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IVAC-P²L: Leveraging Irregular Repetition Priors for Improving Video Action Counting

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01 ABSTRACT

Video action counting faces interruptions and variable cycle lengths. IVAC-P²L addresses these challenges through inter-cycle consistency and cycle-interval inconsistency with a pull-push objective, improving OBO by 8.61%, 10.00%, and 4.61% across three benchmarks.

Research question

How can repetitive actions be accurately counted despite interruptions and variable cycle lengths?

02 METHOD

IVAC-P²L combines multi-scale video features and temporal self-similarity to predict action densities. Its key innovation is a pull-push objective that aligns action-cycle representations while separating them from non-repetitive intervals.

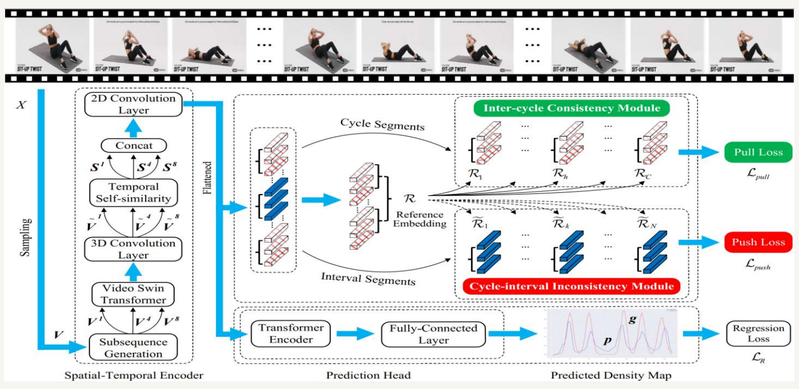


Figure 1. IVAC-P²L aligns action cycles and separates non-repetitive intervals for density-based counting.

Implementation details

RepCount-A: 758 train / 131 val / 152 test videos. Input: 64 frames at 224 × 224. Adam; batch size 64. ERCA augments count diversity. Loss: $L = L_{pull} + L_{push} + L_{MSE}$.

03 RESULTS

Train on RepCount-A; evaluate its test set and the UCFRep / Countix validation sets. Transfer uses no dataset-specific fine-tuning. Lower MAE and higher off-by-one accuracy (OBO) are better.

Off-by-one accuracy across three datasets

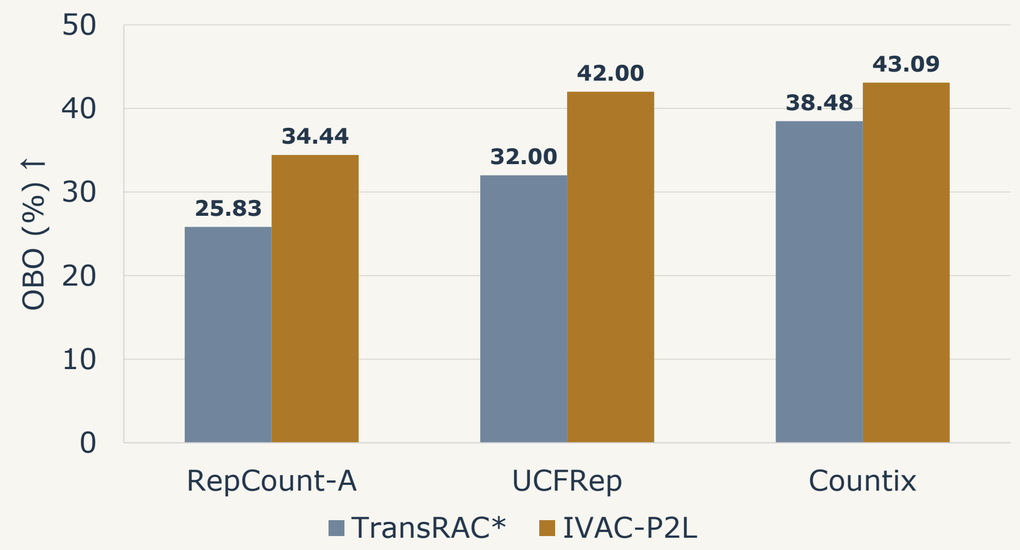


Figure 2. Reported OBO (paper Tables III-IV). TransRAC* was re-run with the proposed data augmentation ERCA.

Table 1. Counting performance and generalization.

Methods	RepCount-A (MAE↓/OBO↑)	UCFRep (MAE↓/OBO↑)	Countix (MAE↓/OBO↑)
TransRAC*	0.4158 / 25.83%	0.5961 / 32.00%	0.5742 / 38.48%
IVAC-P²L	**0.4022 / 34.44%**	**0.5028 / 42.00%**	**0.5071 / 43.09%**

Key result

OBO improves by 8.61%, 10.00%, 4.61% on RepCount-A, UCFRep, Countix. On RepCount-A, pull-only / push-only / both achieve 32.45 / 31.13 / 34.44% OBO (Table VI).

04 DISCUSSION

Temporal cycle annotations are required for supervision. Subtle motion and ambiguous intervals remain challenging.

05 CONCLUSIONS

Cycle alignment and interval separation improve irregular action counting for fitness and activity analysis.

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REFERENCES / ACKNOWLEDGEMENTS

[1] Hang Wang et al. IVAC-P²L: Leveraging Irregular Repetition Priors for Improving Video Action Counting. TMM, 2025. [NSFC U24B20185, 62441238]