Stroke2Sketch: Harnessing Stroke Attributes for Training-Free Sketch Generation

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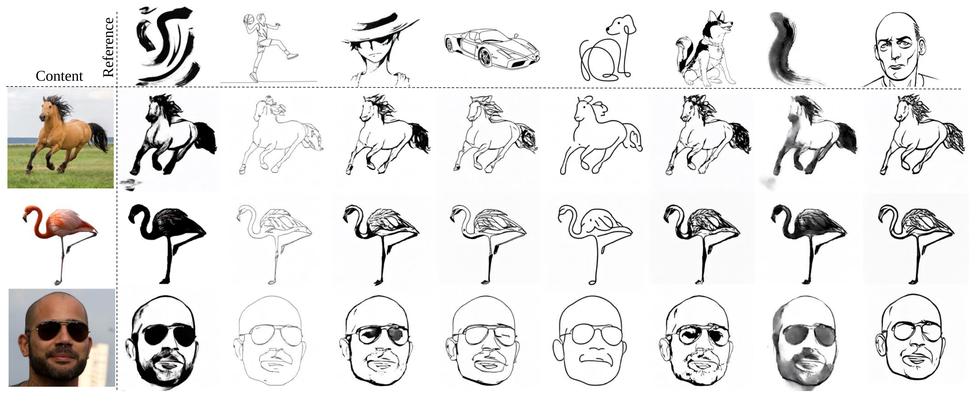
Codes
https://github.com/rane7/Stroke2Sketch

Problem Definition and Contribution

Goal: Generating sketches that align with both the content layout and the reference sketch.

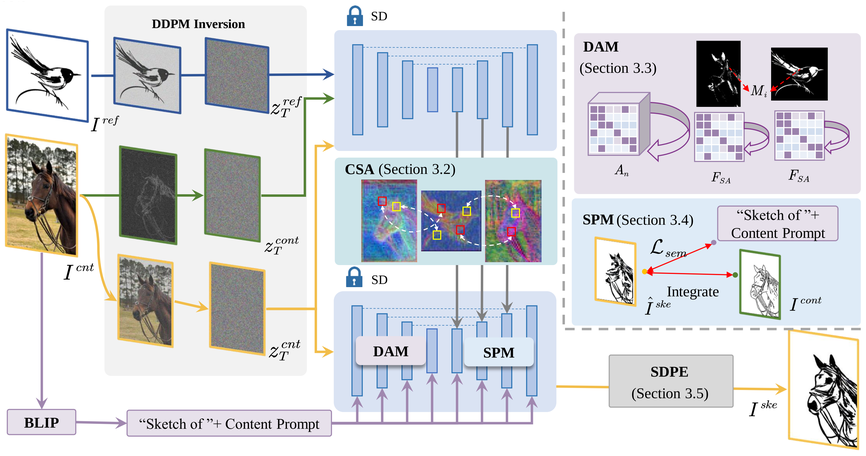


Motivations: Existing Training-based approaches (e.g., [1] [2] [6]) exhibit poor generalization to unseen styles. Current methods (e.g., IP-Adapter [3]) fail to maintain equilibrium between artistic style and content fidelity.ControlNet-based frameworks (e.g., InstantStyle [4]) attenuate subtle artistic characteristics.

Key Contributions: Training-free reference-based sketch synthesis.Novel noise injection strategy preserving textures.Layer-specific attention modulation.

Method

Stroke2Sketch takes a content image I^{cnt} and a reference sketch I^{ref} to generate a stylized sketch I^{ske} that preserves content structure while adopting reference stroke style. The framework leverages DDPM inversion and cross-image attention for semantic-aligned stroke transfer



Core Components:

- CSA for stroke attribute transfer
- DAM for foreground segmentation
- SPM with contour integration
- SDPE for detail refinement

Key Mechanisms:

$$K_t^{\text{ske}} = K_t^{\text{ref}} + \alpha K_t^{\text{cnt}} \quad (1)$$

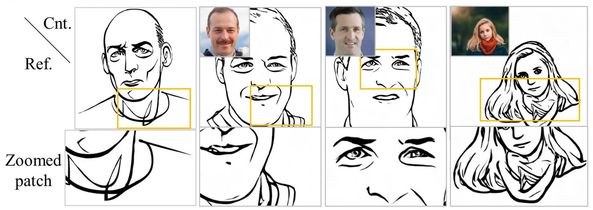
Feature blending with α controls stroke transfer. Semantic loss: $\mathcal{L}_{sem} = \lambda \cdot \text{CLIP}(I^{ske}, T^{cnt})$ ensures content alignment.

Experiments & Results

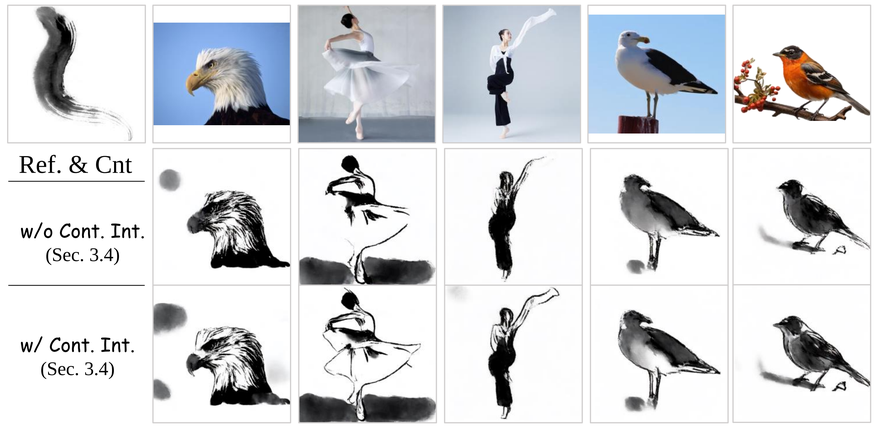
Quantitative comparison on Stroke2Sketch-dataset with training-based and training-free baselines:

Metric	Ours	Ref2sketch	Semi-ref	Infor-drawing	IP-Adapter	InstantStyle	InstantStyle+	StyleID
ArtFID ↓	**32.455**	45.292	33.242	34.214	33.457	32.532	37.656	35.727
LPIPS ↓	0.5315	0.6982	**0.5306**	0.6037	0.6634	0.5432	0.6532	0.5426
FID ↓	**22.435**	34.650	24.359	25.035	24.068	23.940	26.632	25.658

Shows stroke details:

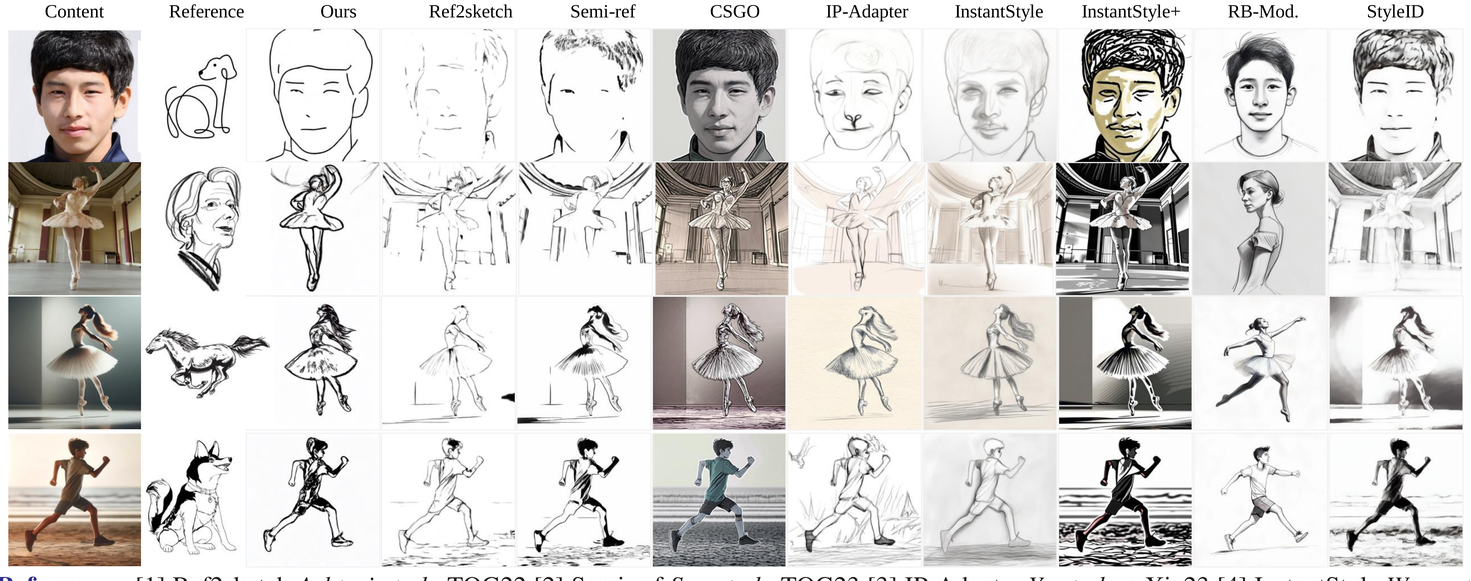


Qualitative comparison of results w/ and w/O contour integration:



Stroke2Sketch's color sketch generation:

Qualitative comparison of sketch generation across training-based (4th-6th columns) and training-free baselines (7th-11th columns) using various reference sketches. Our method (3rd column) demonstrates superior adaptability to different reference styles, maintaining both stroke fidelity and semantic consistency across a range of content and reference types:



References: [1] Ref2sketch *Ashtari et al.*, TOG22 [2] Semi-ref *Seo et al.*, TOG23 [3] IP-Adapter *Ye et al.*, arXiv23 [4] InstantStyle *Wang et al.*, arXiv24 [5] StyleID *Chung et al.*, CVPR24 [6] InstantStyle + *Wang et al.*, arXiv24 [7] Infor-draw *Chan et al.*, CVPR22