References

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Appendix A Appendix Tables

Table A1 Basic Information of Videos in Dataset

Name	Frame Number	Ball Number	FPS	Situation	Source	View	Player
Directly-Facing Female Race01	283	76	15	Competition	TV broadcast	Directly-Facing	Professional athlete
Directly-Facing Female Race02	54	41	15	Competition	TV broadcast	Directly-Facing	Professional athlete
Directly-Facing Female Race03	98	34	15	Competition	TV broadcast	Directly-Facing	Professional athlete
Directly-Facing Female Race04	130	62	15	Competition	TV broadcast	Directly-Facing	Professional athlete
Directly-Facing Female Race05	518	98	15	Competition	TV broadcast	Directly-Facing	Professional athlete
Warm-up 01	382	259	30	Warm-up	Mobile recording	Side-Facing	Amateur
Student Race 01 (partly)[1]	1996	974	120	Competition	High-speed binocular camera	Side-Facing	Student athlete
Warm-up 02	1779	705	60	Warm-up	Mobile recording	Side-Facing	Student athlete
openTT Race (partly)[1]	1996	446	120	Competition	openTT Dataset[1]	Side-Facing	Professional athlete
Attack Training (partly)[1]	1997	607	60	Training	Mobile recording	Side-Facing	Amateur
Drive Training01	257	223	60	Training	Mobile recording	Player-Facing	Student athlete
Drive Training02	2322	983	60	Training	Mobile recording	Player-Facing	Student athlete
Side-Facing Female Race01	326	222	30	Competition	Internet live streaming	Side-Facing	Professional athlete
Directly-Facing Male Race01	305	190	25	Competition	TV broadcast	Directly-Facing	Professional athlete
FMO paint	118	70	N/A	N/A	FMO Dataset[2]	Side-Facing	N/A
FMO side	348	368	N/A	N/A	FMO Dataset[2]	Side-Facing	N/A
FMO top	443	346	N/A	N/A	FMO Dataset[2]	Side-Facing	N/A
Side-Facing Female Race02	162	113	30	Competition	Internet live streaming	Side-Facing	Professional athlete
Side-Facing Female Race03	178	138	30	Competition	Internet live streaming	Side-Facing	Professional athlete
Side-Facing Male Race01	258	72	30	Competition	Internet live streaming	Side-Facing	Professional athlete

[1]Due to the excessive length of the original videos, in order to balance the number of various types of videos in the dataset, we only utilized approximately the first 2000 frames of these videos.

Table A2 Frame ranges of Dataset Videos Used for Training, Testing, and Validation

Name	Frame Number	Ball Number	View	Train Interval,Test Interval/Frame Index
Directly-Facing Female Race01	283	76	Directly-Facing	[0,198],[142,283]
Directly-Facing Female Race02	54	41	Directly-Facing	[0,38],[27,54]
Directly-Facing Female Race03	98	34	Directly-Facing	[0,69],[49,98]
Directly-Facing Female Race04	130	62	Directly-Facing	[0,91],[65,130]
Directly-Facing Female Race05	518	98	Directly-Facing	[0,363],[259,518]
Warm-up 01	382	259	Side-Facing	[0,191],[191,82]
Student Race 01 (partly)	1996	974	Side-Facing	[0,998],[998,1996]
Warm-up 02	1779	705	Side-Facing	[0,890],[890,1779]
openTT Race (partly)	1996	446	Side-Facing	[0,1397],[998,1996]
Attack Training (partly)	1997	607	Side-Facing	[0,999],[999,1997]
Drive Training01	257	223	Player-Facing	[0,129],[129,257]
Drive Training02	2322	983	Player-Facing	[0,1161],[1161,2322]
Side-Facing Female Race01	326	222	Side-Facing	[0,163],[163,326]
Directly-Facing Male Race01	305	190	Directly-Facing	[0,214],[153,305]
FMO paint	118	70	Side-Facing	[0,83],[59,118]
FMO side	348	368	Side-Facing	[0,244],[174,348]
FMO top	443	346	Side-Facing	[0,310],[222,443]
Side-Facing Female Race02	162	113	Side-Facing	Validation
Side-Facing Female Race03	178	138	Side-Facing	Validation
Side-Facing Male Race01	258	72	Side-Facing	Validation

Table A3 Comparison of Filtering Out Short Trajectories (GMP_F4) with the Original GMP Scheme: Evident Increase in Precision without Significant Decrease in F1-Score

	Train&Test Set						Validation Set					
	Target			Relationship			Target			Relationship		
Algorithm Name	Pre.	Rec.	F1.	Pre.	Rec.	F1.	Pre.	Rec.	F1.	Pre.	Rec.	F1.
GMP_F4(0.05-0.70)[1]	0.887	0.937	0.911	0.846	0.924	0.883	0.981	0.948	0.964	0.910	0.944	0.927
GMP_F4(0.30-0.70)[1]	0.923	0.926	0.925	0.883	0.912	0.897	0.990	0.939	0.964	0.920	0.933	0.927
GMP_F4(0.40-0.60)[1]	0.925	0.930	0.927	0.883	0.914	0.898	0.992	0.941	0.966	0.920	0.935	0.928
GMP(0.05-0.70)	0.842	0.951	0.893	0.827	0.933	0.877	0.968	0.952	0.960	0.901	0.946	0.923
GMP(0.30-0.70)	0.879	0.944	0.910	0.860	0.923	0.890	0.979	0.945	0.962	0.911	0.936	0.924
GMP(0.40-0.60)	0.880	0.946	0.912	0.865	0.927	0.895	0.981	0.946	0.963	0.912	0.938	0.925

Pre., Rec., and F1. are abbreviations for Precision, Recall, and F1-Score, respectively.

[1]GMP_F4 means before outputs we filter trajectories with length<4.