Chapter 2
A Review on Image Super–Resolution Using GAN

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ABSTRACT

This study focuses on the utilization of generative adversarial networks (GANs) for generating high-resolution facial images from low-resolution inputs, which is vital for computer vision applications. Facial images present a complex structure, posing challenges for obtaining high-quality results using traditional super-resolution methods. However, recent advancements in deep learning, particularly GANs, have shown promising outcomes in this area. In this work, the authors conduct a comprehensive analysis of state-of-the-art GAN-based techniques for realistic high-resolution face image generation. They discuss the principles of image degradation, the learning process of GANs, and the challenges associated with these methods. By offering insights into the current state and future research directions, they aim to familiarize readers with the context and significance of GAN-based face image generation. This work highlights the importance of GANs in improving facial image quality and their relevance to advancing computer vision applications such as face verification and recognition.

1. INTRODUCTION

Face hallucination super resolution is a domain specific task which generally used to resolve the problem of unimaginable facial image to imaginable facial images. This task is important because face recognition is important in surveillance purpose and in computer vision (Wang, Chen, Nie et al, 2020; Yu & Porikli, 2016; Zheng & Shao, 2018). If the image is present in small pixel values, then after magnification of image it becomes blurry so it is difficult to determine face image (Chen & Tong, 2017). Therefore, Baker et.al.(2000), proposed Gaussian pyramid model for predicting high frequency of HR image. To map the face image perfectly training is required and then deep learning introduced for training the network. Deep Learning is a process in which it works on CNN network for super resolving the image and un-blur the image by different CNN models but our mainly focused is on Generative Adversarial Network GAN (Goodfellow et al., 2017), UR-DGN (Yu & Porikli, 2016), ESRGAN (Yu, 2019), WGAN (Chen & Tong, 2017), TDAE (Xu,, 2017), LS GAN (Qi, 2017), Hi-face GAN (Yang & Liu, 2020) suggested. The magnification does by the different states of art methods up to 8x. The existing SR method is totally based on the quality of the given low-resolution image & the availability of high-resolution image. The process is only applicable if, facial features can be found in low resolution image and similar image is trained as a reference for the mapping. But, still there is a margin of error for the low-resolution tiny image, Typical variation in pose, illumination issue and ghosting artifacts in the reconstructed HR image. Existing state of art method with deep learning are failed to generate authentic result of facial details because many of the techniques are patch based which ignore the information of image class. When low resolution image is super resolved using 8x magnification using upscaling techniques 98.5% of the image information is lost (Jiang, 2016; Li et al., 2020; Zhi-Song, 2019). Despite the fact that the as of recent proposed CNN-based SR arrangements give state of arts quantitative outcomes as far as peak signal to noise ratio (PSNR) when they improve for recreation losses, for example, L1 or L2 in space, the outcomes are smooth without the fine subtleties required for good perceptual quality. This issue is more obvious with the expansion of the upscaling factor. On head of that, the PSNR measure can't catch perceptually significant contrasts between two pictures as it depends on the distinction between pixel level qualities at a similar position. One approach to bring perceptually significant element into SR picture is to utilize generative adversarial network. These organizations help to make reconstruct SR pictures that appear as though HR pictures, which are normally keener and contain fine information of image. This Facial image-based task received attention recently, there are few most popular studies of FHSR based on generative adversarial network is discussed in this chapter.

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