TER2021 – 033 Deep Learning to paint like Van Gogh

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INTRODUCTION

Goal: transfer the artistic **style of Van Gogh** from his paintings to real images.

Main points of the paper:

- New data can be generated when real data is missing, and the dataset containing all Van Gogh's paintings can be augmented.
- Several techniques proposed to transfer artistic style, from **Convolutional Neural Networks** to **Generative Adversarial Networks**.
- Three approaches are proposed here, and they take into account semantics of images, introducing some novelty to state-of-the-art.
- **Paired dataset**, containing couples of samples coming from two different domains: Van Gogh's paintings (*style* images) and real photos (*content* images).

Intuiton: if a landscape painting contains both the sky and trees, it is very likely that Van Gogh used different styles to paint these elements.

PRE-PROCESSING

- It is hard to directly segment paintings since all the pre-trained segmentation models have been trained on real pictures.
- A solution is to first convert paintings to real images through a CycleGAN [1] and then compute segmentation masks.
- Semantics of images is extracted using the approach coined by Penhouët et al. [2], that uses image segmentation and **semantic grouping** to merge minority classes in order for the masks of each pair of images to match.

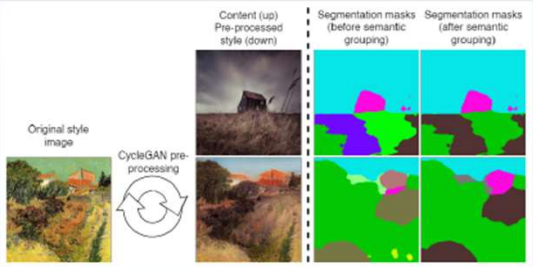

Fig. 1: Pre-processing step.

PATCH-BASED NEURAL STYLE TRANSFER

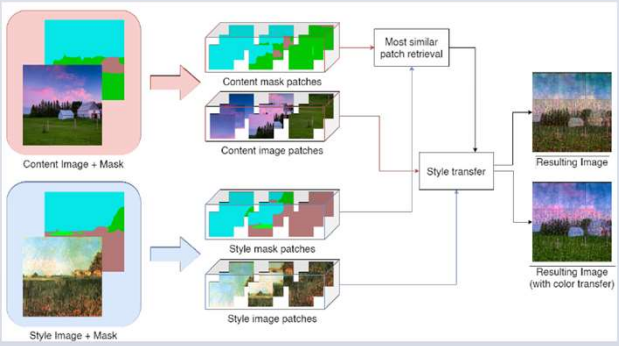

Fig. 2: First architecture tested (later referred to as PbP).

All the masks and the corresponding images are cropped. Then, each patch of the photo is matched with the patch of the painting having the most similar semantic content. Then the style is transferred patch by patch, and in the end the whole resulting image is recomposed.

NEURAL DOODLE

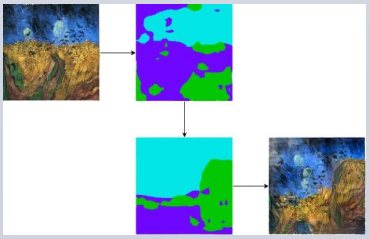

Fig. 3: The composition of each element in the image is re-shaped based on the semantics of the real photo [3].

PHOTOREALISTIC INTO PAINTING-LIKE ARTISTIC STYLE TRANSFER

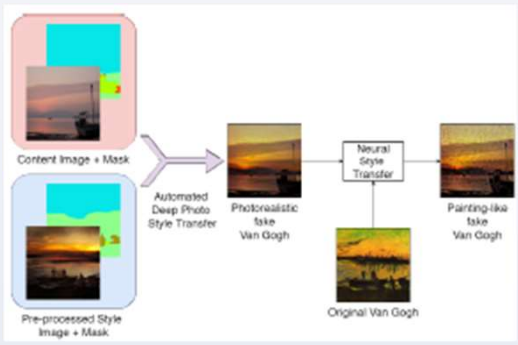

Fig. 4: In this workflow, the style is first transferred in the photo-realistic domain from the painting to the photo. The resulting image and the original painting are then fed into the Neural Style Transfer model [4] as content and style images, respectively.

RESULTS

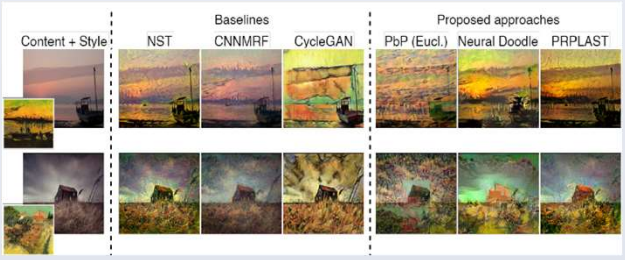

Fig. 5: Comparison between all the three models presented, and three state-of-the-art architectures: Neural Style Transfer [4], CNNMRF [5], and CycleGAN [1].

LIMITATIONS AND DISCUSSION

- Pre-processing must be refined to improve results. A strategy to test is using *Art2Real* model [6] instead of CycleGAN.
- Parameters should be fine-tuned since now they are still too generic.
- Numerical metrics are needed in order to better evaluate performances.
- An automatic way of pairing images to generate dataset would significantly reduce the amount of time required to run new experiments.

CONCLUSION

- Results of PRPLAST showed an improvement of state-of-the-art, since they are the ones exploiting the most the pre-processing phase.
- Pre-processing phase adds novelty to current literature by allowing to have better segmentation masks thanks to a conversion of paintings into real photos.

REFERENCES

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[5] Chuan Li and MichaelWand. Combining Markov Random Fields and Convolutional Neural Networks for Image Synthesis. 2016. arXiv: 1601.04589 [cs.CV].

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CONTACTS

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