Applications of Generative Adversarial Networks in images style transfer: A survey

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Introduction. Style transfer problems focus on generating new data based on two sets of samples, such that the result would feature content belonging to the first set, presented in a style specific to the second set. This follows Gatys et al.'s revolutionary findings that the content and style of an image are separable [4]. Two main subclasses of style transfer neural network models have been proposed, considering the way their inputs are structured, whether in a paired or unpaired manner [1]. Needless to say, datasets providing paired real images with corresponding artistic interpretations are rare and small in size, since their creation is a monumental task that requires a professional hand and countless hours of work for a single sample [3].

Recently, a lot of effort was put into engineering unsupervised learning solutions for artistic image generation, namely artistic style transfer. With the astonishing advances in generative models, researchers were able to produce Generative Adversial Networks that learn the defining look and feel features of the style set and consequently apply them to the input's content in the same way a human would imagine how a natural landscape would look like if painted by a renouwned painter [9]. This survey visits a handful of interesting state-of-the-art GAN applications in image style transfer domains.

Motivation. Unsupervised GANs serve as a powerful tool to automate drawing in situations where time or volume of work would become an impediment and traditional software editors would often fail to create satisfactory results [8]. The main advantage of GANs over other style transfer models is their adaptability which makes them capable of producing more sophisticated results than the traditional texture transfer approached in older studies [4] [5].

Furthermore, style transfer has given birth to valuable experiments on self-supervised representation learning (regarded as a black-box process in GANs) and feature disentangling [7]. This is a popular research topic in GANs due to the quest to understand how the model handles information in order to control and manipulate its outcome to the desired form [2] [6]. This can prove useful in style transfer applications which require non-trivial inter-domain morpholohical transformations [8].

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