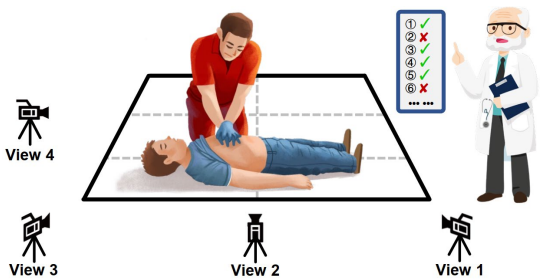
CPR-Coach: Recognizing Composite Error Actions based on Single-class Training

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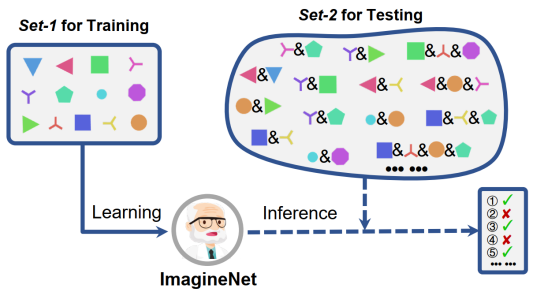
Homepage: https://github.com/Shunli-Wang/CPR-Coach

Introduction

- Cardiopulmonary Resuscitation (CPR) is an essential skill in emergency treatment. Currently, the assessment of CPR skills mainly depends on dummies and trainers, leading to high training costs and low efficiency.
- For the first time, this paper constructs a vision-based system to complete error action recognition and skill assessment in CPR.



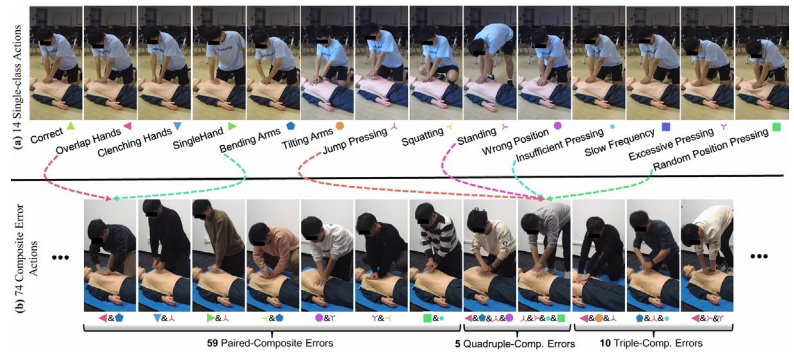
- **The main contributions of this paper are as follows:**
  - We propose the first CPR skill assessment dataset named CPR-Coach.
  - To solve the unavoidable *Single-class Training & Multi-class Testing* problem, we propose ImagineNet to improve the model's multi error recognition performance under restricted supervision.
  - Extensive comparison and actual deployment experiments verify the effectiveness of the framework.



Dataset & Method

- **Fine-grained Error Recognition Dataset in CPR Assessment**

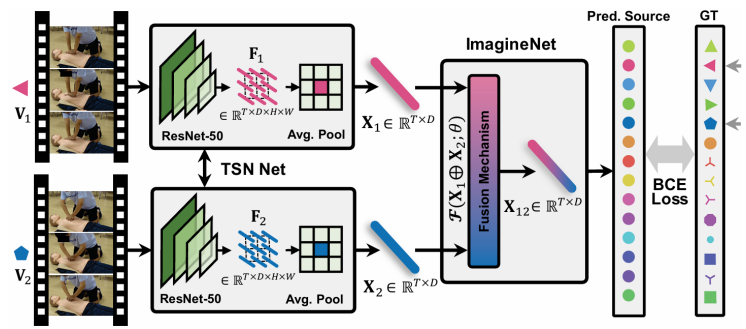
We propose a dataset named CPR-Coach in the visual CPR assessment task, which supports fine-grained action recognition and composite error recognition tasks.



- ***Set-1*** contains 1 correct action and 13 types of single-error actions.
- ***Set-2*** contains 74 types of composite error actions.
- **74** contains **59 paired-**, **10 triple-**, and **5 quadruple**-composite errors.

- **The First Composite Action Recognition Algorithm & System**

We propose a human-cognition-inspired framework named ImagineNet, which significantly improved the composite error recognition performance under restricted supervision.



System Demonstration

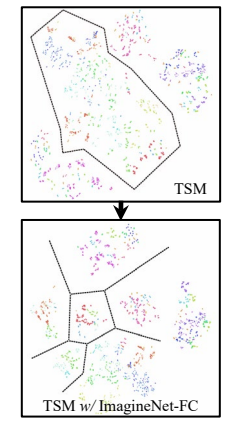
- **Qualitative and Quantitative Results**

Performance comparison between direct migration and ImagineNet-FC.

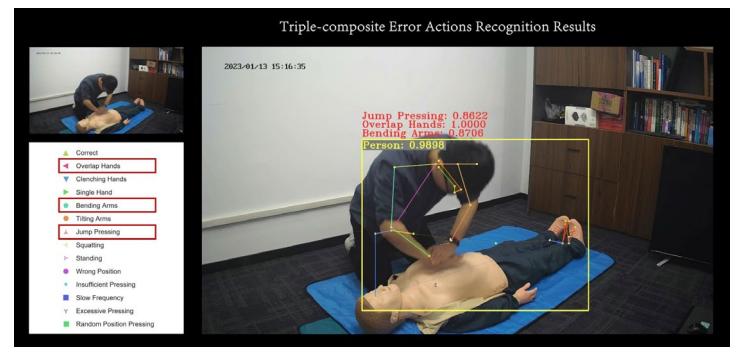
Model	mAP	Δ	mmit mAP	Δ
TSN [58]	0.5598	—	0.6143	—
w/ ImagineNet-FC	**0.6259**	↑ 6.61%	**0.6893**	↑ 8.50%
TSM [31]	0.5662	—	0.6618	—
w/ ImagineNet-FC	**0.7053**	↑ 13.91%	**0.7566**	↑ 9.48%
ST-GCN [63]	0.5776	—	0.6692	—
w/ ImagineNet-FC	**0.6404**	↑ 6.28%	**0.7115**	↑ 4.23%
MMNet [65]	0.5948	—	0.6735	—
w/ ImagineNet-FC	**0.6927**	↑ 9.79%	**0.7478**	↑ 7.43%

Model	mAP	Δ	mmit mAP	Δ
Vi-ViT [2]	0.5582	—	0.6651	—
w/ ImagineNet-FC	**0.6587**	↑ 10.05%	**0.7523**	↑ 8.72%
MViTv2 [13]	0.5715	—	0.6740	—
w/ ImagineNet-FC	**0.6869**	↑ 11.54%	**0.7461**	↑ 7.21%
Video Swin [15]	0.5696	—	0.6701	—
w/ ImagineNet-FC	**0.7082**	↑ 13.86%	**0.7638**	↑ 9.37%

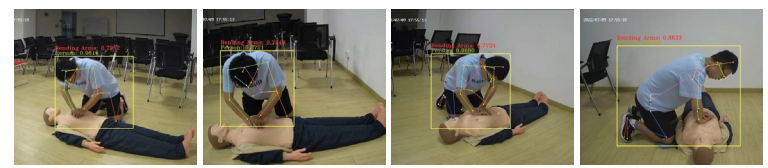
t-SNE Feature Visualization



- **Composite Error Actions Recognition Results**



- **Multi Perspective Recognition Results**



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