Paint Transformer

Feed Forward Neural Painting with Stroke Prediction

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What is it?

Motivation

Why neural painting?

- Computer-aided art creation fueled by AI;
- Usually done by optimizing each pixel or feed-forward pixel-wise neural networks;
- Humans paint stroke-by-stroke with different brushes;
- Replicating human behaviour can lead to more human-creation-like paintings.

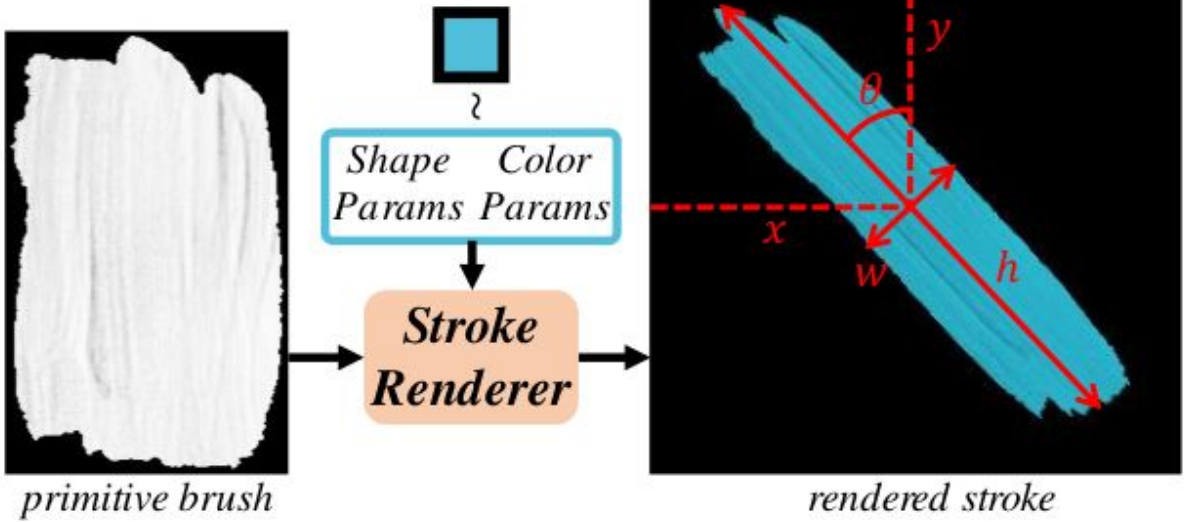
How does it work

Training

DETR (Detection Transformer)

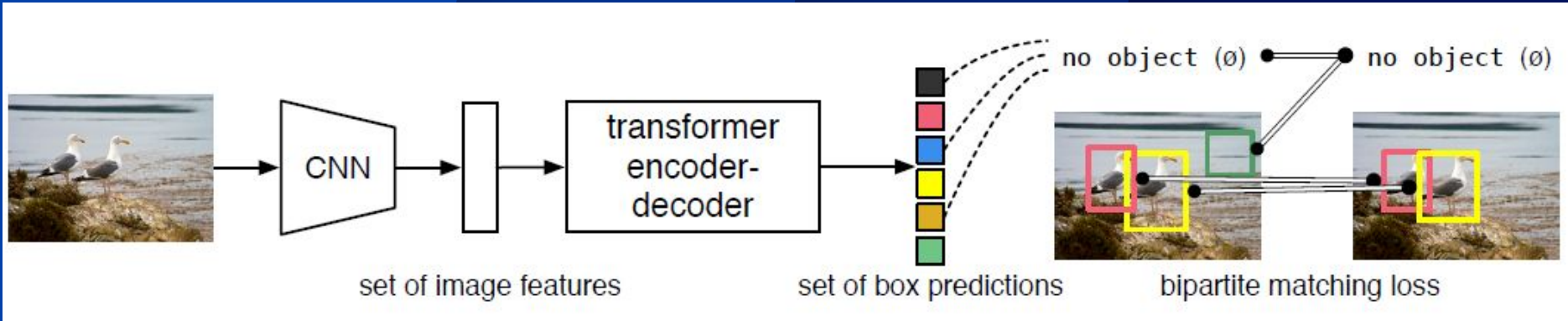
- Set prediction model;
- Largely inspired by object detection model;
- Predicts all objects at once;
- Uses bipartite matching;
- Can be easily reproduced in any framework with a standard CNN and transformer.

Stroke definition

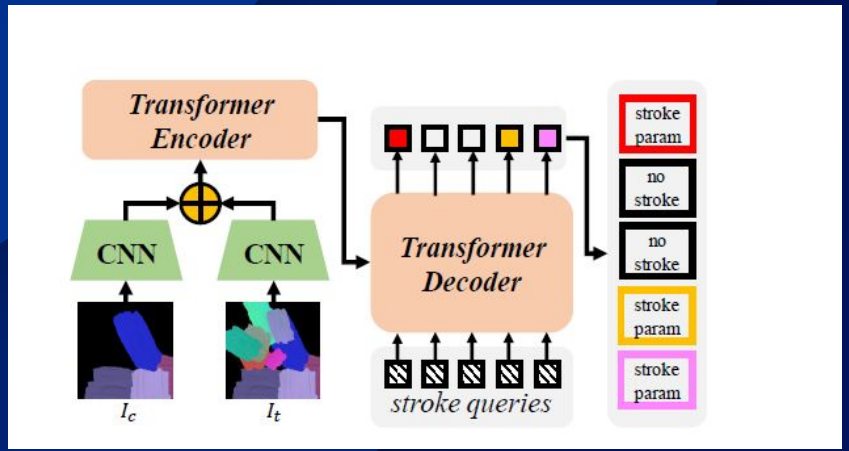


$$s = \{x, y, w, h, \theta, r, g, b\}$$

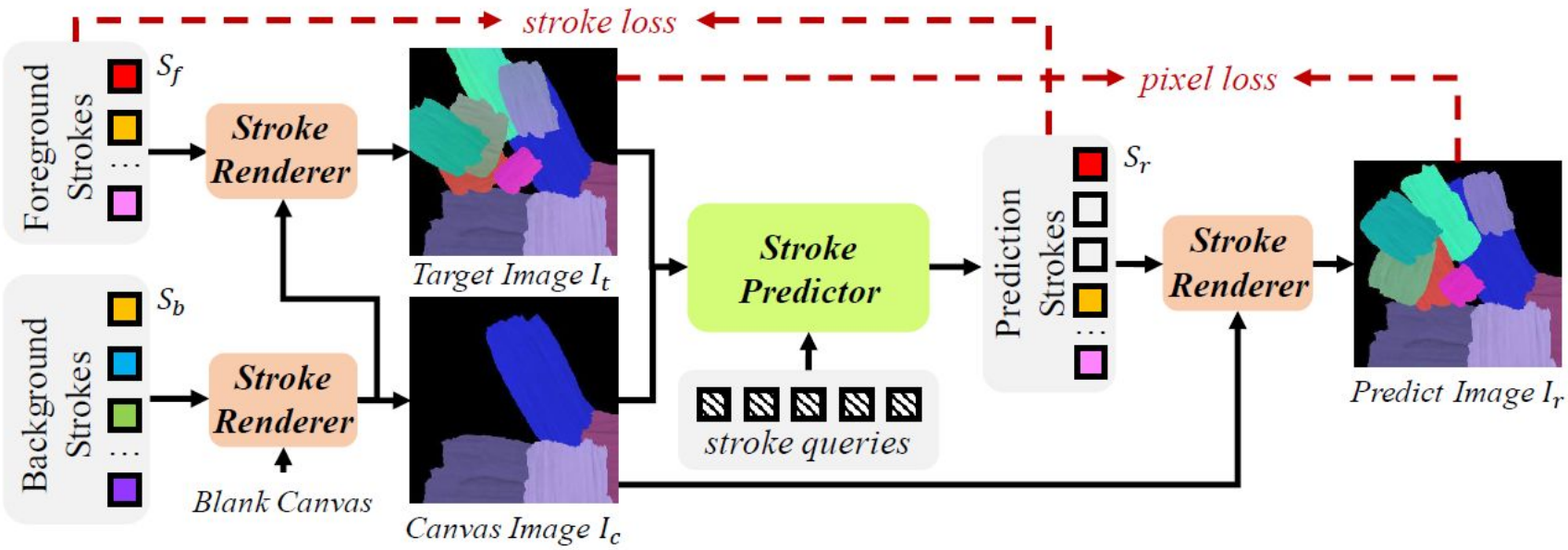
DETR



Stroke Predictor

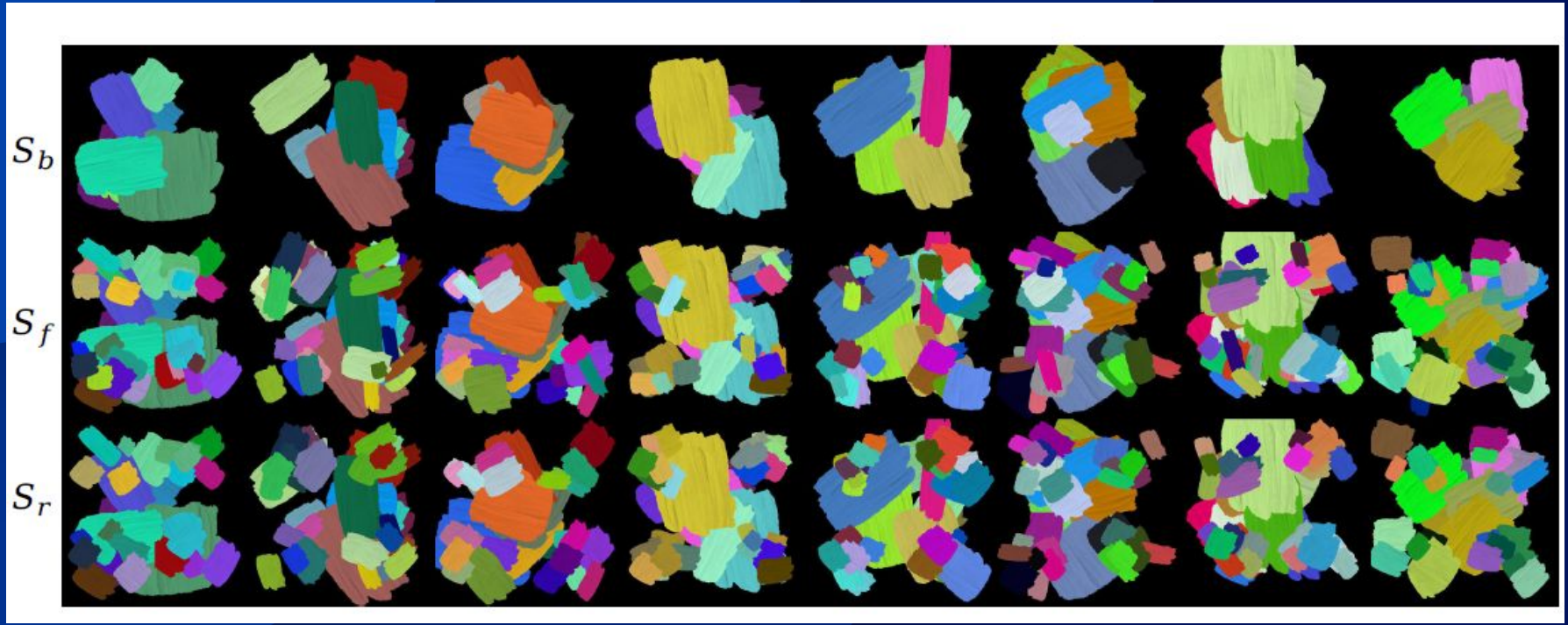


Self-training pipeline for Paint Transformer



$$\mathcal{L} = \mathcal{L}_{stroke}(S_r, S_f) + \mathcal{L}_{pixel}(I_r, I_t),$$

Canvas-target-predict pairs in training



Inference

How does it paint?

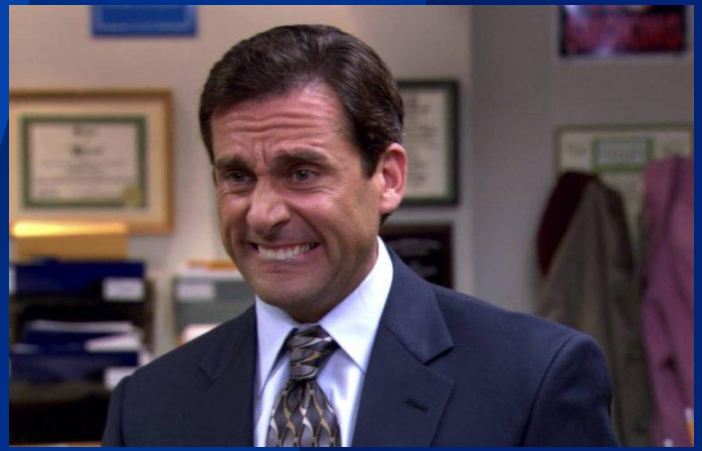
$$K = \max(\text{argmin}_K\{P \times 2^K \geq \max(H, W)\}, 0)$$

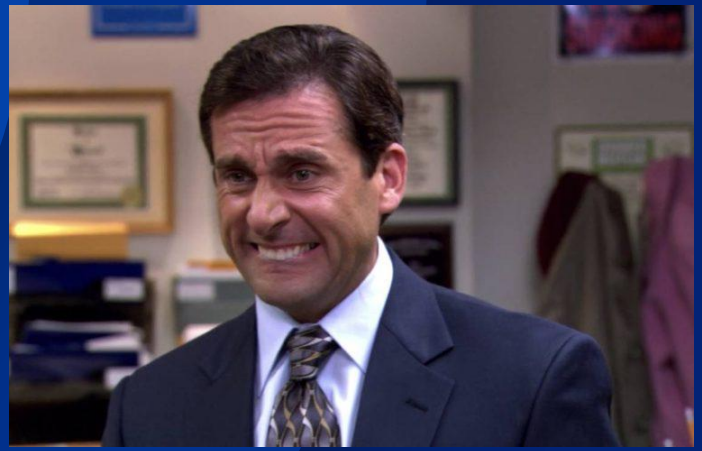
Original K = 3 K = 4

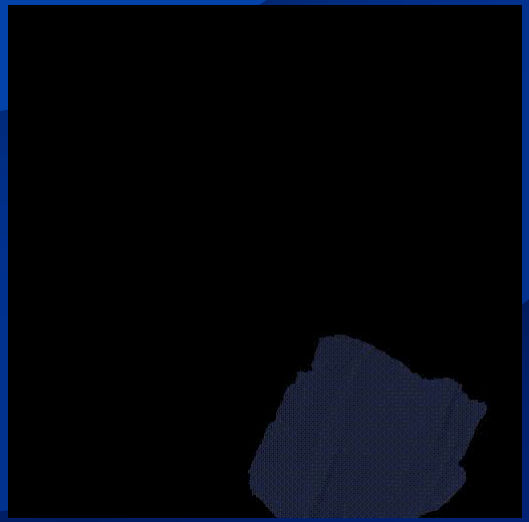
Results

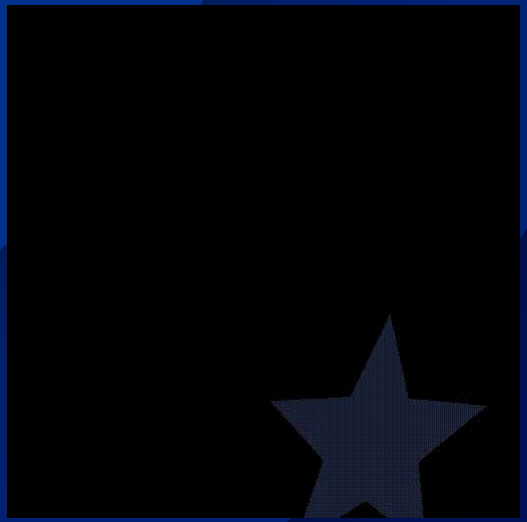
Modifications

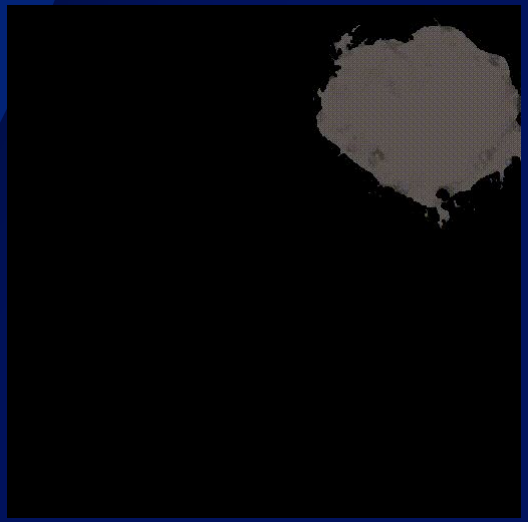
- Once trained with a primitive strokes, the Stroke Predictor can be transferred to another kind by replacing the primitive brush;
- A few different brushes were created to test this;
- The number of scales (K) used was 4.

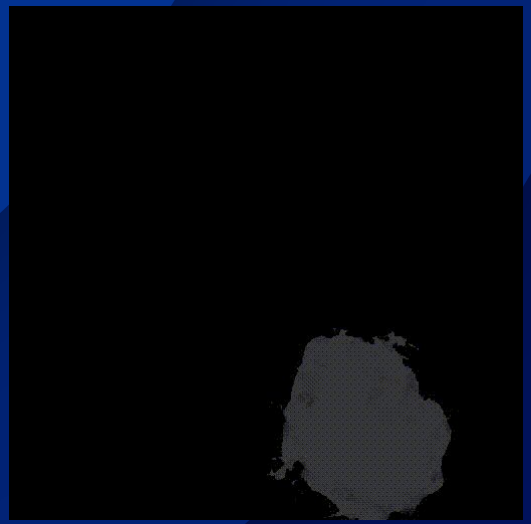


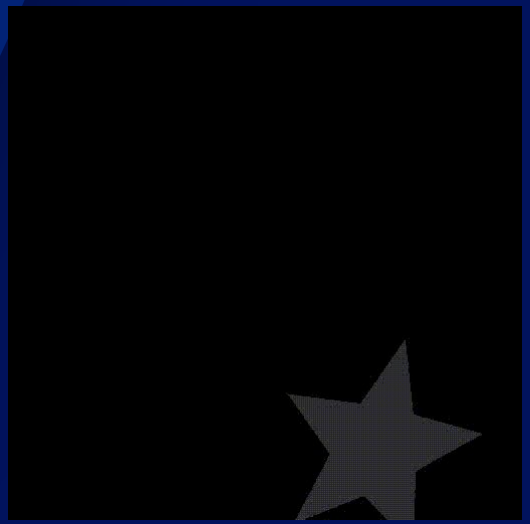












Advantages and tools

Paint Transformer advantages

- Results are usually more appealing and refreshing;
- Generates fewer strokes (less overlapping strokes);
- Runs significantly faster in comparison to some other methods;
- Requires no training data and can still accomplish good results;
- Offers better trade-off between artistic abstraction and realism, compared to state-of-the-art methods.

Tools

- PaddlePaddle;
- Python;
- Python dependencies:
  - Numpy
  - OpenCV
  - PyTorch
  - PIL

References

- Papers with code link to the chosen paper
- DETR paper
- Original Transformer paper