



AI judge assistant for recognition of jump rope skills in videos.

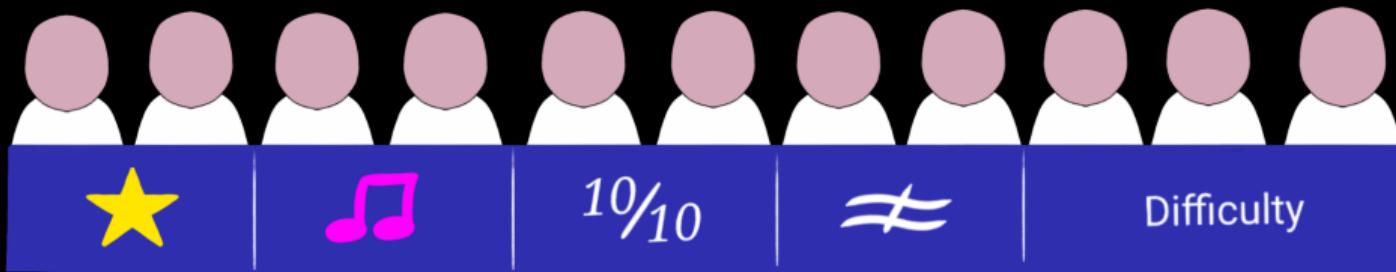
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June 12, 2025

Diciplines



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Judges



Scoring difficulty.

Using levels [1 -> 8]



Base skill level

+

Turner restrictions

+

Nr of rotations

+

Modifiers (one hand, body rotations...)

AI Judge assistant

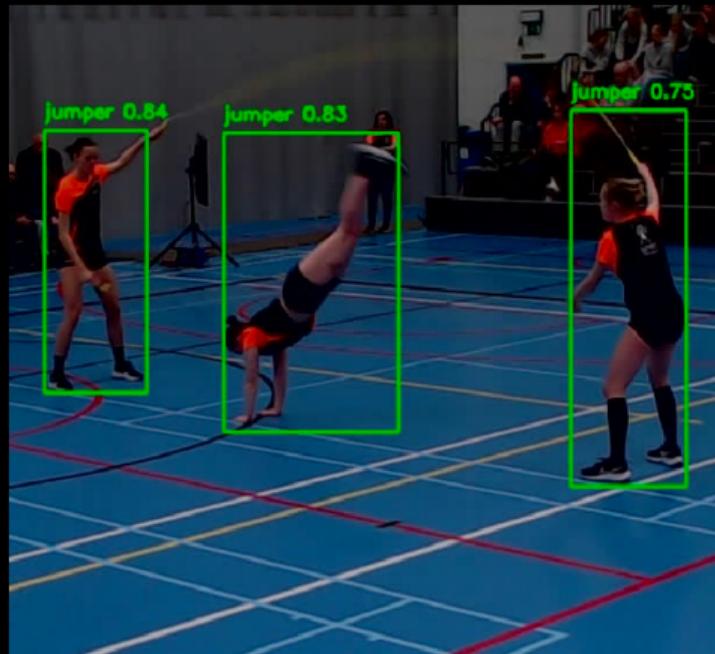


1. localize
2. segment
3. recognition

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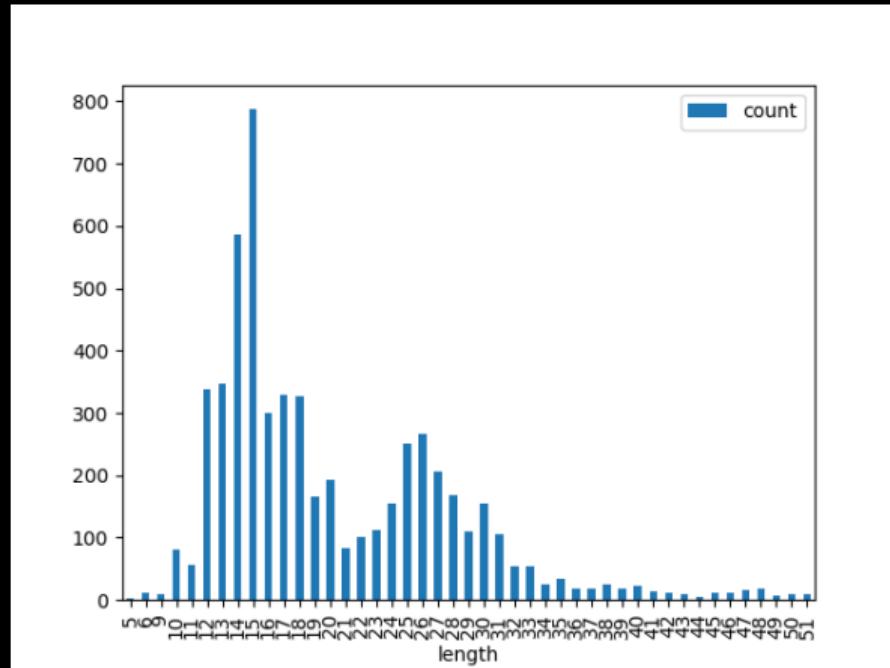
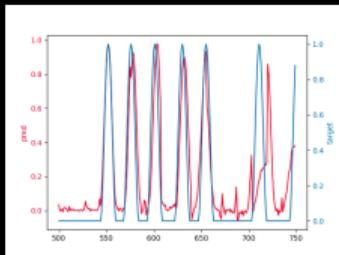
Jumper localization

1. Full team
2. Individual
3. YOLO



Action segmentation

1. 0 or 1
2. every N frames
3. Peaks
4. Transform to an equal length



Skill recognition

- Data labels, nr of videos
- Up-sampling
- 5 classes & down sampling
- Multiscale Video Transformer
- Data augmentation (Mirror)
- ResNet (R3D, R2plus1, MC3), SA_Conv3D_LSTM, SwinTransformer

Skill recognition

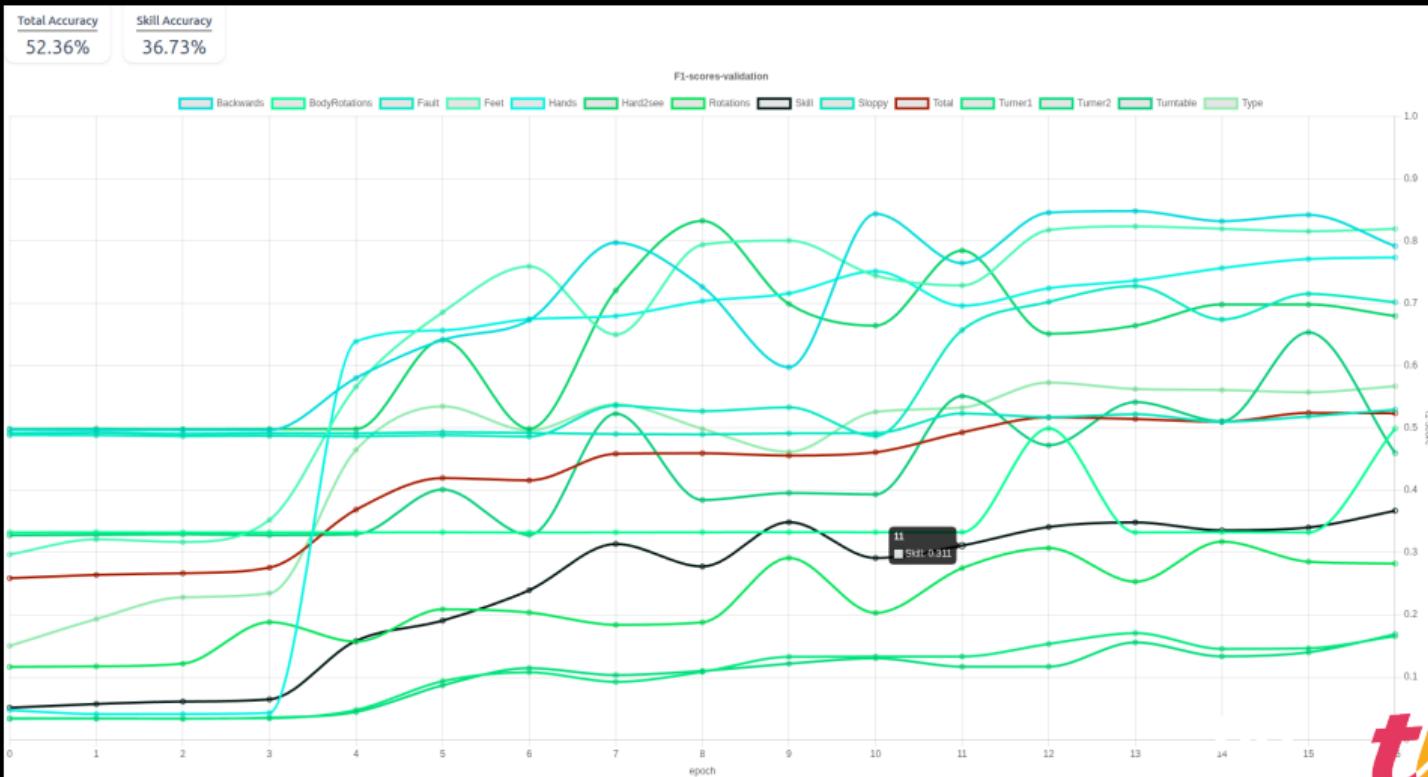
	precision	recall	f1-score	support
SPAGAAT	0.00	0.00	0.00	0.0
UNKOWN	0.00	0.00	0.00	3.0
buddy-bounce	0.00	0.00	0.00	1.0
crab	0.68	0.89	0.77	19.0
flip	0.47	0.70	0.56	10.0
flip-to-pushup	0.00	0.00	0.00	0.0
footwork-cancan	0.00	0.00	0.00	0.0
footwork-cross	0.00	0.00	0.00	0.0
footwork-kick	0.00	0.00	0.00	0.0
footwork-knee	0.00	0.00	0.00	0.0
footwork-open	0.00	0.00	0.00	2.0
frog	0.98	1.00	0.99	88.0
handspring	0.67	0.40	0.50	5.

Skill recognition

	precision	recall	f1-score	support
jump	0.98	0.96	0.97	444.0
kip	1.00	0.62	0.77	8.0
kopkip	0.00	0.00	0.00	2.0
pushup	0.92	0.99	0.95	100.0
rad	0.00	0.00	0.00	4.0
return from power	0.85	0.90	0.87	108.0
rol2kip	0.44	1.00	0.61	7.0
roll	0.00	0.00	0.00	2.0
rondat	0.50	0.43	0.46	7.0
split	0.89	0.50	0.64	16.0
stut	0.00	0.00	0.00	4.0
suicide	0.69	0.90	0.78	10.0
swift	0.00	0.00	0.00	0.0

Table: Skill class report after weighted losses

F1 accuracies



Compare models

model ↑↓	f1-macro-avg ↑↓	f1-macro-avg-skills ↑↓	f1-weighted-avg ↑↓	f1-weighted-avg-skills ↑↓	total-accuracy ↑↓
HAR_SA_Conv3D	24.12	2.53	69.71	37.97	75.39
HAR_Resnet_R2plus1	25.64	2.7	70.3	25.51	71.87
HAR_Resnet_MC3	25.98	1.39	69.49	9.85	69.88
HAR_Resnet_R3D	27.43	3.52	70.24	19.76	71.22
HAR_SwinT_t	49.13	32.06	91.28	89.4	91.99
HAR_MViT	51.53	27.75	93.11	90.7	93.83
HAR_MViT_extra_dense	51.96	31.46	93.1	91.45	93.73
HAR_SwinT_s	52.36	36.73	92.8	91.79	93.3

Comparing judge scores

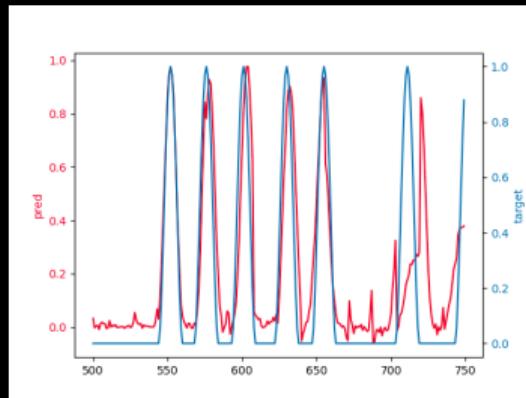
- 20.94% MViT extra dense
- 21.68% MViT
- 23.83% SwinT s
- 27.72% SwinT t
- 38.85% Resnet MC3
- 53.09% Resnet R3D
- +47.15% Resnet R2plus1

AI Judge assistant

Localize



Segment



Recognize

cartwheel
handstand
2 rotations
1 hand
2 feet

...

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Video example



▶ Click to play the video

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