



Scrutinizing the Implementation of Super-Resolution Techniques in Photo-Editors using Artificial Intelligence in Photography

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ABSTRACT

We can determine resolution, symmetry, content, location, and other factors by judging the quality of a photograph from the perspective of a photographer. as well as some of the other elements that influence a photograph's quality. The ever-increasing allure of photography compels us to find new ways to improve an input image in terms of the mentioned parameters. While content and placement are unchangeable, qualities like as symmetry and resolution can be improved. I prioritised resolution as our cynosure in this research, and there are various methods to refine it. In the fields of computer graphics, computer vision, and image processing, image super-resolution is increasingly becoming a requirement. It's the process of converting low-resolution photos into high-resolution ones. Image super-resolution techniques such as Interpolation, SRCNN (Super-Resolution Convolutional Neural Network), SRResNet (Super Resolution Residual Network), and GANs (Generative Adversarial Networks: Super-Resolution GAN- SRGAN and Conditional GAN- CGAN) were investigated experimentally for post-enhancement of images in photography as used by photo-editors in my research. determining the most coherent technique for achieving quality-optimized super-resolution.

KEYWORDS: interpolation, image processing, computer vision, super-resolution, gan

1. INTRODUCTION

Artificial Intelligence's introduction into the realm of technology ushered in a revolution that altered our perceptions of the world. Surprisingly, one of the most immediately impacted fields is image processing. Gone are the days of analogue and synthesised photo alteration and editing tools that could only do a little bit of everything (skill, equipment, suitable environment, capital, etc.). The advent of digitalization and artificial intelligence is likely the most significant breakthrough

in the world of photography. Humans are a demanding species. While our lenses and cameras are always improving in order to capture the most details, we still want more. As a result, post-photo editing software [5] began to use AI to upsample and preserve picture quality at the same time. AI's benefits frequently outweigh its potential drawbacks. The ways it has impacted our sector of interest are numerous, including ease of use (nearly no professional training or skills required), automation of image manipulation

processes, self-learned graphical designing tools, cost-effectiveness (most editing software and applications are free), a timely result (within milliseconds), improved visual marketing, and so on.

As an application of image super-resolution, I evaluated the technology behind numerous image post-processing or photo editing software in this study (ISR)[1][2]. The transformation of a low-resolution snapshot into an analogous and naturalistic high-resolution photograph has always been a difficult task in the fields of computer graphics, computer vision, and image processing. Image super-resolution tries to improve the resolution and quality of noisy, fuzzy, and unclear images by sharpening and boosting (raising) the resolution and quality. It's a method for recovering or restoring a high-resolution image from a set of low-resolution images. A high-resolution image is one with a resolution of 300 pixels per inch and a bigger pixel dimension, whereas a low-resolution image has fewer pixels (less than 72 ppi), higher compression, or both.[8] As a result, we have to choose between image resolution and image storage space. A collection of techniques known as super-resolution imaging can improve the resolution of any imaging system. As an input, a low-resolution indistinct image is upscaled to obtain our high-resolution desired output. Noise reduction, image upscaling, colour changes, and other SR imaging techniques are commonly used.

This study will examine the relationship between AI and photography in terms of resolution enhancement for a variety of use-cases of the most popular photo-editors currently on the market. A fair comparison of the key models used was carried out, based on the methodology used by most of these software programmes. Using a variety of SR models, I was able to demonstrate which strategy was best for restoring a better-resolved image (high-resolution image) while preserving texture details [6][7]. Nearest neighbour, bilinear, bicubic, and bicubic smoother interpolation approaches, as well as three types of deep learning algorithms (SRCNN, SRResNet, GANs: SRGAN and CGANs)[9][10][11][12] were chosen to be discussed. In this project, I used two tailored datasets of my self-clicked photographs: a floral dataset generated from a collection of photographed floral images and a similarly compiled aesthetic dataset of beautiful

imagery. Apart from photo editing, my work has applications in a variety of fields, including remote sensing (satellite imagery), aerial imagery analysis, mapping (map-making), medical image processing, image compression, and production, video enhancement, and so on.

2. LITERATURE REVIEW

With the advancement of devices and technology, there is a growing desire for images that are clear and clean. Low-resolution imaging is inevitable in several knowledge fields, such as history, archaeology, remote sensing, astronomy, medicine, and so on. Images are frequently fuzzy or noisy due to a lack of lens quality or manual errors, and it may be necessary for the owner to fix them. In some circumstances, such as investigations, criminal cases, traffic and road safety, item recognition, and so forth, graphical information may be required to be magnified for human interpretation. However, in the realm of my profession, photography, the lack that necessitates super-resolution might be any flaw that appears during the process of taking a shot, a limitation of our camera's resolution, file handling, and so on. This project is universally useful because it can improve the quality of practically any photograph. Its application can be seen in the fields of remote sensing and cartography, where improving satellite images necessitates improved extraction of elements such as buildings, landforms, soil types, traffic, and so on. There has been a lot of progress in image super-resolution. To achieve digital zoom, basic picture editing software, digital cameras, phones, and most point-and-shoot cameras use the most basic and well-known technique of interpolation [3]. Although recent advances in deep neural networks provide a superior solution for obtaining optimal pictures. Neural networks are computer-implementable mathematical instructions that allow a system to learn sampling criteria from previous data while being trained.

3. METHODOLOGY

The approach of interpolation in image processing was a fairly basic solution for noisy images. Interpolation is the process of estimating values at unknown points by pursuing sample points (points with known values). When we resample or remap a photograph, it is said to occur at some level. The low-resolution image is scaled

by a factor of 2 or 4 using bilinear, bicubic, or nearest-neighbour non-adaptive interpolation algorithms. These methods are simple to use; however, they have the drawback of causing image distortion or lowering visual quality. Interpolation methods such as bi-cubic, in general, generate fuzzy images. To reliably develop a mapping connection between low-resolution images and their high-resolution counterparts, they use the internal homogeneity of a given image as input or distinct datasets of low-resolution images and their high-resolution counterparts. These include super-resolution methods that primarily employ the sparse coding method. Photoshop uses the interpolation method to assign colour values to new pixels based on the colour values of existing pixels when resampling photos. Resampling is the process of altering the aggregate of image data by modifying the image's pixel measurements or resolution. Image quality may suffer as a result. Up sampling increases the number of pixels, whereas down sampling reduces the number of pixels or removes information from the image. To determine how pixels are added or deleted, we specify an interpolation method. Nearest neighbour interpolation, a rapid but less exact approach for replicating pixels, is one of the most popular interpolation techniques for balancing abnormalities such as edge halo, alias, and blur. It's utilised for images with non-anti-aliased edges (anti-aliasing is the process of smoothing jagged edges in digital photographs by averaging the colours of pixels along the border). It minimises visual faults caused by high-resolution photos being shown as low-resolution) in order to keep stiff edges and produce a tiny file. Following that, the bilinear interpolation method adds pixels by averaging the colour values of nearby pixels. It has an accuracy that falls in the middle of the spectrum. Finally, as seen in Fig. 2, the bicubic interpolation technique is slow yet precise. It produces smoother tonal gradations since it is based on examining the values of a nearby pixel using complicated calculations. As a smoother form of bicubic interpolation, we have the bicubic smoother method.

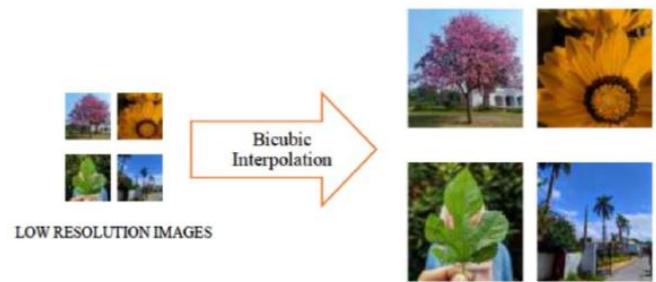


Fig. 1. Bicubic Interpolation Intition

4. CONCLUSION

The quality of output images provided by each of the five models under consideration was inspected and examined. The best version of super-resolved imagery is provided by both of our Generative Adversarial Network (GAN)[4] models: SRGAN and CGAN. As a result, they can practically enhance all forms of low-resolution images in photo-editors with greater precision, and they outperform all previous image super-resolution approaches used in my research. A photo-editor based on the CGAN technology will be capable of producing excellent results. We'll be able to get even cleaner pixels and more optimal results with a larger number of training epochs.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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