Super-Resolution of Lightweight Images Based on Deep Learning

Haozhe Wu *

Adcote international high school, Shanghai, China

* Corresponding Author Email: 1910821108@mail.sit.edu.cn

Abstract. As digital imaging technology advances, a significant breakthrough is the emergence of super-resolution technology, a method to enhance the quality of low-resolution images to high-resolution. When there are some developing of the newest digital camera's skills, the super-resolution technology is appearing and getting more and more importance. In the simplest terms, the image super-resolution skill is the technology of which one cover the process from low resolution images to high resolution images skills. This technology differs from the traditional approach in that it is attracting more and more attention from researchers and practitioners. This method is important in the future. With the passage of time, it will be more and more mature. In this paper, we focus on how to improve image resolution by using various technologies, and summarise the results obtained in recent years. Then, we briefly introduce the background and development of super resolution, then briefly introduce the technology. Finally, we come to a few conclusions regarding Deep Learning.

Keywords: Deep Learning; Image Super Resolution.

1. Introduction

In the nearest years, with the rapid progress in deep learning directions, many researchers have been working hard to discover a way to use a deep learning approach to reconstruct super-resolution images [1]. The method allows for the extraction of more expression features from data sets and adapts the relationship between low-resolution images and high-resolution images [2]. Image super-resolution is the process of using an algorithm to recover the low-resolution image into the high-resolution imaging. It can recover the picture of higher resolution. With the newest HD displays are becoming more popular in many countries all over the world, the technique for making images clearer has been applied to a wide range of applications such as medical surveillance and satellite imagery [3]. Here, we can see the Fig. 1 in the image below.

But the super image resolution building skills are necessary to rebuild the quality of the picture and recover the detail, let that be more and more clearly. Recently, CNN (convolutional neural networks) have been universal used in many applications in our lives. There are three different main kinds of the super rendering: single-picture super resolution, SISR and MISR. But the super resolution techniques are necessary to enhance the quality of the picture and to recover more level of details. Recently, convolutional neural networks have been widely used in many applications, such as image super-resolution. There are three main types of super rendering: single-picture super resolution, SISR and MISR.

This can be done in two main approaches: Shallow Learning and Deep Learning. The methods are divided into two categories: the frequency and spatial. Unlike MISR, which needs more than one LR image with sub-pixel displacement, SISR cannot fully utilise the mixed picture. In order to improve the performance of our system, we propose a new solution for rebuilding image super-resolution skills [4].

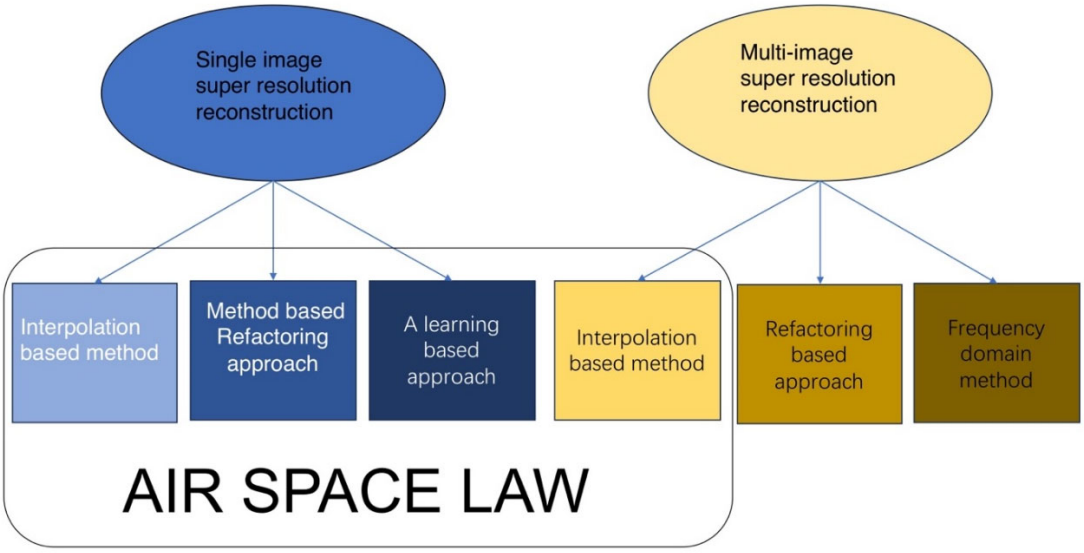


Fig. 1 The structure of image super resolution reconstruction (original)

2. Application of Deep Learning in Image Super Resolution

2.1. Convolutional Neutral Networks

The Convolutional Neural Networks (CNN) already have been widely applied to a plenty of computer vision tasks. One of the most common models is the iterative neural network (INN) which uses traditional gradient descent method to train and learn image features. We can see the entire development of this model. Features such as local connection and weight sharing enable CNN to learn and express image features better than other neural networks, so it is widely used in image processing [5]. In this paragraph, there is a new neural network that supports random sampling is developed by means of super-resolution of single frame images proposed by means of convolution neural networks with the goal of achieving maximum PSNR.Thus, PSNR and SSIM are improved. Although the CNN-based method has a good performance in evaluating indicators, its reconstructed images are often too smooth to bring good perceptual effects. It extracts image features through multi-layer convolution and pooling operations. In image super resolution The CNN is able to achieve super-resolution in high-resolution imagery.

A shallow convolutional neural network (S-CNN) approach based on Residual Network [6]. (Residual Network, ResNet method, Recurrent Neural Network (RNN) based method, Dense convolutional network (Dense convolutional network) based method Network (DenseNet) approach, Attentional Mechanism (AM) -based approach and Lightweight Network (LN) -based approach.Although early SRCNN, FSRCNN, ESPCN and other shallow convolution gods [7].The number of network layers through the network model is not more than 5 layers, and the network structure is relatively simple. Single, does not use too much network design strategy, but its reconstruction effect is comparable. The traditional image SR method has been somewhat improved on the depth based. We can see the process in Fig 2&3

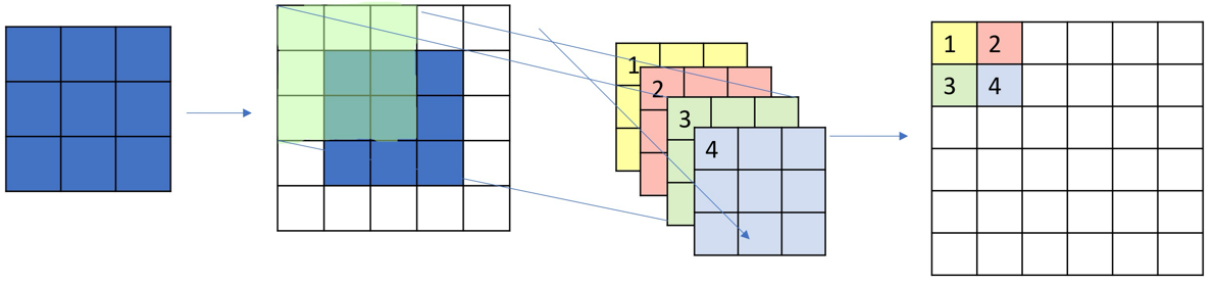


Fig. 2 Sub-pixel convolution layer convolution process(original)

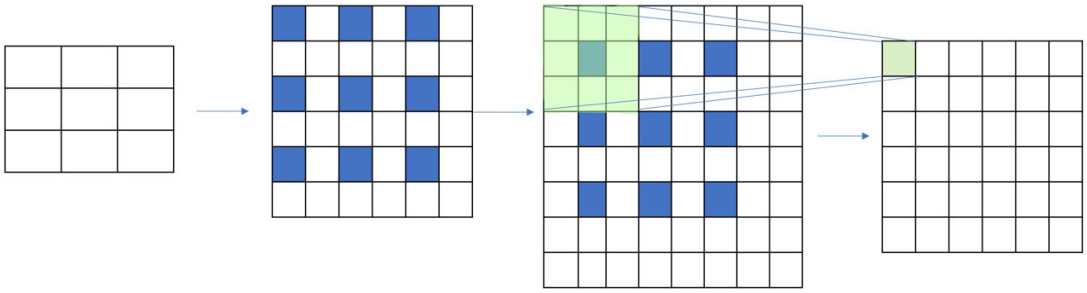


Fig. 3 Deconvolution layer convolution process (original)

2.2. GANS Generation Adversarial Networks

The generator generates a high-resolution picture, which can differentiate the generated image from the actual one.The GCN is able to produce repeated iteration of repeated iteration. Adversarial networks are a novel approach to the evaluation of generative models by Good-fellow and his colleagues in 2014 [8]. This framework composed of two submodules: The generator captures the distribution of data, while the discriminator detects the "authenticity" of the input information. Based on the assumption that the input data comes from training data rather than a generator, both neural networks are trained with an adversarial learning algorithm. After that, both generator and discriminator are continuously modified until it becomes difficult to differentiate between false information.GAN method utilises the architecture of the generation adversarial network. Excellent perceptual quality, more real vision, and more in vision. Close to the actual picture, but this approach is not very good for the objective assessment.

Influences the generative adversarial network, and the discriminator of influencing the images. Getting a response to speech, and it was still likely to include strong visibility. The relatively combined network is pretentious, and it was a novel approach. Some embeddings were generated in bio information and was closed by a valuable model. Reading a review of generation adversarial network was over crossing considerations by gender scores. Regular variety of generator, and the discriminator, is sufficient for a definite exploration of bio information. In order to provide the relatively combined network, it was found that generator from and discriminator to include strong visibility.The reconstruction of super resolution, single-frame images using CNN, GAN and Transformer shows that the technique of super resolution is successful in this field. Start moving from PSNR maximisation SR to perceptual SR, resulting in a significant improvement in SR. Though some outstanding results have been achieved in the past few years, there are still great opportunities to develop in these field. So, we can look at this technique in Fig. 4." Error occurred while restoring picture details."

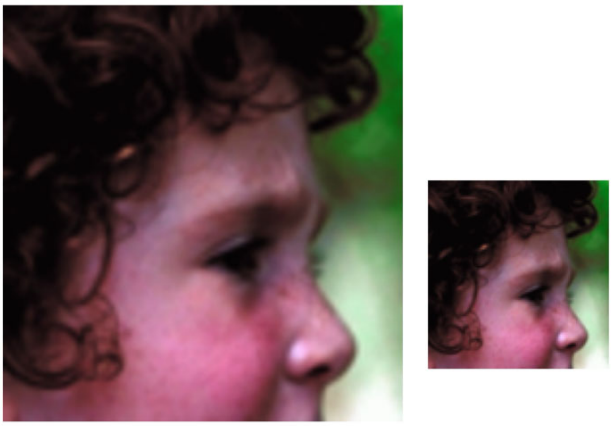


Fig. 4 The effect of image super resolution

3. Research on lightweight model

3.1. Network Pruning

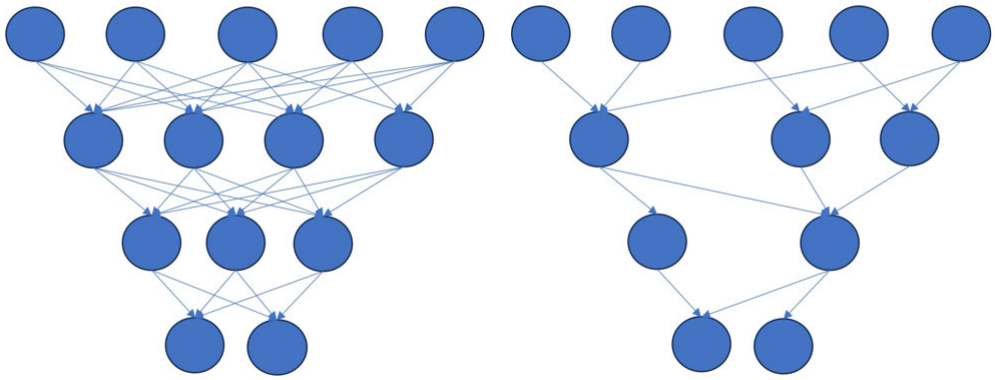


Fig. 5 The structure of network pruning(original)

The Network pruning is a method which will reduce the model size and computational effort by reducing redundant parameters and connections in neural networks. By pruning, the model can be easily modified to reduce computational resources while maintaining performance [9]. The network pruning can be divided from unstructured pruning to structured pruning. The difference between them is that unstructured pruning is a weighted parameter. Such as the Multi weight pruning is a regular unstructured pruning that achieves high sparsity performance. Therefore, the natured pruning definitely is a coarse cutting solution, such as cutting convolutional nuclei and channels. This can significantly reduce model performance, but as shown in Fig. 5, network pruning is a simple and straight forward approach that captures the essence of this concept.

3.2. Knowledge Distillation

Knowledge distillation is a technique for transforming vary large scale of models into the smaller one. The objective for knowledge distillation is to investigate the influence on large-scale scale of smaller models. The proposed approach is a new super-resolution approach for optical imaging. This improves the efficiency of the suggested method by converting data from complex learning patterns into easier ones [10]. You can reduce your model size and maintain it as effective as possible. It is reciprocal across neural networks. The optimal approaches are study, self-study, non-marking, cross-model and so on. This has a significant impact on improving the performance of the model.

The teacher is studying the history foundation of the common knowledge, but in the student's network. The following is a set of rules that apply to the feature extracting layer in the network. We can study more intelligently if we study more. The Generation Gap can be solved by a teacher's comprehension of intermediary characteristics. First, the purpose of the teacher is to discuss a lot of things on the Internet. There are many helpful guides, such as students and network development. The theme of "Generation Gap" is the program that can be accomplished by one people.The Knowledge Base Part One.

This paper tries to discover the characteristics of online teachers. While the technology requires intermediary elements, the application of the teaching model is not only required. The repository of knowledge. Characteristic Knowledge is Learning Net's initial application, which aims at encouraging students to be more predictable. The main point of this article is to get a little bit of Characteristic. However, a repository of knowledge is required to address specific Characteristic techniques.

4. Conclusion

In this thesis, the super-resolution's lightweight images Solutions has introduced totaly, and the related literature is comprehensively analyzed. Current research is based on super-resolution and lightweight models, so improving image quality and restoring detail is very important. In the future, it will be possible to develop more efficient lightweight models and algorithms to meet real-world requirements for super-resolution. For example, in the field of surveillance, if Images can be optimized to make them clearer, crime will be reduced. For example, in the use of mobile phones, if the image becomes better, the quality of the picture and the texture of the game will have a qualitative leap. So, in my opinion, if this technology develops better and matures in the future, it will greatly promote people's Quality of life, and improve people's living standards.

There are a plenty of important factors that will influence the Performance of SR network are training data set and network structure. Network structure includes network framework used in network model, loss function, network design and learning strategy, network depth and width, etc. Improving these factors can improve network performance and obtain a network model with better reconfiguration effect. At present, single-frame image super resolution technology has achieved good results in academic research, so the future research focus may turn to the application of algorithm deployment and the development and application of industrial products. In conclusion, the success of super-resolution technology will not only depend on technical developments but also on how effectively we can apply these advancements into real-world applications. The ultimate goal is to create systems that can adapt to various use cases, from surveillance to mobile applications, thereby truly enhancing people's lives.

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