

Supplemental Material for “Recognizing Activities via Bag of Words for Attribute Dynamics”

1 Weizmann Activity

1.1 Synthetic Datasets

The synthetic dataset consists of two sets: Syn20×1 and Syn1s0×2, which are generated using the 10 atomic actions (per person) from the original Weizmann dataset [1]. One category of the 20 activities in Syn20×1 (Syn10×2) are shown in Table 1 (Table 2), together with two examples of the 9 instances for an activity (each instance is assembled from each of the 9 people’s atomic actions).

Table 1: Examples for Syn20×1

Ground-truth Activity	wave1-wave1-wave2-walk-walk-wave1-walk-wave2-wave2-walk-jack-skip-wave2-bend-bend-jump-run-skip-jack-wave1
Noisy Instances ¹	<div style="border-bottom: 1px solid black; padding-bottom: 5px;"> side-wave2-walk-skip-run-wave1-bend-bend-walk-walk-wave1-wave1-wave2-walk-walk-wave1-walk-wave2-wave2-walk-jack-skip-wave2-bend-bend-jump-run-skip-jack-wave1-side-bend-side-walk-run-side-walk-jack-bend-walk; </div> <div style="padding-bottom: 5px;"> jump-run-wave1-wave1-wave2-walk-walk-wave1-walk-wave2-wave2-walk-jack-skip-wave2-bend-bend-jump-run-skip-jack-wave1-wave1-walk-side-jump-side-jump-jump-run-jack-side-wave1-run-run-skip-wave1-jack-side-bend; </div>

¹ actions in red are ground-truth activities.

Table 2: Examples for Syn10×2

Ground-truth Activity	jack-jump-side-jump-pjump-run-jack-side-bend-wave1; run-side-side-skip-run-jump-walk-jack-run-skip
Noisy Instances ²	<div style="border-bottom: 1px solid black; padding-bottom: 5px;"> wave2-run-wave1-bend-jump-wave1-skip-side-jack-jump-side-jump-pjump-run-jack-side-bend-wave1-walk-wave2-wave2-wave1-side-pjump-wave2-run-side-side-skip-run-jump-walk-jack-run-skip-jack-pjump-pjump-pjump-pjump; </div> <div style="padding-bottom: 5px;"> jump-jack-jump-side-jump-pjump-run-jack-side-bend-wave1-jump-side-skip-jack-run-side-bend-jump-pjump-side-run-side-side-skip-run-jump-walk-jack-run-skip-side-pjump-wave2-walk-run-pjump-wave2-wave2-walk; </div>

² actions in red are ground-truth activities.

1.2 Attribute Definitions

Attribute definitions for Weizmann activity are shown in Table 3.

Table 3: Attributes for Weizmann Actions

attribute	bend	jack	jump	pjump	run	side	skip	walk	wave1	wave2
arm-hand-alternate-move-forward	0	0	0	0	1	0	0	1	0	0
arm-hand-hang-down-swing-back-forward	0	0	0	0	0	0	0	1	0	0
arm-hand-swing-move-back-forward-motion	0	0	1	0	1	0	1	1	0	0
arm-intense-motion	0	1	1	0	0	0	0	0	0	0
arm-shape-fold	0	0	1	0	1	0	1	0	1	1
arm-shape-straight	1	1	1	1	0	1	0	1	1	1
arm-side-open-up-down-motion	0	1	0	0	0	0	0	0	0	1
arm-small-swing-motion-left-right-up-down	0	1	0	0	0	0	0	0	1	1
arm-synchronized-arm-motion	0	1	1	0	0	0	1	0	0	0
arm-up-motion-over-shoulder	0	1	1	0	0	0	1	0	1	1
chest-level-arm-motion	0	0	0	0	1	0	0	0	0	0
cyclic-motion	0	1	1	1	1	1	1	1	1	1
huge-wave motion-up-down	0	0	1	0	1	1	1	0	0	0
intense-motion	0	1	1	1	1	1	1	0	0	0
leg-alternate-move-forward	0	0	0	0	1	1	0	1	0	0
leg-feet-small-moving-motion	0	0	0	0	0	0	0	1	0	0
leg-intense-motion	0	1	1	1	1	1	1	0	0	0
leg-motion	0	1	1	1	1	1	1	0	0	0
leg-side-stretch-motion	0	1	0	0	0	1	0	0	0	0
leg-two-leg-synchronized-motion	0	1	1	1	0	0	0	0	0	0
leg-up-forward-motion	0	0	1	0	1	0	1	0	0	0
one-arm-motion	1	0	0	0	0	0	1	0	1	0
small-wave-motion-up-down	0	0	0	0	0	0	0	1	0	0
torso-bend-motion	1	0	0	0	0	0	0	0	0	0
torso-vertical-shape-down-forward-motion	0	0	1	0	1	0	1	0	0	0
torso-vertical-shape-down-motion	0	1	0	1	0	0	0	0	0	0
torso-vertical-shape-up-forward-motion	0	0	1	0	1	0	1	0	0	0
torso-vertical-shape-up-motion	0	1	0	1	0	0	0	0	0	0
translation-motion	0	0	1	0	1	1	1	1	0	0
two-arms-motion	0	1	1	0	1	0	0	1	0	1

2 Olympic Sports

Attribute definitions for Olympic Sports dataset [2] are shown in Table 4.

3 TRECVID MED11

Attribute definitions for TRECVID MED11 dataset [3] are shown in Table 5.

References

- [1] L. Gorelick, M. Blank, E. Shechtman, M. Irani, and R. Basri. Actions as space-time shapes. *IEEE TPAMI*, 29(12):2247–2253, 2007. 1

- [2] J. Niebles, C. Chen, and L. Fei-Fei. Modeling temporal structure of decomposable motion segments for activity classification. *ECCV*, 2010. [2](#)
- [3] P. Over, G. Awad, J. Fiscus, B. Antonishek, M. Michel, A. F. Smeaton, and W. Kraaij. Trecvid 2011 – an overview of the goals, tasks, data, evaluation mechanisms, and metrics. *Proceedings of TRECVID 2011*, 2011. [2](#)

Table 4: Attributes for Olympic Sports

attribute	basketball-layup	bowl	clean-jerk	discus-throw	diving-platform-10m	diving-spring-3m	hammer-throw	high-jump	javelin-throw	long-jump	pole-vault	shot-put	snatch	tennis-serve	triple-jump	vault
ball	1	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0
bend	0	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0
big-ball	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
big-step	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
crouch	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0
down-motion-in-air	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0
fast-run	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1
indoor	1	1	1	0	1	1	0	0	0	0	0	0	1	0	0	1
jump	1	0	0	0	1	1	0	1	0	1	1	0	0	0	1	1
jump-forward	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
lift-something	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
local-jump-up	1	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0
motion-in-the-air	0	0	0	0	1	1	0	1	0	1	1	0	0	0	1	1
one-arm-open	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
one-arm-swing	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0
one-hand-holding-pole	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
open-arm-lift	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
outdoor	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1
raise-arms	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
run	1	0	0	0	0	0	0	1	1	1	1	0	0	0	1	1
run-in-air	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
slow-run	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
small-ball	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0
small-local-jump	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
somersault-in-air	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1
spring-platform	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1
standup	0	0	1	0	0	0	0	0	0	1	1	0	1	0	1	0
throw-away	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0
throw-up	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
track	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1
turn-around	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0
turn-around-with-two-arms-open	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
two-arms-open	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
two-arms-swing-overhead	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
two-hand-holding-pole	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
up-down-motion-local	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
up-motion-in-air	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1
water	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
with-pat	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
with-pole	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0

Table 5: Attribute List for TRECVID MED11¹

animal-eats-food-from-a-container	animal-grabs-offered-food-and-eats
bending-metal-using-a-vice	blowing-out-candles-on-a-cake
bride-and-groom-standing-in-front-of-a-priest-official	brushing-smoothing-fur
casting	clapping
clipping-nails-of-an-animal	cutting-and-shaping-wood
cutting-dishing-up-fillings	cutting-fur
cutting-metal	cutting-ripping
dancing	dancing-singing-in-unison-in-a-group
delivering-a-speech	exchanging-vows
falling	flipping-the-bike
flipping-the-board-and-landing-on-it	gestures-indicating-directions
going-down-on-one-knee	grinding-with-the-board
group-dancing	group-marching
group-walking	hammering-metal
heating-metal-over-a-flame	hugging
human-holding-food-in-front-of-an-animal	jumping-over-obstacles
jumping-with-the-bike	jumping-with-the-board
kissing	landing-with-the-board
lifting-up-body-with-arms-legs	lurching-of-pole
marking-on-metal	measuring-length
milling-around	moving-along-a-rock-face
moving-in-a-coordinated-fashion	multiple-people-jumping-forward
multiple-people-running-in-a-race	opening-closing-parts
opening-presents	passing-a-baton-while-running
placing-fillings-on-bread	polishing-metal
pressing-ironing	putting-fish-in-net-bucket
raising-hands	reeling-in
removing-fish-from-hook	removing-hubcap-wheel
riding-bike-on-one-wheel	rolling
running	running-next-to-dog
scaling-walls-trees	sewing
sewing-by-hand	slicing-cutting-bread
sliding-the-board	slowing-pace-to-a-stop
soaping-rinsing-an-animal	somersaulting
spinning-the-bike	spinning-the-bike-handle
spinning-the-board	spinning-with-the-board
spreading-condiments-on-bread	standing-on-the-board
taking-a-tire-out	toasting-bread
tracing-marking	turning-wrench-unscrewing
unscrewing-screwing-parts	walking-down-the-aisle
waving-signs	attaching-pieces-of-wood-together
drilling	exchanging-rings
holding-out-ring	lifting-machine-parts
making-winning-gestures	pulling-pushing-a-vehicle
putting-ring-on-finger	scrubbing-appliance-by-hand
standing-on-top-of-bike	wiping-down-an-appliance
working-on-a-table-top-machine	

¹ About 4000 short-term training clips are annotated to learn the attribute models.