HAA500: Supplementary Material

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1. Video Collection Procedure

To guarantee a clean dataset with no label noises, we adopt a strict video collecting methodology for every class. We detail the method below.

1. We assign a single annotator for a single class. This is to assure that the same rule applies to every video in a class.
2. The action class is classified as either continuous action or discrete action. Discrete action is when the action can have a single distinguishable action sequence. (*e.g.*, *Baseball-Swing*, *Yoga-Bridge*, etc.). Continuous action otherwise. (*Running*, *Playing Violin*, etc.)

    (a) If it is discrete, make an internal rule to define the action. (e.g., *Jumping Jack* starts and ends when the person is standing still. The video clip contains only a single jump. *Push-up* starts and ends when the person is at the highest point. It should only have a single push-up). Every video should follow the internal rule so that every action in the class has compatible motion.

    (b) For continuous, we take video clips with appropriate length.

3. Here are rules that the annotator has to follow.

    - 20 videos should be unique to each other with a varied person, varied backgrounds.
    - The person in action should be the dominant person of the frame. If there are people of non-interest, they should not be performing any action.
    - Camera cuts should not exist.
    - Every video should include a large portion of the human body.
    - It is fine to have action variance that doesn't influence the semantics of the action. (*e.g.*, a person can sit or stand in *Whistling with One Hand* as long as the motion of whistling exists.)

    - 20 videos are split into train/val/test set by 16/1/3. The validation set contains the "standard" body action of the class, and 3 videos in the test set should be well diverse.

4. Two or more reviewers that are not the annotator review the video to check for any mistakes.

2. Experiment Detail

In this section, we explain some of the experiment details of our paper.

Variable Length of a Video   For model [1, 2, 3, 5], we randomly select 32 adjacent frames of a video during training. If the video is shorter than 32 frames, we replicate the last frame to match the size. During testing, we replicate the last frame to match the size to a multiple of 32, where the video is then divided into smaller mini-clips of size 32. The prediction score of each mini-clip is averaged to get the final prediction. In Table 11, where we train with fewer frames, we zero-pad on both ends to size 16. On ST-GCN [4] we follow the same procedure of the original paper, where the video is either truncated or replicated to match the length of 300.

Implementation   In all of our experiments, we use PyTorch for our deep learning framework. We use the official code of the model when they are available. While we use the same hyperparameters which the authors used for their model, for a fair comparison we do not pre-train the model before training.

3. List of Classes in HAA500

Here, we list classes of HAA500 in each area.

Sports/Athletics
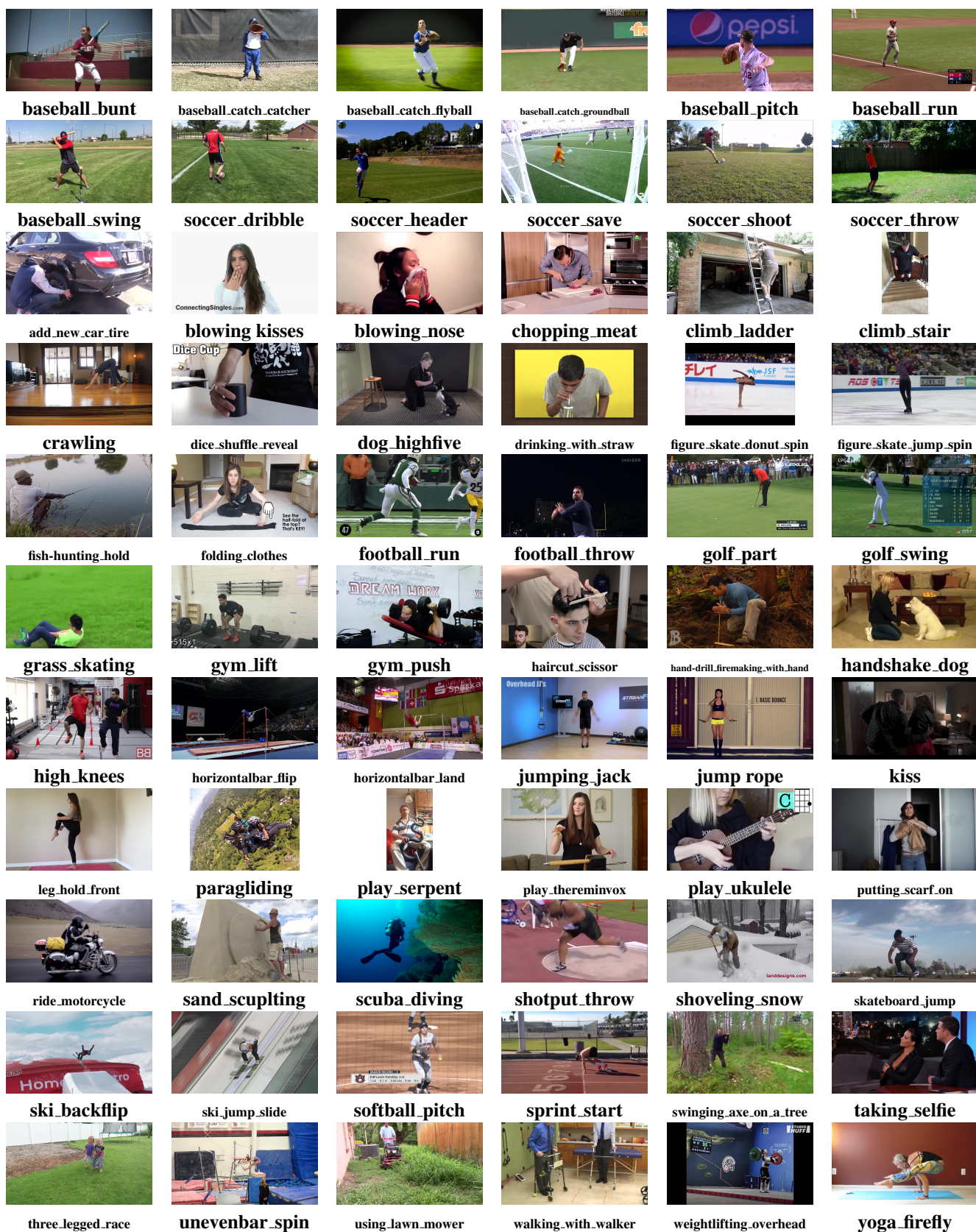
1. Abseiling
2. Archery
3. Backflip
4. Backward Roll

Figure 1. Video samples of different classes.

balancebeam_rotate

chainsaw_log

milking

moonwalk

petanque_throw

play_bangu

play_trombone

roller-skating_forward

shake_cocktail

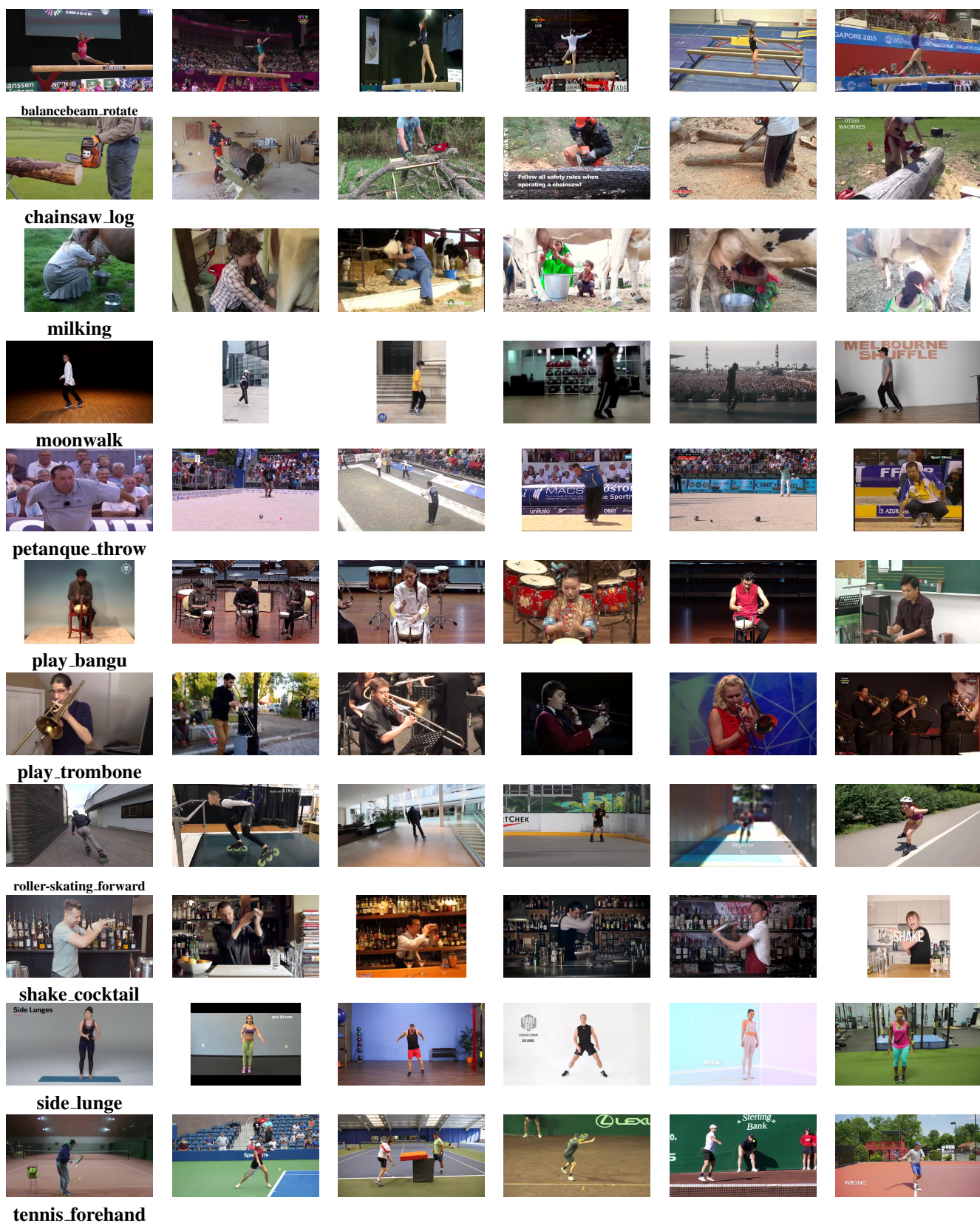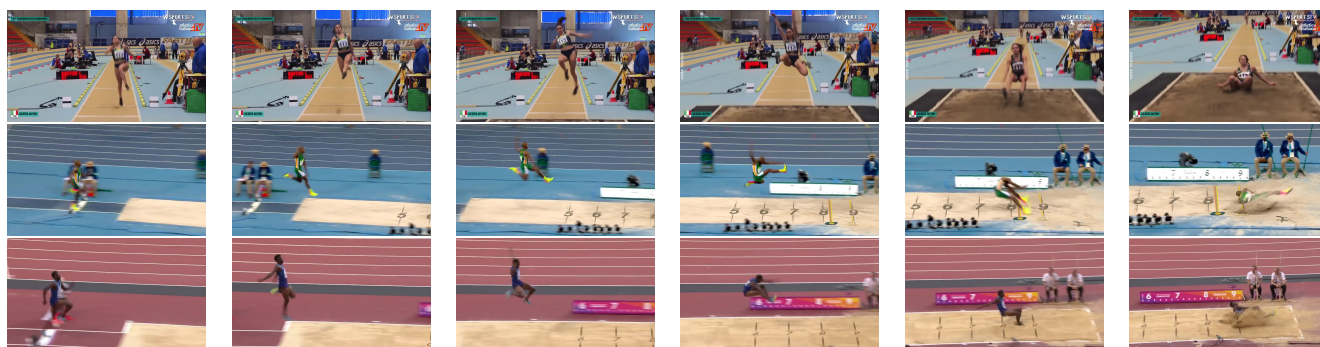side_lunge

tennis_forehand

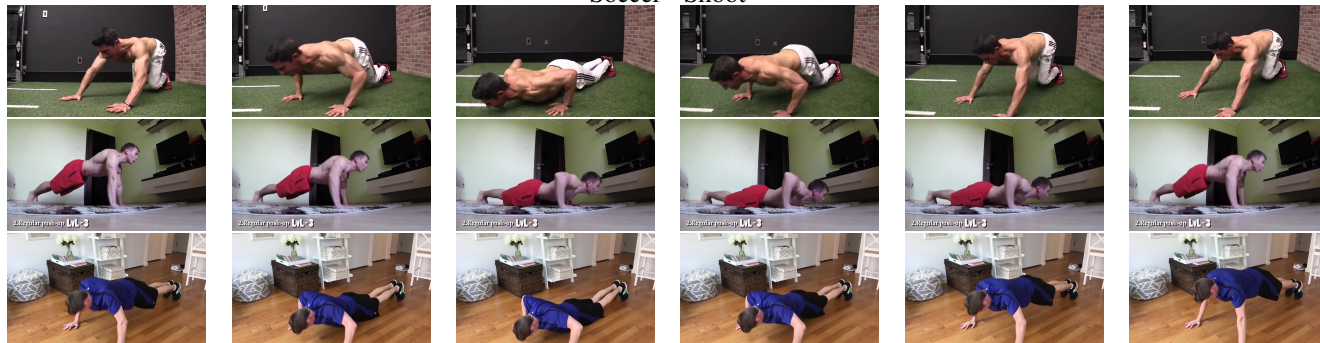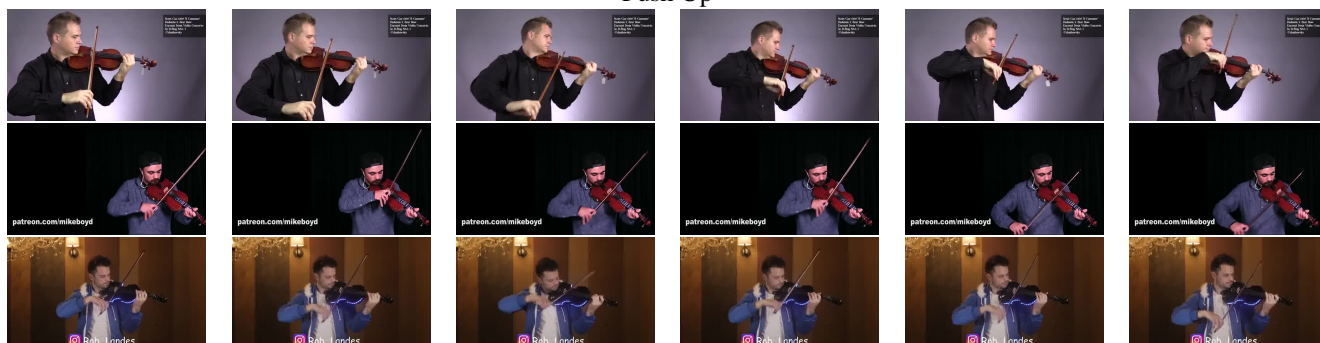Figure 2. HAA500 contains diverse videos per action class.

Long Jump - Jump

Soccer - Shoot

Push Up

Play Violin

Figure 3. Six sample frames of different videos. Each frame has an equal distance from the other, the first and the last sample frame are the first and the last frame of the video. In discrete action classes, (*Long Jump - Jump*, *Push Up*, *Soccer - Shoot*), every video in the class shows a single motion. For action classes where it is hard to define a single motion (*i.e.*, continuous actions, *e.g.*, *Play Violin*), videos are cut in appropriate length.

Figure 4. Hierarchy of action classes in Sports/Athletics area.

5. Badminton Overswing
6. Badminton Serve
7. Badminton Underswing
8. Balance Beam Flip
9. Balance Beam Jump
10. Balance Beam Rotate
11. Balance Beam Spin
12. Balance Beam Walk

13. Base Jumping
14. Baseball Baseball Swing
15. Baseball Bunt
16. Baseball Pitch
17. Baseball Run
18. Basketball Dribble
19. Basketball Dunk
20. Basketball Hookshot
21. Basketball Jabstep
22. Basketball Layup
23. Basketball Pass
24. Basketball Shoot
25. Battle-Rope Jumping-Jack
26. Battle-Rope Power-Slam
27. Battle-Rope Rainbow
28. Battle-Rope Russian-Twist
29. Battle-Rope Sideplank
30. Battle-Rope Snake
31. Battle-Rope Wave
32. Bench Dip
33. Bike Fall
34. Billiard Hit
35. Bmx Jump
36. Bmx Ride
37. Bowling
38. Bowls Throw
39. Breakdancing Flare
40. Breakdancing Flip
41. Breakdancing Rotate
42. Breakdancing Support
43. Burpee
44. Canoeing Slalom
45. Canoeing Spring
46. Catch Catcher
47. Catch Flyball
48. Catch Groundball
49. Climb Pole Climb
50. Climbing Icecliff
51. Climbing Rock
52. Climbing Rope Climb
53. Cross Country Ski Slide
54. Cross Country Ski Walk
55. Crossbow Shoot
56. Curling Follow
57. Curling Push
58. Curling Sweep
59. Dart Throw
60. Dips
61. Discus Throw
62. Diving Jump
63. Diving Rotate
64. Diving Sneak
65. Equestrian Dressage
66. Equestrian Jump
67. Equestrian Run
68. Figure Skate I Spin
69. Figure Skate Backward
70. Figure Skate Bielman Spin
71. Figure Skate Camel Spin
72. Figure Skate Donut Spin
73. Figure Skate Forward
74. Figure Skate Hydroblading
75. Figure Skate Inabauer
76. Figure Skate Jump Spin
77. Figure Skate Scratch Spin
78. Figure Skate Sit Spin
79. Floor Rotate
80. Floor Spin
81. Football Catch
82. Football Run
83. Football Throw
84. Forward Fold
85. Forward Jump
86. Forward Roll
87. Frisbee Catch
88. Frisbee Throw
89. Golf Part
90. Golf Swing
91. Grass Skiing
92. Gym Lift
93. Gym Lunges
94. Gym Plank
95. Gym Pull
96. Gym Push
97. Gym Ride
98. Gym Run
99. Gym Squat
100. Hammer Throw
101. Headstand
102. High Jump Jump
103. High Jump Run
104. High Knees
105. Horizontal Bar Flip
106. Horizontal Bar Jump
107. Horizontal Bar Land
108. Horizontal Bar Spin
109. Hula Hoop
110. Hurdle Jump
111. Javelin Run
112. Javelin Throw
113. Jetski
114. Jump Rope Jump
115. Jumping Jack Jump
116. Kayaking
117. Leg Hold Back
118. Leg Hold Flip
119. Leg Hold Front
120. Long Jump Jump
121. Long Jump Run
122. Luge
123. Paragliding
124. Petanque Throw
125. Pole Vault Jump
126. Pole Vault Run
127. Pull Ups
128. Punching Sandbag
129. Punching Speed Bag
130. Push Up
131. Quadruped Hip-Extension
132. Racewalk Walk
133. Ride Bike
134. Ride Horse
135. Ride Motercycle
136. Ride Scooter
137. Ride Unicycle
138. Roller Skating Backward

139. Roller Skating Forward
140. Rowing Boat
141. Running In Place Run
142. Scuba Diving
143. Shotput Throw
144. Side Lunge
145. Sit Up
146. Skateboard Forward
147. Skateboard Grind
148. Skateboard Jump
149. Skeleton
150. Ski Backflip
151. Ski Cork
152. Ski Frontflip
153. Ski Jump Land
154. Ski Jump Mid-Air
155. Ski Jump Slide
156. Skydiving
157. Snorkeling
158. Snowboard Jump
159. Snowboard Slide
160. Snowboarding Forward
161. Soccer Dribble
162. Soccer Header
163. Soccer Save
164. Soccer Shoot
165. Soccer Throw
166. Softball Pitch
167. Speedskating Forward
168. Split Leap
169. Sprint Kneel
170. Sprint Run
171. Sprint Start
172. Star Jumping Jump
173. Surfing
174. Swimming Backstroke
175. Swimming Breast Stroke
176. Swimming Butterfly Stroke
177. Swimming Freestyle
178. Taekwondo High Block
179. Taekwondo Kick
180. Taekwondo Low Block
181. Taekwondo Middle Block
182. Taekwondo Punch
183. Tennis Backhand
184. Tennis Forehand
185. Tennis Serve
186. Tire Pull
187. Tire Sled
188. Trapeze Interacting
189. Trapeze Single
190. Triple Jump Jump
191. Triple Jump Run
192. Uneven Bar Cross
193. Uneven Bar Flip
194. Uneven Bar Jump
195. Uneven Bar Land
196. Uneven Bar Spin
197. Volleyball Overhand
198. Volleyball Pass
199. Volleyball Set
200. Volleyball Underhand
201. Water Skiing

202. Weight Lifting Hang
203. Weight Lifting Overhead
204. Weight Lifting Stand
205. Windsurfing
206. Workout Chest-Pull
207. Workout Crunch
208. Yoga Bridge
209. Yoga Cat
210. Yoga Firefly
211. Yoga Tree
212. Yoga Updog

Daily Actions

213. Add New Car Tire
214. Adjusting Glasses
215. ALS Icebucket Challenge
216. Answering Questions
217. Applauding
218. Applying Cream
219. Arm Wave
220. Bandaging
221. Bending Back
222. Blowdrying Hair
223. Blowing Balloon
224. Blowing Glass
225. Blowing Gum
226. Blowing Kisses
227. Blowing Leaf
228. Blowing Nose
229. Bowing Fullbody
230. Bowing Waist
231. Brushing Floor
232. Brushing Hair
233. Brushing Teeth
234. Burping
235. Calfrope Catch
236. Calfrope Rope
237. Calfrope Subdue
238. Carrying With Head
239. Cartwheeling
240. Cast Net
241. Chainsaw Log
242. Chainsaw Tree
243. Chalkboard
244. Chewing Gum
245. Chopping Meat
246. Chopping Wood
247. Cleaning Mirror
248. Cleaning Mopping
249. Cleaning Sweeping
250. Cleaning Vacumming
251. Cleaning Windows
252. Clear Snow Off Car
253. Climb Ladder
254. Climb Stair
255. Climbing Tree
256. Closing Door
257. CPR
258. Crawling
259. Cross Body Shoulder Stretch
260. Cutting Onion

261. Dabbing
262. Dog Highfive
263. Dog Walking
264. Drinking With Cup
265. Drinking With Straw
266. Eat Apple
267. Eat Burger
268. Eat Spagetti
269. Eating Hotdogs
270. Eating Ice Cream
271. Eating Oyster
272. Face Slapping
273. Falling Off Chair
274. Fire Extinguisher
275. Fist Bump
276. Flamethrower
277. Folding Blanket
278. Folding Clothes
279. Gas Pumping To Car
280. Guitar Smashing
281. Hailing Taxi
282. Haircut Scissor
283. Hammering Nail
284. Hand In Hand
285. Hand-Drill Firemaking Blow
286. Hand-Drill Firemaking Drill With Bow
287. Hand-Drill Firemaking Drill With Hand
288. Handsaw
289. Handshake Dog
290. Hanging Clothes
291. Headbang
292. Heimlich Maneuver
293. High Five
294. Hold Baby
295. Hold Baby With Wrap
296. Hookah
297. Hugging Animal
298. Hugging Human
299. Ironing Clothes
300. Jack Up Car
301. Kick Open Door
302. Kiss
303. Leaf Blowing
304. Milking
305. Neck Side Pull Stretch
306. Opening Door
307. Pancake Flip
308. Peeling Banana
309. Pizza Dough Toss
310. Plunging Toilet
311. Pottery Wheel
312. Pouring Wine
313. Push Car
314. Push Wheelchair
315. Push Wheelchair Alone
316. Putting Scarf On
317. Read Newspaper
318. Reading Book
319. Remove Car Tire
320. Rescue Breathing
321. Riding Camel
322. Riding Elephant
323. Riding Mechanical Bull
324. Riding Mule
325. Riding Ostrich
326. Riding Zebra
327. Rolling Snow
328. Salute
329. Screw Car Tire
330. Setup Tent
331. Shake Cocktail
332. Shaking Head
333. Shaving Beard
334. Shoe Shining
335. Shoveling Snow
336. Sledgehammer Strike Down
337. Smoking Exhale
338. Smoking Inhale
339. Spitting On Face
340. Spraying Wall
341. Sticking Tongue Out
342. Stomping Grapes
343. Styling Hair
344. Swinging Axe On A Tree
345. Talking Megaphone
346. Talking On Phone
347. Throwing Bouquet
348. Using Inhaler
349. Using Lawn Mower
350. Using Lawn Mower Riding Type
351. Using Metal Detector
352. Using Scythe
353. Using Spinning Wheel
354. Using String Trimmer
355. Using Typewriter
356. Walking With Crutches
357. Walking With Walker
358. Wall Paint Brush
359. Wall Paint Roller
360. Washing Clothes
361. Washing Dishes
362. Watering Plants
363. Wear Face Mask
364. Wear Helmet
365. Whipping
366. Writing On Blackboard
367. Yawning

Musical Instruments

368. Accordian
369. Bagpipes
370. Bangu
371. Banjo
372. Bass Drum
373. Bowsaw
374. Cajon Drum
375. Castanet
376. Cello
377. Clarinet
378. Conga Drum
379. Cornett
380. Cymbals
381. Doublebass
382. Erhu

383. Gong
384. Grandpiano
385. Guitar
386. Handpan
387. Harp
388. Hulusi
389. Jazzdrum
390. Leaf-Flute
391. Lute
392. Maracas
393. Melodic
394. Noseflute
395. Ocarina
396. Otamatone
397. Panpipe
398. Piccolo
399. Recorder
400. Sanxian
401. Saxophone
402. Serpeng
403. Sheng
404. Sitar
405. Snare Drum
406. Sunoa
407. Taiko Drum
408. Tambourine
409. Thereminvox
410. Timpani
411. Triangle
412. Trombone
413. Trumpet
414. Ukulele
415. Viola
416. Violin
417. Xylophone
418. Yangqin

Games and Hobbies

419. Air Drumming
420. Air Guitar
421. Air Hockey
422. Alligator Wrestling
423. Archaeological Excavation
424. Arm Wrestling
425. Atlatl Throw
426. Axe Throwing
427. Balloon Animal
428. Beer Pong Throw
429. Belly Dancing
430. Blow Gun
431. Building Snowman
432. Card Throw
433. Conducting
434. Decorating Snowman
435. Dice Shuffle Reveal
436. Dice Stack Shuffle
437. DJ
438. Draw Handgun
439. Face-Changing Opera
440. Fire Breathing
441. Fire Dancing Circulating

442. Fish-Hunting Hold
443. Fish-Hunting Pull
444. Flipping Bottle
445. Floss Dance
446. Flying Kite
447. Ganggangsullae
448. Gangnam Style Dance
449. Grass Skating
450. Guitar Flip
451. Hopscotch Pickup
452. Hopscotch Skip
453. Hopscotch Spin
454. Ice Scuplting
455. Juggling Balls
456. Kick Jianzi
457. Knitting
458. Marble Scuplting
459. Moonwalk
460. Piggyback Ride
461. Play Diabolo
462. Play Kendama
463. Play Yoyo
464. Playing Nunchucks
465. Playing Rubiks Cube
466. Playing Seesaw
467. Playing Swing
468. Rock Balancing
469. Rock Paper Scissors
470. Running On Four
471. Sack Race
472. Sand Scuplting
473. Segway
474. Shoot Dance
475. Shooting Handgun
476. Shooting Shotgun
477. Shuffle Dance
478. Sling
479. Slingshot
480. Snow Angel
481. Speed Stack
482. Spinning Basketball
483. Spinning Book
484. Spinning Plate
485. Stone Skipping
486. Sword Swallowing
487. Taichi Fan
488. Taking Photo Camera
489. Taking Selfie
490. Tap Dancing
491. Three Legged Race
492. Throw Boomerang
493. Throw Paper-Plane
494. Tight-Rope Walking
495. Trampoline
496. Tug Of War
497. Underarm Turn
498. Walking On Stilts
499. Whistle One Hand
500. Whistle Two Hands

4. Composite Classes

We list how *Musical Instrument* and *Sports/Athletics* classes form to become composite actions. We list indices of the classes for each composite action.

4.1. Sports/Athletics

1. 49
2. 79, 80
3. 99
4. 65, 66, 67
5. 2
6. 178, 179, 180, 181, 182
7. 120, 121
8. 39, 40, 41, 42
9. 114
10. 140
11. 111, 112
12. 25, 26, 27, 28, 29, 30, 31
13. 60
14. 56, 57, 58
15. 156
16. 144
17. 59
18. 150, 151, 152
19. 168
20. 167
21. 102, 103
22. 145
23. 81, 82, 83
24. 92
25. 128, 129
26. 50, 51
27. 53, 54
28. 138, 139
29. 43
30. 174, 175, 176, 177
31. 183, 184, 185
32. 201
33. 8, 9, 10, 11, 12
34. 142
35. 149
36. 1
37. 32
38. 62, 63, 64
39. 141
40. 109
41. 104
42. 122
43. 110
44. 38
45. 100
46. 157
47. 37
48. 197, 198, 199, 200
49. 116
50. 153, 154, 155
51. 84
52. 131
53. 127
54. 18, 19, 20, 21, 22, 23, 24
55. 117, 118, 119
56. 186, 187
57. 160
58. 169, 170, 171
59. 158, 159
60. 206, 207
61. 13
62. 172
63. 133, 134, 135, 136, 137
64. 123
65. 124
66. 205
67. 5, 6, 7
68. 86
69. 208, 209, 210, 211, 212
70. 113
71. 202, 203, 204
72. 166
73. 105, 106, 107, 108
74. 192, 193, 194, 195, 196
75. 125, 126
76. 61
77. 173
78. 143
79. 85
80. 188, 189
81. 130
82. 101
83. 55
84. 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78
85. 52
86. 115
87. 91
88. 146, 147, 148
89. 87, 88
90. 44, 45
91. 89, 90
92. 3
93. 190, 191
94. 4
95. 35, 36
96. 34
97. 33
98. 14, 15, 16, 17, 46, 47, 48
99. 93, 94, 95, 96, 97, 98
100. 132
101. 161, 162, 163, 164, 165

4.2. Musical Instruments

1. 369, 377, 379, 388, 390, 394, 395, 397, 398, 401, 402, 403, 406, 412, 413,399
2. 371, 373, 376, 381, 382, 385, 387, 391, 396, 400, 404, 409, 414, 415, 416
3. 370, 372, 374, 375, 378, 380, 383, 386, 389, 392, 405, 407, 408, 410, 411, 417, 418
4. 368, 384, 393

5. HAA-COCO

Here we list the classes in HAA-COCO.

- 1, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 32, 33, 34, 35, 36, 37, 45, 46, 47, 58, 60, 80, 81, 82, 86, 87, 88, 89, 99, 108, 110, 111, 115, 124, 125, 127, 128, 132, 133, 134, 135, 136, 139, 142, 160, 161, 162, 163, 164, 165, 182, 183, 184, 196, 197, 198, 199, 201, 202, 203, 212, 214, 235, 236, 237, 245, 246, 248, 249, 250, 251, 252, 263, 264, 265, 266, 267, 268, 276, 277, 278, 289, 298, 299, 305, 307, 311, 312, 313, 314, 316, 317, 318, 321, 325, 328, 330, 336, 337, 339, 345, 357, 358, 359, 360, 361, 367, 375, 376, 379, 381, 383, 384, 386, 388, 398, 400, 409, 410, 411, 412, 413, 414, 415, 427, 431, 434, 435, 443, 454, 480, 481, 487, 488

6. Sample Videos

Figure 1 shows the first frame of a video in different classes. Figure 2 lists diverse videos per class.

7. Hierarchy

Figure 4 shows the hierarchy of action classes in *Sports/Athletics* area where the actions are grouped together with other actions in the same sports category.

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