NATIONAL YANG MING CHIAO TUNG UNIVERSITY

CoVis LABORATORY

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RAPrivacy: a Readable Anonymizer for Privacy Preserving Action Recognition

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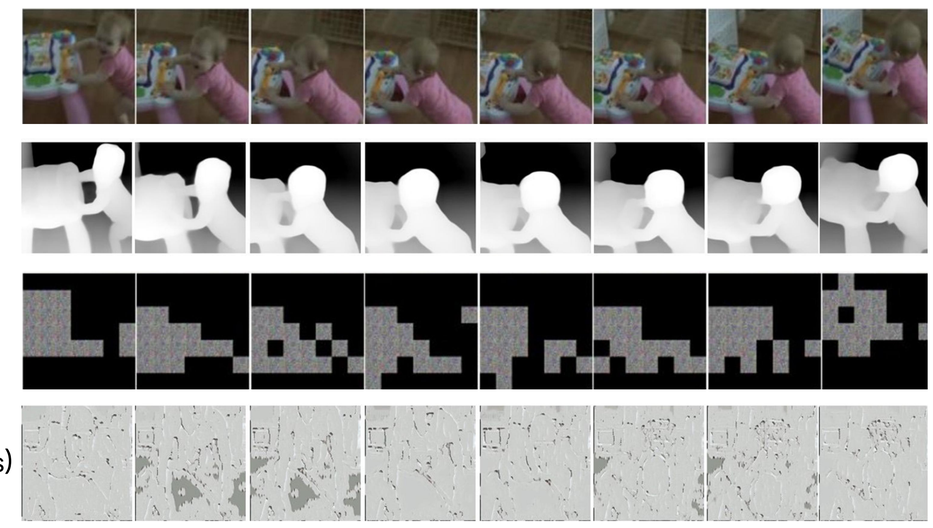
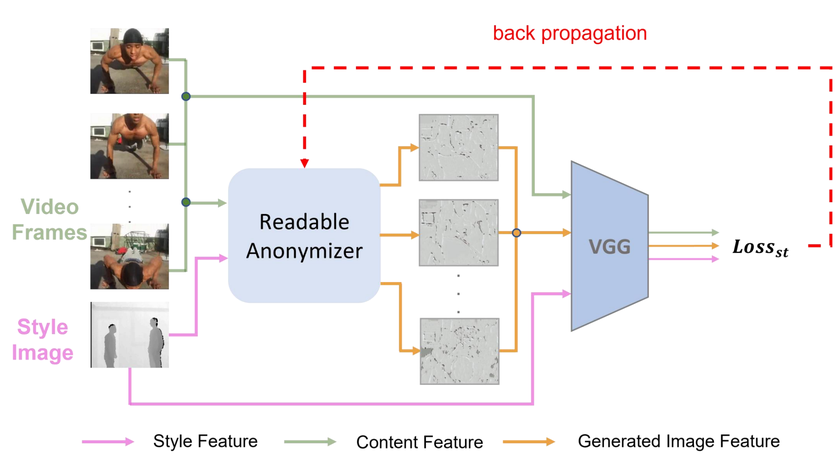
Video on YouTube

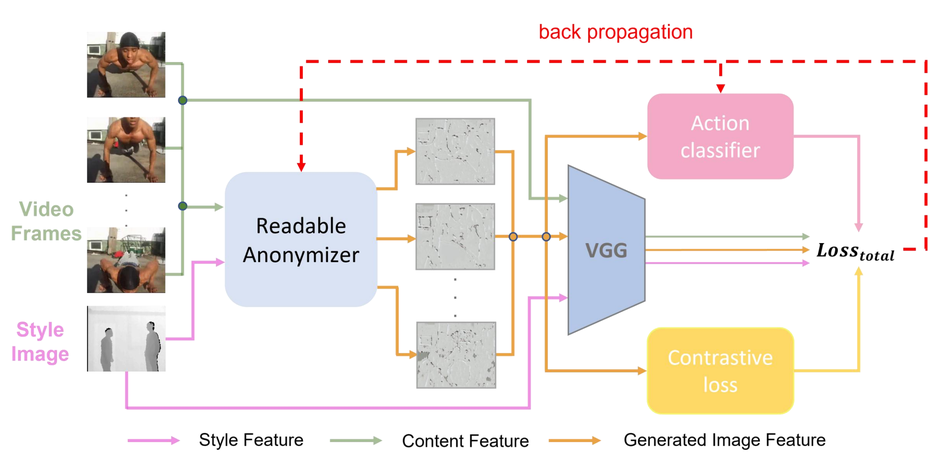
Introduction & Motivation

- Action recognition requires handling sensitive personal data. Existing methods can protect privacy but often sacrifice readability.
- Readability helps in understanding, re-annotation, error checking and secondary development
- **Goal:** Strike a balance between privacy protection, recognition accuracy, and human-eye readability.

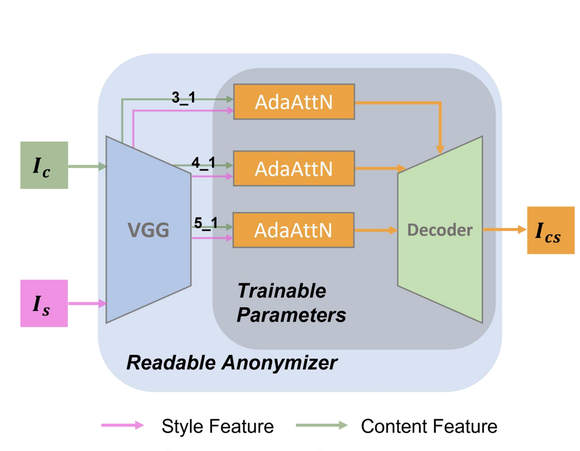




(a) Phase1: Style Adaptation



(b) Phase2: Action Recognition and Privacy Preserving Enhancement



Proposed Method: RAPrivacy

- Core Components
  - Readable Anonymizer (based on AdaAttN [1] + VGG-19 [2])
  - Action Classifier
  - Privacy Protector (Adversarial + Contrastive Loss, no privacy labels needed)
- Style Transfer
  - Using a depth image as a style source, preserving outlines and removing details

[1] S. Liu et al., "Adaattn: Revisit attention mechanism in arbitrary neural style transfer," ICCV 2021.
[2] K. Simonyan and A. Zisserman, "Very deep convolutional networks for large-scale image recognition," arXiv preprint 2014.

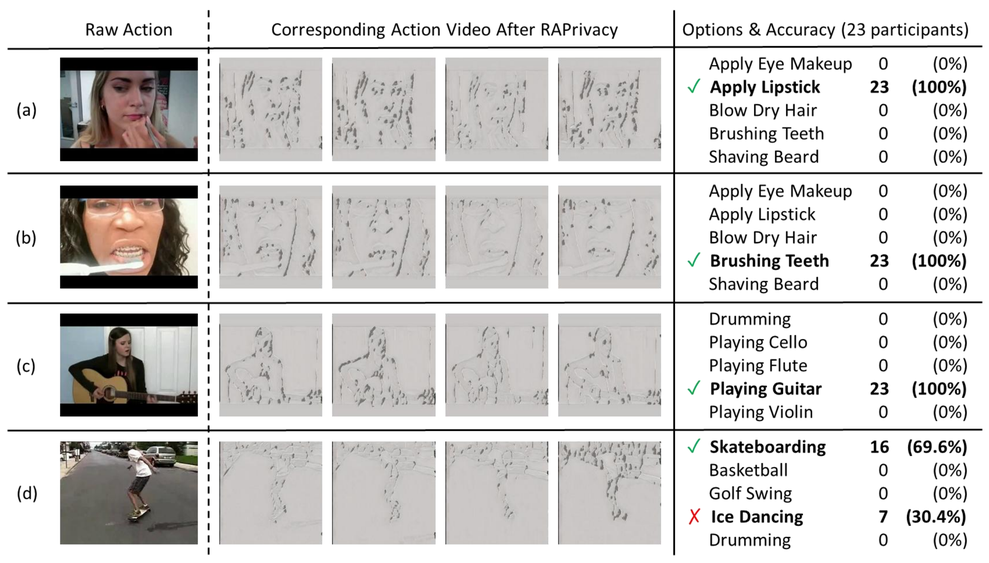
Experiments

- Datasets: VP-UCF101, VP-HMDB51
- Metrics
  - Recognition → Top-1 Accuracy
  - Privacy → cMAP, F1 (lower better)
- Results
  - Accuracy close to/better than SOTA
  - Optimal privacy protection
  - Maintain human readability

➢ **Balances privacy, accuracy, and readability**

User Study

- 23 participants, 98.3% accuracy
- Misjudgments occurred only in extremely similar actions (e.g., skateboarding vs. ice dancing)



Ablation Study

- Different styles: Depth > Colorful > Monochrome
- Frame difference: Good for privacy but low readability

Method	Privacy Learning	Readability	VP-HMDB51			VP-UCF101		
			Top-1 (↑)	F1 (↓)	cMAP (↓)	Top-1 (↑)	F1 (↓)	cMAP (↓)
Raw Data		✓	51.44	0.673	75.58	84.20	0.684	76.62
Depth Image		✓	51.49	0.672	75.48	83.57	0.681	76.52
Downsample-2×		✓	40.80	0.601	71.35	72.79	0.620	71.49
Downsample-4×		✓	31.32	0.594	69.79	56.07	0.615	69.85
Blackening [8]		✓	38.27	0.649	74.06	69.41	0.660	75.37
StrongBlur [8]		✓	40.91	0.655	74.33	73.94	0.672	75.58
WeakBlur [8]		✓	47.24	0.663	75.11	77.31	0.678	76.03
Collective [34]	✓		46.88	0.651	74.12	78.01	0.663	75.22
VITA [32]	✓		48.11	0.638	73.89	78.49	0.657	75.36
SPAct [8]	✓		48.56	0.642	73.78	78.40	0.651	75.29
STPrivacy [17]	✓		**50.73**	0.613	72.48	**82.55**	0.634	73.79
RAPrivacy (ours)	✓	✓	50.12	**0.605**	**70.12**	78.7	**0.626**	**70.50**