HW9

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1. Accuracy:

	Top 1 Accuracy	Top 5 Accuracy	Top 10 Accuracy
Single-frame model	0.78	0.95	0.98
3D model	0.83	0.97	0.98
Combined model	0.87	0.98	0.99

2. Highest / Lowest Performance in these 3 models:

	10 Classes with the Highest Performance	10 Classes with the Lowest Performance
Single-frame model	Rowing (1.0), Surfing (1.0), Basketball (1.0), Billiards(1.0), Bowling (1.0), Fencing (1.0), HorseRace (1.0), Skiing (1.0), FrisbeeCatch (1.0), Typing (1.0)	JumpRope (0.03), Front Crawl (0.07), YoYo (0.19), JumpingJack (0.22), HandstandWalking (0.23), CliffDiving (0.28), Diving (0.29), Long Jump (0.31), Breaststroke (0.37), BrushingTeeth (0.42)
3D model	Drumming (1.0), JumpRope (1.0), Fencing (1.0), HorseRiding (1.0), Playing Flute (1.0), PlayingViolin (1.0), PlayingTabla (1.0),	CricketShot (0.22), HandstandWalking (0.25), Lunges (0.30), HighJump (0.32), Nunchucks (0.35), YoYo (0.42), FrontCrawl (0.47), SoccerJuggling

	PlayingPiano (1.0), PlayingGuitar (1.0), Punch (1.0)	(0.51), Yo Yo (0.53), PommelHorse (0.56)
Combined model	JumpingJack (1.0), Rafting (1.0), PlayingDhol (1.0), BenchPress (1.0), BasketballDunk (1.0), Bowling (1.0), ParallelBars (1.0), Playing Flute (1.0), Playing Guitar (1.0), PlayingViolin (1.0)	HandstandWalking (0.32), HighJump (0.32), Lunges (0.41), Nunchucks (0.51), YoYo (0.53), CricketShot (0.55), BrushingTeeth (0.57), FrontCrawl (0.59), Breaststroke (0.61), Haircut (0.61)

There are some classes that can be easily recognized by the 3D model but hard for the single-frame model to classify. For example, the probability of *JumpRope* being correctly classified by the single-frame model is just 0.03, while this probability is 1.0 for the 3D model which means that *JumpRope* requires more temporal information to be correctly identified than spatial information.

The overall performance of the three models is combined model > 3D model > single frame model. This makes sense as the combined model combines the spatial and temporal information together that is why we always plan to ensemble model to complete deep learning work

There are also classes that can be easily classified by each of the three models such as *playing* something like *PlayingViolin*.

3. Most Confused Classes:

	10 Most Confused Classes

Single-frame model	• ('BrushingTeeth', 'ShavingBeard') • ('CricketShot', 'CricketBowling') • ('ApplyEyeMakeup', 'ApplyLipstick') • ('Shotput', 'ThrowDiscus') • ('Haircut', 'BlowDryHair') • ('Hammering', 'HeadMassage') • ('BodyWeightSquats', 'Lunges') • ('HighJump', 'JavelinThrow') • ('FrontCrawl', 'BreastStroke') • ('JumpRope', 'HulaHoop')
3D model	• ('CricketShot', 'CricketBowling') • ('BrushingTeeth', 'ApplyEyeMakeup') • ('FrontCrawl', 'BreastStroke') • ('Kayaking', 'Rafting') • ('Haircut', 'BlowDryHair') • ('PommelHorse', 'ParallelBars') • ('ApplyLipstick', 'ApplyEyeMakeup') • ('HammerThrow', 'ThrowDiscus') • ('Lunges', 'FloorGymnastics') • ('HighJump', 'PoleVault')

Combined model	('FrontCrawl', 'BreastStroke') ('BrushingTeeth', 'ShavingBeard') ('CricketShot', 'CricketBowling') ('PommelHorse', 'ParallelBars') ('Haircut', 'BlowDryHair') ('Nunchucks', 'TaiChi') ('HammerThrow', 'ThrowDiscus') ('HighJump', 'JavelinThrow') ('Kayaking', 'Rafting') ('HighJump', 'PoleVault')

From the table above, some pairs like ('CricketShot', 'CricketBowling'), ('Haircut', 'BlowDryHair'), ('FrontCrawl', 'BreastStroke') are very confused for all three models. And the confusing classes in these 3 models are very similar.