

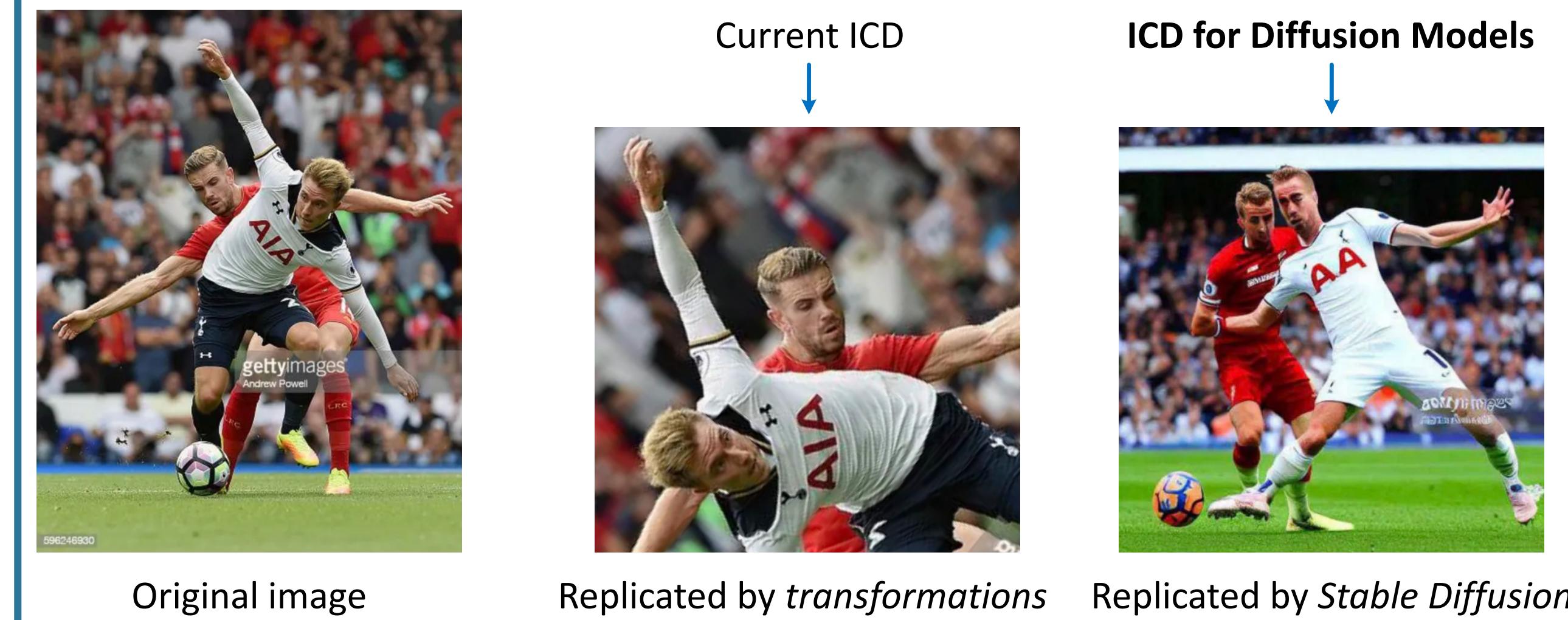
*corresponding author

Introduction

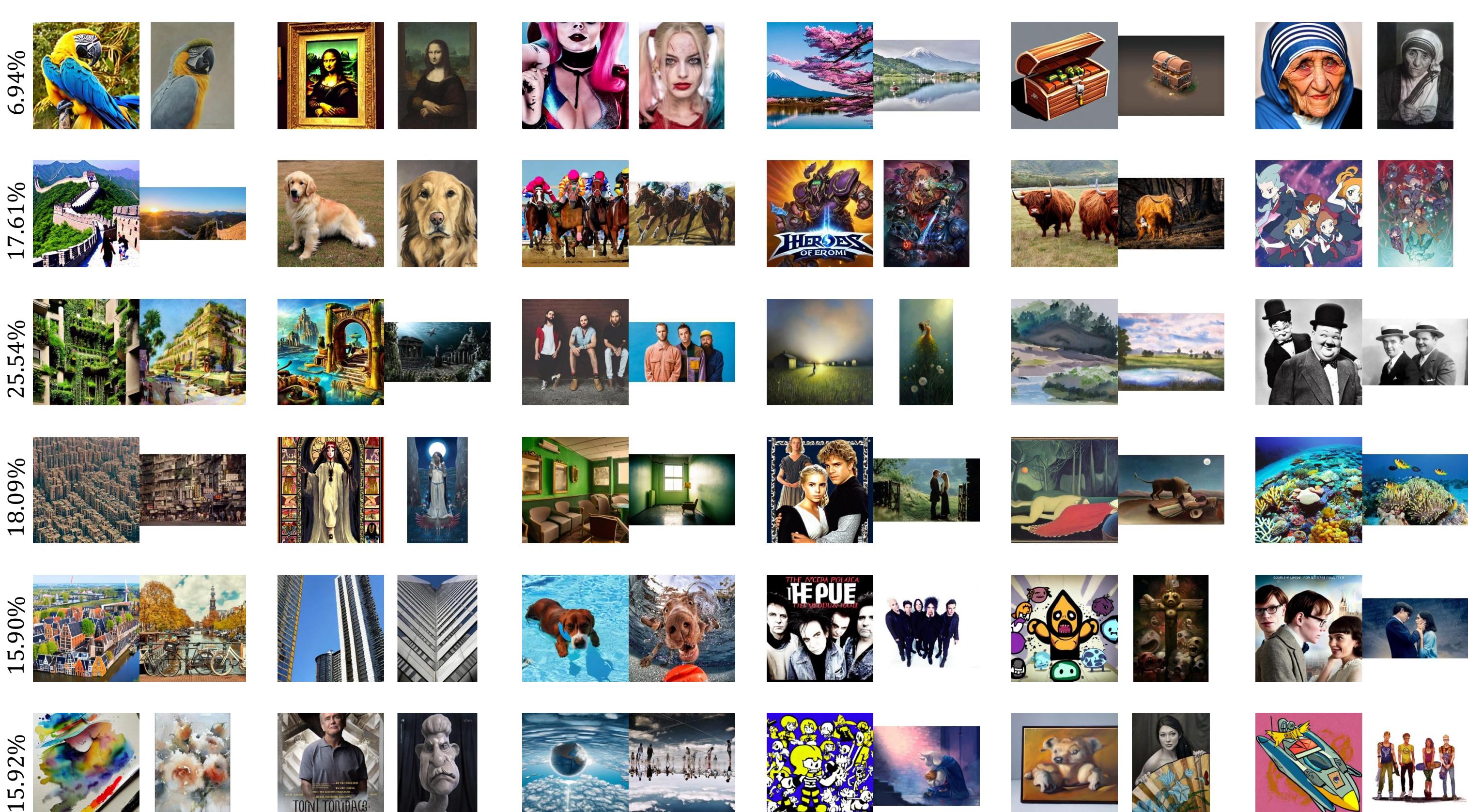


- We propose a timely and important ICD task, i.e., Image Copy Detection for Diffusion Models (ICDiff), designed specifically to identify the replication caused by diffusion models.
- We build the first ICDiff dataset and introduce PDF-Embedding as a baseline method. PDF-Embedding transforms replication levels into probability density functions (PDFs) and learns a set of representative vectors for each image.
- Extensive experimental results demonstrate the efficiency of our proposed method. Moreover, we discover that between 10% to 20% of images generated by six well-known diffusion models replicate contents of a large-scale image gallery.

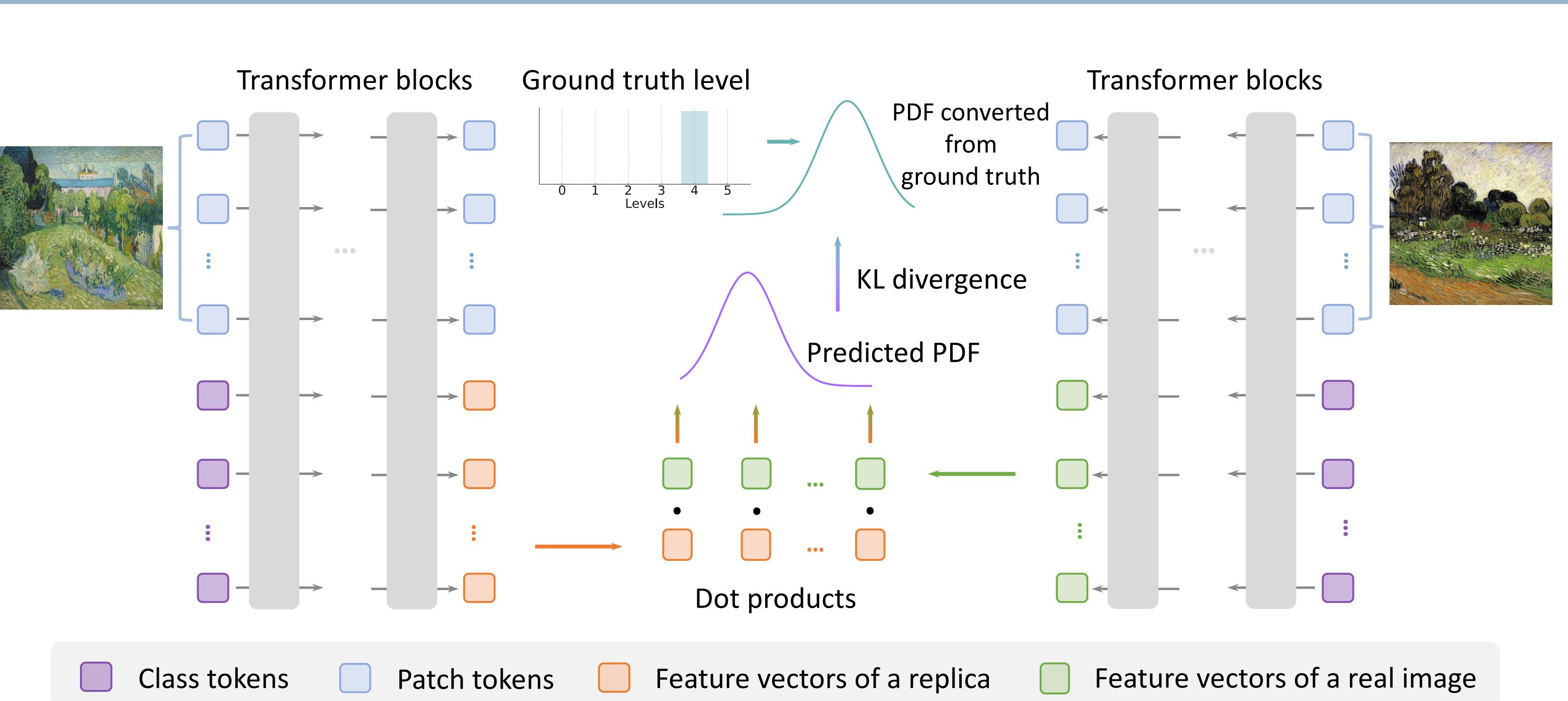
Current ICD and the proposed ICDiff



D-Rep Dataset



PDF-Embedding



Evaluation Metrics

- Pearson Correlation Coefficient

$$PCC = \frac{\sum_{i=1}^n (s_i^p - \bar{s}^p)(s_i^l - \bar{s}^l)}{\sqrt{\sum_{i=1}^n (s_i^p - \bar{s}^p)^2} \times \sqrt{\sum_{i=1}^n (s_i^l - \bar{s}^l)^2}}$$

- Relative Deviation

$$RD = \frac{1}{n} \sum_{i=1}^n \left(\frac{|s_i^p - s_i^l|}{\max(N - s_i^l, s_i^l)} \right)$$

Experiments

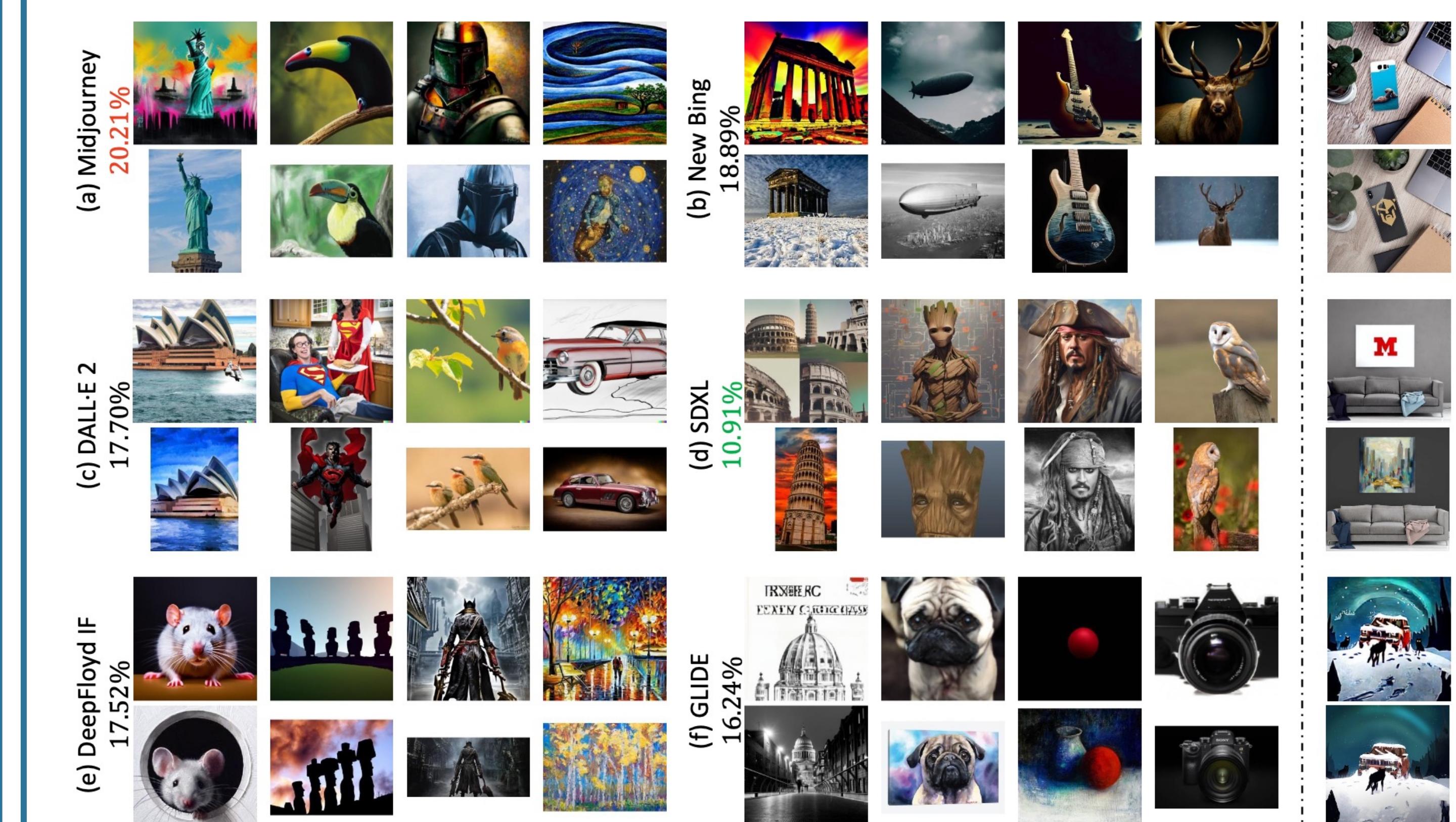
- Publicly available models fail on the D-Rep.

Class	Method	PCC (%) ↑	RD (%) ↓
Vision-language Models	SLIP [41]	31.8	49.7
	BLIP [42]	34.8	41.6
	ZeroVL [43]	36.3	36.5
	CLIP [32]	36.8	35.8
Self-supervised Learning Models	GPT-4V [44]	47.3	38.7
	SimCLR [45]	7.2	49.4
Supervised Pre-trained Models	MAE [46]	20.7	67.6
	SimSiam [47]	33.5	45.4
	MoCov3 [48]	35.7	40.3
	DINOv2 [49]	39.0	32.9
Current ICD Models	EfficientNet [50]	24.0	59.3
	Swin-B [51]	32.5	38.4
	ConvNeXt [52]	33.8	36.0
	DeiT-B [40]	35.3	41.7
	ResNet-50 [53]	37.5	34.5
Current ICD Models	ASL [14]	5.6	78.1
	CNNCL [18]	19.1	51.7
	SSCD [15]	29.1	62.3
	EfNet [19]	30.5	62.8
	BoT [17]	35.6	53.8

- Our method shows superiority over others.

Method	PCC (%) ↑	RD (%) ↓	Train (s/iter) ↓	Infer (s/img) ↓	Match (s/pair) ↓
Enlarging PCC	54.4	40.1	0.293	2.02×10^{-3}	1.02×10^{-9}
Reducing RD Regression	15.1	29.9	0.294	0.292	0.292
One-hot Label Label Smoothing	37.6	43.3	0.310	2.07×10^{-3}	6.97×10^{-9}
Ours (Gaussian)	53.7	24.0	0.310	2.07×10^{-3}	6.97×10^{-9}
Ours (Linear)	54.0	24.6	0.310	2.07×10^{-3}	6.97×10^{-9}
Ours (Exp.)	56.3	25.6	0.310	2.07×10^{-3}	6.97×10^{-9}

- Simulated evaluation of diffusion models.



Contacting

 Project Homepage:
<https://icdiff.github.io>

 If you have any questions, please contact:
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