LanePainter: Lane Marks Enhancement via Generative Adversarial Network

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Introduction

Lane detection has achieved outstanding progress in recent years. However, the performance of lane detection algorithms struggle with low-quality marks as shown below. In this research, we propose LanePainter, a Generative Adversarial Network (GAN) based model, which simultaneously classifies and enhances lane markings. We also present a new public dataset which annotates low-quality lane marks to serve as a benchmark in the field.

Figure 1. Two low-quality lane mark images random sampled from our dataset.

Methodology

Due to the difficulty of gathering low-quality and high-quality lane mark pairs, we adopted a GAN which is an unsupervised technique. The overview of LanePainter is shown below. It contains a two-branch U-Net Generator and a multi-scale discriminator.
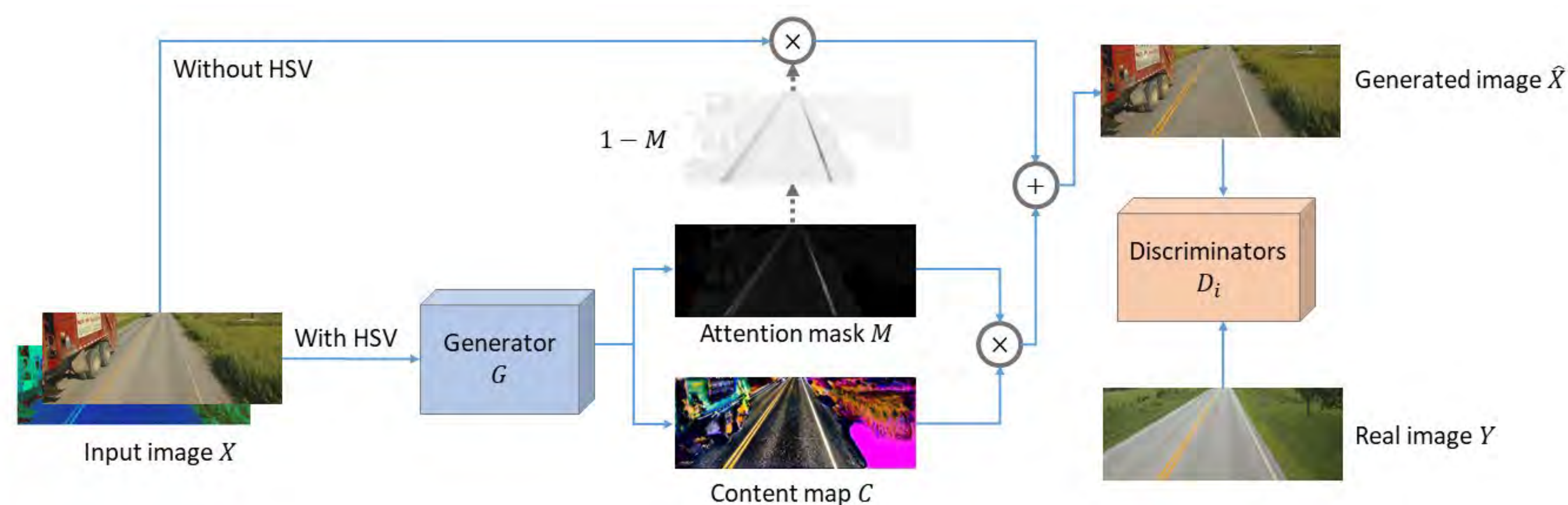

Figure 2. Overview of our proposed LanePainter model.

Results

We performed classification analysis on our test set. We achieved *98.16%*, *98.59%*, *97.48%*, and *97.99%* in accuracy, precision, recall, and F1 score respectively which demonstrates that our proposed model accurately classifies the quality of the lane marks.

In our quantitative analysis, we adopted a pre-trained lane detection model, SCNN, to detect low-quality lane marks before and after it is augmented by LanePainter in 6 different configurations. The result demonstrated that we achieved an average *15.38%* improvement on F1 score. Even with ResNet101 as the backbone, our model still achieved a *5.93%* improvement on the F1 score.

Figure 3. Enhanced lane marks from Figure 1.

Conclusion

Our proposed model will help VTrans in reducing their burden of manually annotating low-quality roads. Additionally, it can improve the performance of lane detection algorithms under low-quality lane mark conditions.

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References

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