77	94.75	97.26	95.10	95.88
116	88.81	95.50	93.79	94.42	90.22	96.32	94.89	95.42
117	94.05	96.93	95.13	95.74	96.01	97.95	96.43	96.95
121	90.70	96.35	94.26	95.06	94.69	97.14	95.28	95.95
123	93.18	96.69	94.53	95.31	94.92	97.34	95.53	96.18
126	91.15	96.36	94.24	95.02	94.54	97.23	95.30	95.98
129	90.64	96.25	93.55	94.68	93.60	97.39	94.92	95.93
134	87.93	96.46	94.45	95.16	90.18	97.47	95.79	96.38
135	92.83	96.76	95.05	95.69	94.89	97.59	96.31	96.77
138	94.14	95.72	93.35	94.20	96.58	96.75	94.83	95.52

Table 19: Results of team NCC_NEXT for task5 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
139	94.01	96.66	95.13	95.67	96.55	98.07	96.93	97.33
142	93.36	97.11	94.76	95.67	95.52	98.02	95.97	96.77
145	90.73	96.02	94.41	94.96	93.36	97.13	96.05	96.41
148	91.95	95.72	93.34	94.18	94.22	96.75	94.83	95.53
150	90.12	95.07	93.30	93.90	92.50	96.03	94.88	95.25
Mean	90.97	95.66	93.59	94.30	93.09	96.51	94.79	95.36

C.6 SK

Table 20: Results of team SK for task1 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	88.23	96.50	96.05	96.15	91.08	97.48	97.03	97.14
004	87.26	96.84	96.50	96.59	88.82	97.63	97.32	97.39
006	86.00	96.50	95.93	96.12	89.57	97.39	96.97	97.10
009	88.79	95.59	94.81	94.98	90.59	96.51	95.81	95.94
012	85.68	95.48	95.12	95.23	88.50	96.40	96.07	96.16
015	83.33	94.83	93.33	93.75	86.11	95.51	94.12	94.49
019	83.06	94.07	93.14	93.23	84.37	94.80	93.97	94.01
020	87.88	96.31	96.08	96.10	90.35	97.05	96.86	96.85
022	90.48	96.46	95.53	95.78	93.12	97.24	96.46	96.65
023	92.92	96.51	95.84	96.04	94.40	97.30	96.75	96.91
029	89.63	96.08	95.06	95.34	91.83	97.03	96.20	96.41
030	86.15	94.17	93.20	93.41	87.79	94.87	94.09	94.22
031	85.89	95.10	94.67	94.76	87.72	95.84	95.50	95.57
032	84.13	95.35	94.45	94.62	86.12	96.26	95.60	95.68
036	95.95	97.24	96.71	96.88	97.55	98.28	97.81	97.95

Table 20: Results of team SK for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
040	87.44	95.88	94.92	95.15	90.62	96.64	95.77	95.97
043	89.44	96.23	95.88	95.94	91.83	97.40	97.07	97.14
044	95.74	97.71	97.38	97.48	98.04	98.72	98.44	98.53
046	86.24	94.56	93.77	93.86	89.27	95.59	94.80	94.88
049	90.23	96.61	96.32	96.36	92.75	97.67	97.50	97.49
053	84.89	94.58	94.21	94.25	87.26	95.60	95.22	95.23
054	73.46	85.05	84.58	83.95	75.15	85.81	85.38	84.72
056	86.71	95.43	94.76	94.89	90.11	96.55	95.91	96.03
059	91.51	96.80	96.22	96.41	94.53	97.61	97.13	97.27
063	84.86	94.99	93.73	94.02	88.20	96.24	95.12	95.36
064	82.45	92.69	92.25	92.34	85.20	93.47	93.13	93.16
069	87.42	93.88	93.50	93.38	90.92	95.15	94.80	94.64
070	88.13	96.25	95.58	95.83	92.68	97.63	97.06	97.26
072	88.88	96.07	94.81	95.20	91.55	97.20	96.09	96.41
073	87.29	95.30	94.35	94.58	90.05	96.40	95.69	95.82
077	86.56	96.61	95.86	96.09	89.50	97.60	96.93	97.12
079	78.57	86.11	86.17	85.58	83.30	87.30	87.33	86.76
083	86.69	95.01	94.54	94.57	89.81	96.19	95.73	95.76
085	87.70	96.25	96.02	96.07	89.88	97.34	97.20	97.22
086	87.50	96.81	96.40	96.48	89.90	97.88	97.50	97.56
089	88.30	96.64	95.47	95.94	91.98	97.68	96.69	97.08
091	88.53	96.47	96.02	96.16	92.29	98.00	97.69	97.77
093	88.29	95.20	94.50	94.62	92.32	96.50	95.98	96.03
097	88.20	96.54	95.80	96.01	91.43	97.81	97.26	97.39
098	91.31	97.70	97.32	97.47	94.29	98.84	98.57	98.65
101	86.11	96.19	95.58	95.69	88.88	97.11	96.58	96.64

Table 20: Results of team SK for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
104	94.77	97.11	96.59	96.76	97.20	98.21	97.82	97.94
106	90.67	96.68	96.40	96.45	94.84	97.94	97.73	97.77
108	92.69	97.10	96.29	96.55	96.05	98.05	97.44	97.60
112	89.37	96.71	96.12	96.27	91.92	97.57	97.15	97.23
113	91.37	96.71	96.09	96.30	94.58	97.64	97.19	97.32
116	86.29	94.48	94.41	94.27	88.93	95.89	95.80	95.69
117	91.27	97.04	96.54	96.69	94.56	98.57	98.26	98.31
121	86.57	96.54	94.84	95.41	88.90	97.39	95.88	96.34
123	92.19	96.85	95.44	95.93	93.85	97.60	96.37	96.80
126	84.55	96.19	95.34	95.61	87.99	97.54	96.88	97.08
129	91.36	96.43	95.52	95.86	93.80	97.36	96.53	96.84
134	87.56	96.74	96.04	96.29	90.66	97.93	97.43	97.58
135	89.76	97.10	96.87	96.92	92.51	98.38	98.19	98.21
138	86.13	93.10	92.32	92.46	89.28	94.31	93.64	93.74
139	89.39	95.56	95.13	95.14	92.65	97.20	96.84	96.86
142	92.75	97.23	96.60	96.85	95.75	98.40	97.89	98.09
145	86.44	94.50	94.22	94.14	88.72	95.58	95.44	95.31
148	90.40	96.25	95.66	95.82	92.55	97.21	96.75	96.86
150	88.39	95.09	93.99	94.22	91.67	96.35	95.24	95.46
Mean	88.00	95.60	94.95	95.09	90.77	96.64	96.09	96.19

Table 21: Results of team SK for task2 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	87.85	96.24	96.04	96.04	89.37	97.07	97.02	96.95
004	87.69	96.73	96.18	96.25	89.02	97.41	96.97	97.00

Table 21: Results of team SK for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
006	87.35	97.42	97.06	97.17	89.03	98.31	98.08	98.15
009	89.21	96.38	96.42	96.28	91.05	97.22	97.41	97.21
012	78.89	90.14	89.49	89.27	80.61	90.74	90.22	89.95
015	81.24	92.63	89.98	88.80	82.72	93.05	90.62	89.36
019	79.12	90.98	89.31	89.35	80.50	91.55	90.00	89.97
020	88.56	96.30	96.31	96.24	90.45	97.00	97.18	97.04
022	86.88	95.59	95.28	95.32	88.39	96.40	96.22	96.22
023	92.10	97.17	96.84	96.91	94.07	98.05	97.95	97.95
029	88.65	94.97	93.27	93.52	90.53	95.79	94.53	94.63
030	83.12	91.92	89.90	89.90	84.42	92.52	90.72	90.63
031	86.24	95.61	94.88	95.03	88.26	96.50	95.91	96.01
032	76.25	85.04	84.24	82.60	77.81	85.85	85.32	83.56
036	90.22	94.47	92.79	92.70	91.88	95.50	94.11	93.91
040	87.17	94.84	93.66	93.84	88.92	95.63	94.71	94.80
043	88.56	96.12	95.80	95.78	90.26	97.03	96.90	96.81
044	91.17	96.93	96.61	96.67	92.87	98.00	97.92	97.90
046	86.63	94.62	94.32	94.17	88.85	95.62	95.39	95.20
049	87.55	96.06	96.09	95.97	89.45	97.09	97.34	97.14
053	85.66	95.75	95.61	95.38	87.81	96.64	96.59	96.34
054	69.98	78.68	78.95	78.05	72.19	79.54	80.08	79.08
056	90.83	97.31	96.97	97.04	92.80	98.15	98.00	98.00
059	95.29	98.31	97.96	98.08	97.73	99.24	99.14	99.18
063	86.74	95.35	94.17	94.02	88.92	96.46	95.49	95.27
064	83.24	90.85	88.49	87.33	85.25	91.68	89.47	88.22
069	89.47	96.13	95.98	95.89	91.91	97.18	97.20	97.06
070	88.51	96.00	95.74	95.78	91.12	97.04	96.89	96.87

Table 21: Results of team SK for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
072	91.09	97.51	97.07	97.23	93.15	98.49	98.24	98.31
073	89.05	96.35	95.34	95.34	91.62	97.30	96.45	96.40
077	88.42	97.46	97.42	97.40	90.72	98.50	98.58	98.52
079	74.50	85.07	85.07	83.74	76.49	86.28	86.30	84.96
083	89.87	95.67	95.48	95.46	91.92	96.62	96.53	96.47
085	86.94	96.75	96.84	96.77	88.94	97.77	98.03	97.89
086	75.02	88.02	89.90	88.59	76.67	89.07	91.12	89.74
089	90.62	97.33	97.13	97.18	92.74	98.16	98.07	98.08
091	90.11	96.77	96.39	96.47	93.78	98.17	98.03	98.02
093	87.93	96.63	96.47	96.43	90.78	97.89	98.02	97.89
097	90.76	97.60	97.43	97.44	93.35	98.64	98.60	98.59
098	92.42	97.87	97.77	97.78	94.71	99.00	99.05	99.01
101	87.13	96.87	96.62	96.66	89.30	97.87	97.88	97.82
104	93.50	96.19	95.80	95.86	95.72	97.23	96.96	96.99
106	90.72	96.73	96.36	96.45	92.20	97.53	97.34	97.37
108	94.73	97.80	97.31	97.47	96.89	98.64	98.35	98.44
112	90.74	97.81	97.45	97.58	94.09	98.86	98.70	98.75
113	86.81	96.61	96.17	96.29	88.82	97.40	97.25	97.25
116	84.65	93.73	92.27	92.41	86.43	94.62	93.33	93.42
117	90.81	96.92	96.47	96.57	93.46	98.00	97.76	97.78
121	84.55	96.07	95.45	95.66	87.48	97.00	96.51	96.64
123	93.94	96.28	95.38	95.60	95.88	97.06	96.38	96.52
126	84.75	95.92	95.19	95.42	88.39	97.12	96.54	96.69
129	92.28	96.73	95.97	96.24	95.76	97.92	97.35	97.52
134	85.56	96.03	95.52	95.63	87.56	96.94	96.70	96.71
135	91.46	97.19	96.77	96.89	93.48	98.17	98.01	98.02

Table 21: Results of team SK for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
138	87.45	96.44	95.94	96.06	89.48	97.50	97.27	97.30
139	90.91	96.84	96.59	96.66	93.03	98.07	97.97	97.99
142	90.94	96.53	95.86	95.97	93.70	97.60	97.12	97.15
145	86.69	95.93	96.00	95.89	89.67	97.14	97.37	97.19
148	91.53	96.85	96.55	96.59	93.47	98.02	97.95	97.92
150	91.14	96.44	96.48	96.35	93.70	97.39	97.62	97.43
Mean	87.52	95.19	94.68	94.59	89.66	96.14	95.81	95.65

Table 22: Results of team SK for task3 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	86.19	95.29	94.73	94.92	88.85	96.33	95.95	96.06
004	85.50	95.64	95.20	95.34	87.61	96.52	96.17	96.28
006	87.45	95.99	94.92	95.24	89.77	96.96	96.05	96.32
009	85.56	94.96	94.14	94.29	87.55	95.97	95.25	95.37
012	82.77	94.46	93.00	93.52	85.43	95.23	93.88	94.35
015	81.81	93.98	91.42	92.29	84.35	94.63	92.27	93.04
019	85.39	94.23	92.65	92.95	87.67	95.06	93.58	93.84
020	88.13	95.26	94.77	94.90	91.33	96.46	96.16	96.20
022	87.39	94.63	93.39	93.77	89.42	95.58	94.49	94.81
023	88.82	95.23	93.90	94.35	90.96	96.20	94.94	95.34
029	87.98	95.25	93.78	94.30	91.03	96.39	95.20	95.60
030	85.30	93.45	91.34	91.85	87.49	94.30	92.31	92.78
031	85.00	94.56	93.90	94.11	87.01	95.52	94.92	95.11
032	82.69	93.37	92.57	92.71	84.78	94.33	93.69	93.76
036	91.04	96.31	95.34	95.64	92.70	97.35	96.58	96.82

Table 22: Results of team SK for task3 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
040	86.02	94.61	92.70	93.23	88.19	95.52	93.73	94.22
043	87.86	95.44	95.02	95.06	90.09	96.59	96.38	96.36
044	88.40	95.83	95.00	95.25	90.60	97.00	96.31	96.50
046	84.39	93.25	92.43	92.48	87.10	94.53	93.84	93.87
049	85.87	94.99	94.27	94.37	87.90	95.84	95.30	95.34
053	82.90	93.27	92.48	92.62	84.96	94.25	93.54	93.65
054	68.62	82.45	81.41	80.90	70.64	83.48	82.52	81.98
056	86.08	94.53	93.97	93.94	89.27	95.45	94.97	94.92
059	88.67	95.06	93.79	94.14	91.25	95.95	94.83	95.12
063	84.22	93.30	92.07	92.31	86.24	94.33	93.26	93.42
064	83.55	92.88	92.75	92.67	86.34	93.75	93.74	93.60
069	85.86	92.91	91.01	91.54	88.72	93.92	92.28	92.68
070	87.66	95.50	94.89	95.07	90.35	96.65	96.23	96.34
072	86.17	95.34	93.81	94.38	88.43	96.30	94.98	95.44
073	85.51	93.33	91.69	92.05	88.63	94.45	93.11	93.34
077	86.16	95.64	95.03	95.21	88.55	96.75	96.33	96.43
079	71.46	82.83	82.53	81.93	73.33	84.03	83.71	83.11
083	84.56	94.23	93.73	93.88	87.02	95.16	94.73	94.84
085	85.24	95.55	94.96	95.14	88.71	96.88	96.43	96.57
086	85.29	94.88	94.03	94.24	87.13	95.75	95.14	95.25
089	86.39	95.66	94.36	94.88	90.34	96.63	95.57	95.97
091	85.73	95.08	94.10	94.45	89.58	96.39	95.58	95.84
093	84.39	94.05	93.06	93.37	87.62	95.56	95.03	95.15
097	86.76	95.87	94.56	95.03	89.75	97.17	96.14	96.51
098	90.00	96.41	95.61	95.91	94.96	98.12	97.55	97.75
101	85.86	95.28	94.80	94.90	88.75	96.42	96.16	96.19

Table 22: Results of team SK for task3 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
104	89.61	94.71	92.67	93.32	92.74	96.18	94.22	94.80
106	89.28	95.60	94.97	95.14	92.35	96.84	96.41	96.50
108	93.06	97.12	96.54	96.75	96.04	98.30	97.91	98.05
112	87.69	95.80	94.95	95.25	91.37	97.00	96.42	96.60
113	87.66	95.44	93.52	94.23	90.41	96.48	94.81	95.42
116	84.99	94.36	93.91	93.93	88.32	95.75	95.37	95.39
117	89.31	95.74	95.00	95.21	92.57	97.14	96.69	96.77
121	83.93	94.94	93.08	93.69	85.42	95.66	93.92	94.47
123	89.34	95.90	93.94	94.60	90.89	96.60	94.90	95.47
126	84.25	95.72	94.33	94.77	87.74	96.85	95.80	96.12
129	89.85	95.19	93.92	94.27	93.43	96.69	95.66	95.94
134	89.71	96.20	95.47	95.71	92.33	97.60	97.04	97.22
135	88.73	95.73	95.15	95.31	92.13	97.18	96.69	96.79
138	74.64	91.69	90.05	89.81	77.53	92.84	91.37	91.06
139	79.36	89.53	90.37	89.74	83.12	91.31	92.29	91.64
142	90.38	94.84	93.69	93.93	94.12	96.34	95.38	95.56
145	84.82	93.98	93.73	93.62	88.28	95.61	95.38	95.28
148	88.82	95.33	94.44	94.73	91.44	96.52	95.72	95.97
150	86.89	93.72	92.66	92.95	89.72	94.78	93.83	94.06
Mean	85.78	94.37	93.36	93.60	88.51	95.49	94.64	94.82

Table 23: Results of team SK for task4 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	89.94	97.50	97.44	97.42	92.04	98.32	98.28	98.24
004	88.41	97.88	97.93	97.88	90.29	98.67	98.75	98.70

Table 23: Results of team SK for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
006	86.98	97.58	97.52	97.52	88.61	98.39	98.38	98.35
009	90.25	96.76	96.64	96.56	92.09	97.72	97.56	97.49
012	86.17	95.75	95.83	95.72	87.51	96.34	96.46	96.34
015	83.86	94.87	94.19	94.14	85.32	95.40	94.91	94.79
019	83.42	95.05	94.18	94.22	84.53	95.78	94.95	94.95
020	88.26	96.73	96.74	96.66	91.33	97.59	97.64	97.55
022	89.88	97.21	96.99	97.01	91.94	98.01	97.86	97.87
023	94.16	97.41	97.19	97.25	95.71	98.20	98.08	98.11
029	91.37	96.84	96.51	96.57	93.53	97.85	97.69	97.69
030	86.45	94.31	93.35	93.40	87.55	94.85	93.96	93.96
031	87.83	96.37	96.18	96.17	89.87	97.23	97.10	97.08
032	84.54	95.36	95.15	95.07	86.17	96.20	96.16	96.02
036	93.20	97.51	97.23	97.32	94.42	98.36	98.16	98.22
040	88.52	96.15	95.62	95.71	89.66	96.75	96.32	96.37
043	90.31	97.08	96.95	96.92	91.97	97.92	97.85	97.81
044	92.77	97.66	97.50	97.53	96.28	98.78	98.66	98.69
046	87.48	95.75	95.08	95.04	89.60	96.66	96.03	95.99
049	91.25	97.23	97.14	97.12	92.85	98.17	98.12	98.08
053	87.45	96.69	96.70	96.56	89.23	97.55	97.49	97.36
054	73.79	85.76	84.96	84.00	75.59	86.56	85.84	84.86
056	89.11	96.84	96.63	96.61	91.98	97.86	97.67	97.65
059	93.91	98.32	98.15	98.20	96.41	99.12	99.05	99.06
063	87.12	96.11	95.68	95.61	89.70	97.23	96.91	96.84
064	85.75	94.78	94.97	94.77	88.39	95.71	96.00	95.75
069	88.68	95.06	95.05	94.84	92.22	96.20	96.19	95.99
070	88.75	96.76	96.78	96.70	92.04	98.02	98.08	98.00

Table 23: Results of team SK for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
072	91.38	97.69	97.10	97.30	93.96	98.65	98.24	98.35
073	89.67	96.95	96.77	96.74	92.03	97.98	97.84	97.80
077	88.11	97.74	97.67	97.67	90.41	98.68	98.67	98.65
079	81.01	89.75	89.13	88.60	85.19	90.81	90.08	89.61
083	90.04	96.76	96.84	96.75	92.06	97.78	97.89	97.79
085	88.75	97.08	97.03	97.02	90.49	97.94	97.95	97.92
086	87.95	97.25	97.32	97.22	89.80	98.14	98.26	98.15
089	90.50	97.55	97.25	97.36	93.01	98.53	98.28	98.37
091	91.27	97.79	97.80	97.78	94.54	99.26	99.30	99.28
093	88.30	96.73	96.59	96.48	91.24	98.02	98.01	97.88
097	90.90	97.83	97.81	97.75	93.98	98.97	99.02	98.97
098	92.84	98.28	98.31	98.29	95.11	99.26	99.32	99.28
101	87.39	96.87	96.59	96.55	89.78	97.81	97.62	97.56
104	95.86	97.86	97.75	97.78	98.23	98.95	98.91	98.92
106	90.84	97.15	97.03	97.03	93.03	98.22	98.15	98.14
108	94.79	98.00	97.69	97.78	97.92	99.00	98.88	98.90
112	91.02	97.79	97.61	97.65	93.94	98.84	98.75	98.75
113	92.21	97.60	97.32	97.39	95.28	98.49	98.37	98.39
116	86.46	95.21	95.71	95.38	88.22	96.34	96.77	96.46
117	92.74	97.93	97.64	97.67	95.34	99.09	98.92	98.91
121	86.51	96.93	96.47	96.59	89.66	97.93	97.60	97.67
123	95.32	98.00	97.63	97.75	97.46	98.87	98.62	98.69
126	85.88	96.86	96.67	96.72	88.71	98.10	98.01	98.01
129	92.75	97.09	96.65	96.82	95.32	98.12	97.75	97.89
134	87.82	97.26	96.91	97.02	90.74	98.34	98.19	98.23
135	90.71	97.69	97.66	97.64	92.92	98.68	98.75	98.69

Table 23: Results of team SK for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
138	87.39	95.81	95.45	95.50	90.32	96.87	96.58	96.61
139	91.66	97.39	97.40	97.36	94.45	98.88	98.91	98.89
142	94.45	97.98	97.71	97.81	97.44	99.11	98.89	98.97
145	88.33	96.22	96.49	96.28	91.31	97.37	97.73	97.51
148	92.55	97.57	97.50	97.51	94.72	98.63	98.61	98.61
150	90.72	96.21	96.06	95.94	93.31	97.20	97.15	97.01
Mean	89.26	96.60	96.40	96.36	91.61	97.57	97.44	97.38

Table 24: Results of team SK for task5 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	89.78	97.61	97.61	97.56	92.14	98.62	98.67	98.61
004	88.65	97.68	97.65	97.63	90.39	98.51	98.52	98.49
006	86.69	97.16	96.90	96.94	88.74	98.16	98.00	98.01
009	88.84	96.50	96.32	96.25	90.34	97.44	97.30	97.19
012	85.75	96.08	96.14	96.04	87.54	96.78	96.91	96.78
015	84.69	95.61	94.81	94.95	86.48	96.12	95.47	95.56
019	84.41	95.39	94.40	94.45	85.82	96.18	95.23	95.25
020	89.76	96.97	96.94	96.89	91.95	97.74	97.81	97.72
022	91.44	97.24	96.96	97.02	93.43	98.05	97.89	97.90
023	94.92	97.28	96.90	97.01	96.35	97.95	97.71	97.78
029	91.62	96.87	96.25	96.42	93.82	97.87	97.50	97.59
030	86.55	94.80	94.05	94.10	87.58	95.42	94.81	94.81
031	87.78	96.68	96.50	96.51	89.59	97.60	97.48	97.47
032	85.94	95.95	95.55	95.57	87.68	96.80	96.61	96.55
036	93.34	97.57	97.28	97.37	94.51	98.64	98.50	98.54

Table 24: Results of team SK for task5 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
040	87.91	96.06	95.21	95.41	89.09	96.77	96.04	96.18
043	90.27	96.92	96.79	96.73	91.79	97.74	97.71	97.63
044	92.13	97.44	97.33	97.33	93.79	98.49	98.47	98.45
046	87.39	95.15	95.12	94.91	89.39	96.08	96.13	95.92
049	88.69	96.86	96.71	96.60	90.54	97.85	97.69	97.53
053	86.01	95.79	95.79	95.65	88.13	96.78	96.74	96.58
054	73.31	85.58	84.83	83.99	75.69	86.62	85.95	85.04
056	88.19	96.10	95.85	95.77	91.31	97.08	96.83	96.74
059	94.33	98.07	97.81	97.88	96.84	98.92	98.77	98.81
063	86.61	95.72	95.57	95.44	88.95	96.95	96.90	96.73
064	86.28	94.97	95.35	95.08	88.04	95.69	96.14	95.85
069	89.01	94.98	94.86	94.74	92.27	96.08	96.03	95.87
070	89.24	96.72	96.57	96.58	92.44	97.98	97.89	97.89
072	90.42	97.22	96.47	96.73	92.52	98.09	97.53	97.69
073	89.66	96.21	95.71	95.79	92.00	97.20	96.88	96.90
077	88.40	97.28	97.19	97.18	90.54	98.23	98.23	98.19
079	77.76	87.19	87.50	86.54	79.28	88.13	88.40	87.45
083	88.63	96.13	96.14	96.07	91.51	97.22	97.28	97.19
085	87.48	96.76	96.73	96.68	90.14	97.95	97.97	97.88
086	87.98	97.21	97.06	97.01	90.45	98.24	98.11	98.07
089	89.44	97.28	96.67	96.91	92.70	98.34	97.83	98.02
091	90.60	97.28	97.17	97.19	93.83	98.84	98.82	98.81
093	87.86	96.02	95.91	95.88	90.41	97.25	97.38	97.26
097	90.95	97.53	97.35	97.38	93.88	98.69	98.65	98.64
098	92.13	98.06	97.96	97.99	94.77	99.22	99.23	99.22
101	87.74	96.91	96.73	96.69	89.88	97.84	97.78	97.70

Table 24: Results of team SK for task5 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
104	95.68	97.58	97.34	97.41	97.67	98.53	98.39	98.43
106	91.41	97.28	97.14	97.15	93.58	98.28	98.22	98.21
108	95.71	98.31	98.02	98.12	98.46	99.20	99.07	99.10
112	90.34	97.48	97.21	97.29	93.56	98.53	98.41	98.42
113	90.41	97.22	96.80	96.93	92.43	98.09	97.89	97.93
116	86.86	95.42	95.88	95.59	88.93	96.58	97.03	96.76
117	91.68	97.35	97.37	97.31	94.36	98.61	98.75	98.65
121	86.89	96.72	95.88	96.15	89.44	97.64	96.98	97.16
123	94.32	97.69	96.75	97.03	95.64	98.37	97.58	97.81
126	86.80	97.13	96.78	96.86	89.96	98.28	98.09	98.12
129	92.78	96.95	96.30	96.54	95.65	98.06	97.55	97.73
134	88.48	97.48	97.32	97.35	91.64	98.72	98.72	98.68
135	91.23	97.53	97.50	97.49	94.07	98.73	98.77	98.72
138	87.05	96.36	96.15	96.14	89.83	97.51	97.41	97.38
139	91.53	97.34	97.25	97.23	94.69	98.89	98.90	98.89
142	94.67	97.89	97.52	97.65	97.34	99.04	98.78	98.87
145	87.49	96.15	96.25	96.05	90.59	97.27	97.47	97.28
148	92.47	97.36	97.09	97.17	94.59	98.38	98.23	98.27
150	90.49	96.07	95.79	95.76	93.26	97.24	97.06	97.00
Mean	89.08	96.44	96.18	96.17	91.37	97.43	97.28	97.23

C.6 MediCIS

Table 25: Results of team MedicIS for task1 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	85.61	96.36	96.54	96.41	88.70	97.51	97.70	97.57
004	86.52	96.93	96.93	96.84	88.88	97.81	97.79	97.72
006	84.20	96.57	96.47	96.47	86.25	97.51	97.39	97.40
009	86.84	95.98	96.09	95.92	89.00	96.98	97.13	96.94
012	84.08	95.23	95.33	95.21	86.69	95.95	96.06	95.94
015	83.74	95.62	95.12	95.14	86.20	96.24	95.86	95.83
019	78.48	88.99	87.36	87.19	80.06	89.77	88.16	87.98
020	87.04	97.06	96.98	96.95	90.21	98.05	97.97	97.93
022	84.70	94.54	93.86	93.80	86.17	95.23	94.61	94.53
023	90.44	97.09	96.86	96.89	94.26	98.00	97.82	97.84
029	87.72	96.49	96.02	96.13	90.93	97.49	97.12	97.20
030	83.82	94.61	94.53	94.40	85.67	95.33	95.37	95.21
031	84.62	94.31	93.32	93.30	86.13	94.96	93.99	93.97
032	83.67	94.95	94.66	94.61	85.61	95.85	95.65	95.55
036	88.58	95.39	94.20	94.17	90.74	96.46	95.31	95.27
040	86.86	96.38	96.23	96.19	89.18	97.23	97.11	97.04
043	86.73	96.18	96.16	95.85	88.92	97.04	97.02	96.72
044	91.76	97.20	97.14	97.13	95.25	98.43	98.36	98.35
046	86.03	95.57	95.80	95.48	88.60	96.60	96.83	96.53
049	87.30	96.79	96.78	96.63	90.67	97.98	97.92	97.80
053	82.14	94.40	94.63	94.33	84.17	95.21	95.45	95.17
054	77.56	88.96	88.37	87.15	81.62	90.12	89.34	88.15
056	89.07	96.51	96.47	96.39	91.67	97.35	97.28	97.24
059	91.62	97.73	97.52	97.58	95.38	98.74	98.62	98.65
063	85.08	95.11	95.37	95.15	87.31	96.06	96.30	96.10
064	78.05	88.50	84.83	84.42	80.66	89.36	85.64	85.25

Table 25: Results of team MediCIS for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
069	86.33	95.03	95.39	95.15	89.18	96.18	96.48	96.28
070	86.81	96.34	96.17	96.06	90.35	97.52	97.32	97.28
072	89.83	97.47	97.37	97.39	92.62	98.39	98.36	98.35
073	89.49	97.24	97.18	97.15	92.41	98.36	98.32	98.31
077	85.84	97.02	97.19	97.02	87.75	98.11	98.20	98.02
079	74.07	85.72	86.88	85.73	76.40	86.73	87.74	86.65
083	84.66	93.93	93.71	93.43	86.99	95.15	94.84	94.61
085	84.06	96.09	96.30	96.11	87.86	97.38	97.56	97.41
086	85.10	96.35	96.45	96.25	87.55	97.41	97.48	97.32
089	89.43	97.67	97.66	97.65	92.08	98.70	98.72	98.70
091	88.22	96.51	96.42	96.43	92.14	97.91	97.84	97.83
093	86.84	96.23	96.37	96.23	89.58	97.34	97.52	97.37
097	87.38	96.62	96.84	96.69	90.27	97.81	97.94	97.82
098	88.86	97.20	97.43	97.23	92.08	98.35	98.45	98.34
101	84.13	96.20	96.52	96.31	86.83	97.15	97.43	97.24
104	93.60	97.12	96.98	96.99	96.10	98.20	98.08	98.09
106	89.56	97.13	97.02	97.02	92.40	98.16	98.06	98.06
108	91.89	97.30	97.04	97.12	95.17	98.39	98.22	98.26
112	89.80	97.42	97.31	97.33	92.18	98.34	98.29	98.28
113	86.14	96.52	96.46	96.36	90.91	97.63	97.47	97.43
116	84.17	93.49	92.98	92.72	86.75	94.84	94.19	94.00
117	90.23	97.01	96.97	96.90	92.92	98.26	98.18	98.09
121	82.61	95.73	95.58	95.52	85.06	96.45	96.39	96.30
123	90.87	96.61	96.41	96.44	93.90	97.63	97.45	97.48
126	82.65	95.66	95.06	95.21	86.44	96.72	96.15	96.28
129	90.80	96.26	96.10	96.11	93.62	97.38	97.21	97.24

Table 25: Results of team MediCIS for task1 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
134	84.04	96.02	96.32	96.03	87.12	97.27	97.41	97.18
135	88.15	96.57	96.60	96.55	90.60	97.59	97.64	97.57
138	85.68	96.46	96.48	96.36	89.47	97.75	97.74	97.68
139	88.21	95.96	96.07	95.83	91.81	97.62	97.64	97.52
142	87.92	96.79	97.02	96.85	91.08	98.08	98.26	98.14
145	84.97	95.53	96.06	95.73	87.92	96.65	97.14	96.84
148	89.94	96.06	95.96	95.91	92.37	97.26	97.19	97.15
150	87.60	95.06	95.29	95.03	89.92	96.09	96.30	96.08
Mean	86.37	95.63	95.49	95.34	89.15	96.67	96.52	96.39

Table 26: Results of team MediCIS for task2 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	85.54	96.05	96.12	96.04	87.60	96.93	96.96	96.90
004	88.48	96.34	95.86	95.94	91.73	97.00	96.45	96.54
006	88.24	96.80	96.44	96.56	93.43	97.89	97.54	97.65
009	86.65	95.47	95.41	95.32	88.52	96.29	96.30	96.17
012	82.99	94.40	93.57	93.83	84.84	95.06	94.32	94.53
015	78.54	89.23	87.77	87.52	81.42	89.87	88.49	88.20
019	77.73	87.63	86.82	86.92	79.43	88.34	87.62	87.67
020	87.50	96.64	96.44	96.51	89.97	97.51	97.33	97.39
022	85.70	95.18	95.09	95.06	88.74	96.30	96.17	96.15
023	90.55	96.29	95.93	96.05	92.77	97.15	96.83	96.92
029	89.01	96.25	95.94	96.04	91.41	97.04	96.80	96.86
030	80.90	91.93	91.73	91.57	82.58	92.58	92.38	92.21
031	85.30	94.15	92.85	93.14	86.77	94.84	93.70	93.93

Table 26: Results of team MediCIS for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
032	86.59	95.38	94.82	94.74	89.01	96.36	95.82	95.73
036	87.35	93.35	91.14	91.31	89.71	94.56	92.47	92.58
040	92.05	95.58	94.53	94.82	94.55	96.45	95.58	95.79
043	86.23	95.10	94.33	94.07	88.44	96.12	95.47	95.16
044	90.52	96.63	96.19	96.32	92.05	97.65	97.31	97.41
046	85.04	93.91	93.67	93.63	87.87	95.15	94.94	94.87
049	87.32	95.89	95.73	95.66	89.70	97.10	96.78	96.71
053	84.29	94.98	94.78	94.67	88.61	95.77	95.62	95.51
054	75.41	86.23	84.91	83.91	79.43	87.45	86.12	85.14
056	89.98	96.41	95.88	96.08	93.48	97.47	97.02	97.18
059	94.55	97.83	97.40	97.56	96.84	98.88	98.62	98.72
063	87.54	95.42	95.33	95.32	90.06	96.38	96.34	96.30
064	80.78	90.29	88.24	88.56	83.67	91.29	89.26	89.57
069	84.72	94.54	94.75	94.59	87.98	95.79	95.98	95.84
070	85.87	94.58	94.08	94.19	88.20	95.65	95.21	95.28
072	91.28	97.15	96.74	96.89	94.13	98.28	97.99	98.08
073	88.45	96.67	96.29	96.43	91.26	97.59	97.23	97.36
077	86.83	96.93	96.74	96.78	89.41	98.14	97.96	98.00
079	79.20	90.20	90.53	89.96	82.75	91.74	91.81	91.34
083	82.67	90.75	90.25	90.29	85.83	91.81	91.26	91.33
085	84.98	96.44	96.44	96.38	87.44	97.47	97.50	97.44
086	84.28	96.22	96.39	96.21	86.70	97.28	97.44	97.28
089	89.67	96.92	96.44	96.59	92.74	97.87	97.50	97.61
091	88.89	97.44	97.19	97.27	93.91	99.10	98.77	98.92
093	86.34	96.31	96.31	96.26	89.51	97.53	97.54	97.49
097	90.50	97.22	96.86	96.90	93.44	98.39	98.10	98.14

Table 26: Results of team MediCIS for task2 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
098	91.79	97.39	97.37	97.32	95.45	98.53	98.48	98.47
101	86.97	96.60	96.42	96.45	92.08	97.72	97.62	97.63
104	93.48	97.06	96.95	96.97	96.39	98.17	98.06	98.10
106	88.35	96.27	96.02	96.01	91.05	97.37	97.09	97.11
108	92.43	97.37	96.78	97.00	95.17	98.34	97.86	98.04
112	88.55	97.07	96.73	96.87	91.91	98.03	97.77	97.87
113	87.19	96.47	96.09	96.20	90.66	97.54	97.23	97.31
116	79.45	90.01	87.95	87.99	81.80	91.14	89.01	89.09
117	91.17	96.85	96.51	96.59	94.28	98.05	97.72	97.80
121	84.42	95.99	95.61	95.72	87.93	97.07	96.75	96.84
123	90.84	95.87	95.45	95.57	94.00	96.86	96.42	96.53
126	83.74	95.78	95.19	95.36	87.19	96.85	96.40	96.52
129	90.32	96.11	95.60	95.80	93.27	97.30	96.87	97.04
134	83.97	95.55	95.38	95.44	87.59	96.85	96.66	96.72
135	88.58	96.78	96.60	96.64	92.49	98.02	97.86	97.88
138	85.23	96.21	95.98	96.03	88.53	97.49	97.32	97.35
139	88.50	96.45	96.37	96.31	93.19	97.79	97.67	97.67
142	87.59	96.48	96.38	96.38	90.83	97.70	97.65	97.65
145	85.42	95.98	96.19	96.01	89.30	97.19	97.35	97.19
148	89.57	96.01	95.76	95.81	91.59	97.05	96.81	96.86
150	89.01	95.34	95.33	95.18	92.14	96.69	96.72	96.57
Mean	86.75	95.21	94.78	94.79	89.71	96.26	95.86	95.87

Table 27: Results of team MediCIS for task3 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	86.78	95.85	95.75	95.75	89.59	96.89	96.75	96.75
004	82.49	95.00	94.84	94.84	83.94	95.63	95.49	95.48
006	84.63	95.81	95.52	95.60	87.92	96.84	96.59	96.64
009	85.60	95.13	95.13	94.99	87.67	96.02	96.06	95.92
012	82.65	95.00	94.46	94.49	84.97	95.73	95.26	95.27
015	81.43	93.90	93.08	93.01	83.03	94.48	93.75	93.63
019	77.07	89.05	87.37	87.43	78.84	89.78	88.16	88.19
020	84.68	95.95	96.01	95.91	87.31	97.04	97.11	97.01
022	83.33	94.44	93.83	93.86	85.23	95.26	94.70	94.70
023	84.65	94.93	94.74	94.64	88.25	95.88	95.73	95.64
029	87.40	94.92	94.42	94.57	91.14	96.06	95.63	95.74
030	81.86	93.82	93.16	93.23	83.96	94.69	93.90	93.96
031	80.28	93.76	93.07	93.02	82.15	94.53	93.85	93.81
032	79.96	93.10	92.40	92.28	82.19	94.30	93.67	93.51
036	84.75	93.00	90.91	91.00	86.96	94.14	92.12	92.18
040	83.27	94.58	93.68	93.88	86.94	95.75	94.93	95.09
043	84.25	95.10	94.90	94.71	87.08	96.07	96.00	95.82
044	87.42	95.82	95.62	95.66	91.23	97.35	97.22	97.22
046	85.03	95.45	94.83	94.68	87.83	96.53	95.89	95.84
049	84.66	95.46	95.66	95.46	87.08	96.60	96.88	96.66
053	80.44	93.12	93.25	92.98	82.08	93.97	94.10	93.82
054	74.84	89.48	87.21	85.98	76.79	90.68	88.35	87.11
056	86.48	95.53	95.70	95.56	90.18	96.56	96.73	96.59
059	90.41	96.84	96.67	96.72	93.99	97.90	97.81	97.83
063	82.41	93.11	92.23	92.12	85.11	94.28	93.44	93.34
064	76.83	87.66	84.63	83.83	79.54	88.42	85.47	84.69

Table 27: Results of team MediCIS for task3 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
069	85.73	94.30	94.25	94.11	89.05	95.41	95.37	95.22
070	84.77	94.92	94.79	94.69	88.01	96.05	95.84	95.80
072	87.72	96.66	96.44	96.51	90.87	97.66	97.53	97.55
073	88.11	96.12	95.51	95.68	90.80	97.10	96.60	96.71
077	83.78	96.08	96.21	96.06	85.70	97.19	97.24	97.09
079	70.48	86.43	85.41	83.80	72.81	87.45	86.26	84.75
083	84.92	94.67	94.90	94.71	88.51	95.94	96.11	95.96
085	83.46	95.87	96.04	95.88	87.30	97.06	97.23	97.08
086	83.04	95.14	95.38	95.20	86.05	96.53	96.67	96.53
089	86.11	96.24	96.30	96.24	89.39	97.45	97.48	97.44
091	87.10	95.57	95.51	95.49	91.00	97.01	96.98	96.96
093	85.63	95.05	94.99	94.92	88.56	96.32	96.40	96.28
097	85.27	95.54	95.31	95.35	88.94	96.98	96.82	96.82
098	86.82	94.97	94.77	94.72	90.92	96.54	96.36	96.35
101	84.71	96.14	96.24	96.14	87.49	97.17	97.28	97.17
104	88.01	94.89	94.83	94.82	91.43	96.35	96.22	96.25
106	86.04	95.97	95.93	95.86	89.88	97.24	97.13	97.10
108	91.10	96.84	96.49	96.55	94.53	97.81	97.56	97.60
112	86.76	95.95	95.69	95.76	89.79	97.14	97.04	97.03
113	82.12	94.92	94.50	94.62	85.20	95.81	95.52	95.58
116	79.16	90.79	90.28	89.85	82.81	92.22	91.39	91.14
117	88.17	96.28	96.27	96.16	91.24	97.41	97.43	97.33
121	81.16	95.17	94.64	94.74	82.80	95.75	95.28	95.36
123	89.30	95.02	93.94	94.14	91.44	95.81	94.86	95.03
126	85.20	95.66	94.97	95.14	88.58	96.65	96.09	96.22
129	87.88	95.04	94.80	94.85	91.05	96.27	96.03	96.06

Table 27: Results of team MediCIS for task3 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
134	82.87	95.33	95.38	95.25	86.79	96.69	96.72	96.60
135	85.43	95.69	95.86	95.70	88.51	96.85	96.93	96.81
138	83.59	95.19	94.64	94.64	86.67	96.45	95.94	95.96
139	85.13	95.06	95.28	94.96	88.68	96.78	96.81	96.59
142	87.12	96.17	96.28	96.17	90.99	97.44	97.47	97.41
145	84.16	94.71	95.05	94.81	88.17	95.99	96.28	96.09
148	86.62	95.00	94.82	94.78	88.86	96.21	95.96	95.94
150	86.47	95.21	95.53	95.21	89.45	96.45	96.76	96.49
Mean	84.29	94.64	94.27	94.16	87.22	95.74	95.39	95.28

Table 28: Results of team MediCIS for task4 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	86.70	96.77	96.76	96.66	88.69	97.57	97.58	97.50
004	87.96	97.33	97.29	97.24	89.89	98.06	98.04	97.99
006	85.25	96.88	96.78	96.78	87.19	97.91	97.79	97.81
009	88.30	96.48	96.61	96.45	89.89	97.30	97.49	97.30
012	84.69	94.33	94.17	94.07	87.03	95.41	94.96	94.88
015	83.18	95.03	93.03	92.81	85.05	95.53	93.58	93.32
019	78.62	88.43	87.80	87.39	80.25	89.07	88.50	88.08
020	87.00	96.80	96.90	96.80	89.27	97.69	97.78	97.67
022	86.50	95.61	95.60	95.53	87.98	96.38	96.37	96.28
023	92.80	97.51	97.44	97.45	95.95	98.42	98.38	98.37
029	89.08	96.46	96.24	96.28	91.86	97.47	97.28	97.31
030	80.00	93.34	92.57	92.55	81.58	94.02	93.34	93.30
031	86.86	96.06	95.19	95.20	88.34	96.78	95.91	95.92

Table 28: Results of team MediCIS for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
032	86.77	95.88	95.69	95.64	88.47	96.73	96.66	96.57
036	90.76	96.15	94.71	94.66	92.74	97.17	95.75	95.69
040	87.36	96.08	95.75	95.74	89.06	96.89	96.58	96.54
043	87.19	96.31	96.12	95.68	89.04	97.02	96.80	96.37
044	92.89	97.58	97.51	97.49	95.52	98.54	98.49	98.48
046	86.68	95.65	95.77	95.52	89.08	96.58	96.70	96.46
049	89.17	97.03	97.04	96.86	91.31	98.09	98.09	97.91
053	83.10	94.65	94.76	94.49	84.94	95.44	95.56	95.31
054	79.94	90.93	91.62	90.95	82.18	91.87	92.55	91.90
056	90.83	97.21	97.14	97.11	94.21	98.22	98.17	98.17
059	92.89	97.81	97.67	97.70	95.75	98.77	98.67	98.69
063	85.77	94.85	95.12	94.86	88.42	96.02	96.29	96.06
064	82.43	91.56	89.80	89.50	85.08	92.44	90.69	90.42
069	88.18	95.73	96.05	95.81	91.38	96.91	97.22	97.01
070	88.33	96.67	96.67	96.57	91.09	97.77	97.80	97.72
072	90.96	97.58	97.45	97.47	93.49	98.45	98.39	98.38
073	90.39	97.66	97.61	97.59	92.97	98.48	98.42	98.41
077	87.72	97.79	97.92	97.82	89.84	98.62	98.73	98.66
079	76.07	86.22	88.08	86.62	78.61	87.23	88.95	87.55
083	87.52	95.41	95.53	95.34	90.10	96.54	96.63	96.47
085	85.88	96.70	96.90	96.74	88.38	97.65	97.88	97.72
086	86.21	96.92	97.14	96.89	88.70	97.85	98.02	97.82
089	89.63	97.63	97.64	97.61	92.90	98.61	98.61	98.59
091	89.32	96.87	96.82	96.81	92.58	98.16	98.14	98.12
093	87.84	96.59	96.73	96.60	92.22	97.91	98.08	97.96
097	90.00	97.19	97.30	97.22	92.64	98.11	98.19	98.12

Table 28: Results of team MediCIS for task4 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
098	90.11	97.74	97.89	97.75	93.23	98.79	98.89	98.83
101	86.07	96.81	97.08	96.91	88.53	97.83	98.08	97.91
104	94.87	97.79	97.79	97.77	97.53	98.82	98.80	98.80
106	90.22	97.25	97.19	97.19	92.67	98.22	98.16	98.16
108	93.88	97.97	97.79	97.84	97.17	99.07	98.94	98.98
112	90.88	97.83	97.74	97.75	93.76	98.86	98.87	98.84
113	87.67	96.66	96.50	96.48	92.80	97.70	97.57	97.56
116	83.89	93.32	92.03	91.75	86.73	94.75	93.36	93.18
117	90.81	97.01	97.23	97.09	93.43	98.19	98.41	98.27
121	83.86	96.06	95.94	95.90	85.82	96.85	96.78	96.72
123	91.09	96.27	96.08	96.05	93.90	97.27	97.08	97.06
126	84.42	96.00	95.66	95.75	87.98	96.97	96.68	96.74
129	91.09	96.73	96.71	96.67	94.39	97.90	97.84	97.82
134	84.59	95.77	96.02	95.80	88.40	97.13	97.30	97.12
135	90.28	97.35	97.44	97.36	92.92	98.33	98.40	98.33
138	86.42	96.41	96.09	96.00	88.89	97.33	97.06	96.99
139	89.58	96.62	96.72	96.56	92.64	98.12	98.21	98.12
142	88.77	97.03	97.27	97.12	91.74	98.08	98.26	98.15
145	86.11	95.89	96.38	96.06	88.87	97.05	97.55	97.24
148	90.83	96.56	96.53	96.48	93.12	97.66	97.64	97.60
150	89.31	95.76	95.88	95.66	92.51	96.89	97.02	96.83
Mean	87.59	96.01	95.91	95.78	90.18	96.99	96.90	96.77

Table 29: Results of team MedicIS for task5 recognition.

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
003	86.27	96.85	96.70	96.63	88.56	97.72	97.55	97.50
004	87.75	97.30	97.20	97.13	89.50	97.97	97.88	97.83
006	85.08	97.10	97.12	97.09	86.76	97.88	97.93	97.89
009	87.84	96.41	96.55	96.36	89.60	97.23	97.44	97.23
012	85.49	95.99	96.23	96.06	88.12	96.95	97.20	97.04
015	82.71	94.94	93.43	93.38	85.10	95.62	94.10	94.03
019	80.90	91.08	89.96	89.71	82.45	91.79	90.68	90.42
020	87.93	97.50	97.52	97.40	90.42	98.33	98.42	98.28
022	85.91	95.69	95.65	95.56	87.44	96.39	96.38	96.27
023	89.81	96.96	96.81	96.78	93.44	97.87	97.72	97.72
029	89.90	97.15	97.00	97.04	92.86	98.27	98.20	98.20
030	83.69	94.52	94.12	93.99	85.45	95.25	94.91	94.76
031	86.16	95.88	95.22	95.19	87.92	96.67	96.00	95.98
032	86.04	96.41	96.54	96.41	88.28	97.45	97.63	97.48
036	90.88	96.52	96.09	96.08	92.70	97.50	97.10	97.09
040	87.56	95.94	95.38	95.42	89.24	96.81	96.30	96.32
043	86.79	96.24	96.11	95.75	89.17	97.18	97.07	96.72
044	92.00	97.54	97.55	97.51	94.60	98.86	98.90	98.85
046	85.91	95.53	95.59	95.32	88.59	96.50	96.60	96.35
049	87.60	96.82	97.23	96.99	89.88	97.78	98.19	97.95
053	82.95	94.16	94.34	94.04	84.47	94.84	95.02	94.74
054	76.96	88.70	87.92	87.25	79.72	89.72	88.91	88.26
056	88.69	96.60	96.64	96.52	92.01	97.63	97.64	97.56
059	92.05	98.09	98.10	98.08	95.08	99.05	99.05	99.03
063	86.86	95.55	95.83	95.61	89.01	96.50	96.81	96.60
064	81.93	91.49	88.91	88.98	84.59	92.42	89.83	89.91

Table 29: Results of team MediCIS for task5 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
069	87.77	95.53	95.80	95.61	91.05	96.63	96.90	96.72
070	87.12	96.14	96.30	96.16	90.22	97.36	97.48	97.39
072	90.83	97.74	97.64	97.66	92.95	98.50	98.45	98.45
073	89.28	97.21	97.18	97.16	91.96	98.17	98.13	98.11
077	86.93	97.39	97.46	97.38	89.09	98.33	98.44	98.35
079	76.51	88.53	88.49	87.73	78.81	89.73	89.61	88.88
083	86.80	94.58	94.25	94.04	89.53	95.62	95.18	95.02
085	86.34	96.54	96.71	96.54	88.98	97.57	97.76	97.58
086	84.88	96.04	96.20	95.93	87.28	96.95	97.03	96.83
089	90.35	97.49	97.45	97.44	92.65	98.33	98.33	98.30
091	89.90	97.13	97.12	97.09	93.36	98.54	98.54	98.53
093	87.29	96.62	96.83	96.65	90.28	97.70	97.92	97.76
097	88.95	97.13	97.26	97.16	91.67	98.06	98.14	98.07
098	89.96	97.74	97.89	97.74	93.30	98.95	99.05	98.97
101	86.26	97.05	97.30	97.14	89.28	98.03	98.27	98.12
104	93.52	97.31	97.25	97.23	95.69	98.21	98.13	98.13
106	88.84	97.02	96.97	96.95	91.84	98.03	97.96	97.95
108	93.53	97.95	97.71	97.78	96.95	98.92	98.73	98.78
112	90.41	97.62	97.51	97.53	93.19	98.69	98.70	98.68
113	84.09	96.27	96.39	96.28	87.36	97.23	97.29	97.20
116	82.00	92.56	91.71	91.37	84.31	93.67	92.73	92.51
117	91.12	97.28	97.49	97.34	93.58	98.31	98.53	98.39
121	83.27	95.90	95.78	95.70	85.71	96.69	96.56	96.50
123	91.45	97.10	96.96	96.96	93.70	97.97	97.86	97.84
126	85.77	96.19	95.97	96.01	89.06	97.35	97.13	97.15
129	91.23	96.34	96.18	96.19	93.78	97.39	97.21	97.22

Table 29: Results of team MediCIS for task5 recognition. (continued)

Sequence	Frame-by-Frame				Application-Dependant			
	Accuracy	Precision	recall	F1	Accuracy	Precision	recall	F1
134	84.92	95.71	95.84	95.66	88.13	96.81	96.89	96.73
135	89.63	97.32	97.40	97.30	91.87	98.16	98.22	98.14
138	87.07	97.02	96.95	96.86	90.07	98.08	98.02	97.96
139	90.15	96.91	96.92	96.83	93.38	98.23	98.27	98.21
142	88.18	97.01	97.26	97.10	91.36	98.17	98.36	98.25
145	86.50	96.09	96.61	96.28	88.78	97.03	97.54	97.23
148	89.95	96.23	96.08	96.03	92.38	97.28	97.15	97.12
150	88.91	95.72	95.90	95.67	92.33	97.07	97.26	97.06
Mean	87.26	96.06	95.94	95.81	89.81	97.03	96.92	96.80