SINGLE IMAGE SUPER RESOLUTION USING BICUBIC INTERPOLATION WITH DEEP LEARNING

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ABSTRACT

Recently, deep learning based methods have witnessed remarkable accomplishments in single images super resolution field concerning efficiency and effectiveness. Typically, bicubic interpolation is being used for downsampling/upsampling an image and by using different methods, that image is being enhanced. However, when we apply the bicubic interpolation on a simple/plane image or simple/plane part of an image and compare the results with some state of the art deep learning methods, bicubic interpolation results outperform. Based on this analysis, we propose a method that can jointly work with bicubic interpolation and a deep learning method. To do this, we added the results of bicubic interpolation with the results of a deep learning method named SRMD. As SRMD uses degradation maps to provide better SR results, so the degradation maps are very important which can give rise to poor performance if wrong degradation maps are used. Extensive experiments on various images while using random degradation maps show that we surpass the results of SRMD while using randomly generated degradation maps.

Index Terms— Bicubic interpolation, SRMD, degradation maps

1. INTRODUCTION

Single image super resolution aims to enhance an image from low resolution to high resolution which has been studies widely in computer vision, satellite imaging, forensic imaging, medical imaging,etc []. It is a vital yet challenging research topic in digital image processing due to its ill-posed nature[]. As a classical problem, there has been many solutions based on different techniques such as example-based methods[],[],[], interpolation-based methods[][][] and learning-based methods[][][].

Lately, learning-based methods have been widely used to reconstruct LR image to HR image. As with the rapid development of deep learning methods recently, deep learning models have shown impressive improvements in super resolution over all other techniques. A variety of deep learning methods have been proposed to solve super resolution problem starting from simple Convolutional Neural Network (CNN) as SRCNN[]. Later, different types of network architecture[][][], a variety of methods with different loss functions [][][], different types of techniques [][][] have been proposed.

In this paper, we use deep learning based method while focusing on bicubic interpolation. First of all, we analyze the bicubic interpolation as it is widely being used in super resolution to compare its results with other methods or to downsample/upsample images and then those images are being enhanced by different methods. While comparing the results of bicubic interpolation with other deep learning methods[][] while using different images, we realize the bicubic interpolation method provides better results on simple/plain images or simple/plain parts of an image. On the basis of this analysis, we propose a method that combine the bicubic interpolation with deep learning method to enhance any low resolution image. We mainly focus on the paper by Kai Zhang et.[], so we use SRMD[] method to combine with bicubic. SRMD method is non-blind model and one of the few methods that is working on multiple degradations as well as focused on the importance of blur kernel in super resolution. Because of being a non-blind model, they use some selected blur kernels in their method but in real world applications, kernels are unknown so an image can have any type of blur kernel. In, the degradation process, they generate different degradation maps using a kernel and a PCA matrix and concatenate these maps with a LR image to enhance it further. But when there is a mismatch of blur kernel as well as mismatch of PCA matrix, it can largely deteriorate the super resolution results. In SRMD method, when we use randomly generated kernel as well as PCA matrix, it produces worst results even than the bicubic interpolation. Our method can also overcome this problem and can generate better results.

Our major contributions are as follows: (1) We analyze the bicubic interpolation is very useful for plain/simple parts of the images as it gives better results. (2) We propose a method that combines bicubic interpolation results and a deep learning method to get superior results. (3) Our method can also give better results while using random blur kernels and PCA matrix while forming the degradation maps.

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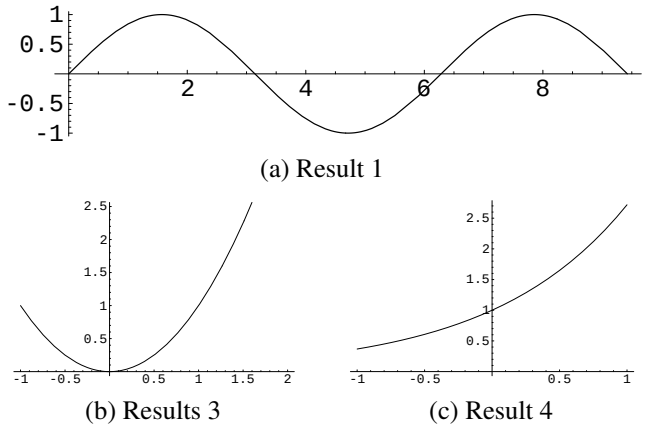

(a) Result 1

(b) Results 3

(c) Result 4

Fig. 1. Example of placing a figure with experimental results.

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