

Super Image Resolution

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Abstract—Using deep learning and GAN models in order to convert a low resolution image to an image of the desired higher resolution. An image may have a lower resolution due to a smaller spatial resolution i.e. due to a result of degradation. The task of super image resolution is of crucial importance. We are often faced with situations where in we are needed to work with high resolution images. However high resolution images are often expensive in terms of memory and computation. These problems can be overcome by the use of image processing algorithms thus leading to the concept of super image resolution.

Key Words—GAN, Image Resolution, Bicubic, Deep Learning, Computer Vision, Mean Square Error

I. INTRODUCTION

High-resolution (HR) image reconstruction from single low-resolution (LR) image is one of the important vision applications. Using deep learning models, we convert the low level image resolution image to the high level image resolution. This is an important problem faced in various vision domains. We do have few algorithms like Bicubic interpolation, SRCNN model and General Adversarial Network available to solve the problem of resolution. However, each of the algorithm have its own set of advantages and disadvantages which we will discuss in the subsequent sections.

II. LITERATURE SURVEY

Considering the existing work in the field of super image resolution and which implemented as of now by us is bicubic interpolation and SRCNN model.

A. Bicubic Interpolation

Bicubic interpolation is one the traditional and old approach used for the improving the image resolution. So, bicubic interpolation is a 2D approach for enhancing and expanding digital pictures utilising cubic splines or other polynomial techniques. It is widely employed by retouchers and editors when upscaling or resampling a picture in computer image editing software. When we interpolate a picture, we're really warping the pixels as they go from one grid to the next. Bicubic interpolation is not just used for scaling images, but video display as well.



Figure-1 : Bicubic Interpolation

B. SRCNN Model

SRCNN is a deep convolutional neural network that learns how to translate low-resolution pictures to high-resolution images from start to finish. As a consequence, we may utilise it to improve the picture quality of photographs of low resolution.

SRCNN consists of the following four operations:

- 1) Pre-processing: Up-scales Low-Resolution image to desired High-Resolution Image size.
- 2) Feature Extraction: Extracts a set of feature maps from the up-scaled low resolution image.
- 3) Non-linear mapping: Maps the feature maps representing low resolution to high resolution patches.
- 4) Reconstruction: Produces the high resolution image from high resolution patches.

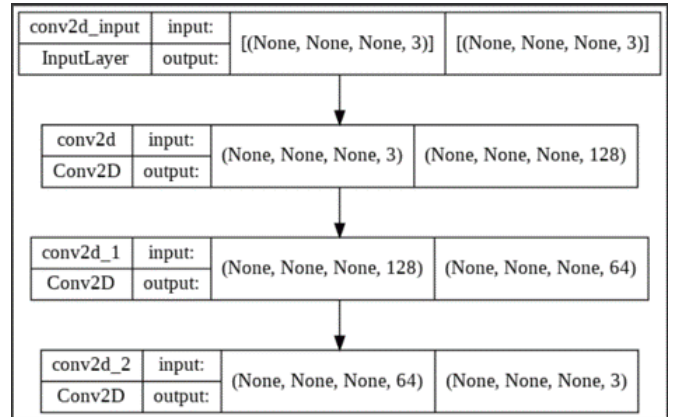


Figure-2 : SRCNN Model




III. IMPLEMENTATION

We have implemented the models from two different papers.

- 1) 1. Image Denoising
 - 2) 2. SRCNN (Super resolution using convolutional neural network).
- Before moving to single image super image resolution it is important to work with comparatively simpler models in order to understand the mechanism behind more complex models. Image denoising aims at reducing any noise from the image.
 - We have recreated the paper on DNCNN which relates to image denoising. The noise has been introduced by us. The noise introduced is gaussian in nature. Our model as shown in results slide helps in reducing the noise which exists inside the image. The accuracy we have achieved is around 80 percent which is good for day to day usage.
 - Next we have created the paper on SRCNN which is the most basic paper which aims at super resolution. The model of which has been attached in the previous slide.

IV. RESULTS

Following are the results obtained from the image denoising process:

Image	Caption
	Noisy image which is to be given for denoising in the model. Noise was added explicitly.
	Clean image and original image
	Denoised image obtained from the denoising model.

The image resolution obtained from the SRCNN is as follows:

MSE Between Images	MSE Along Column 1	MSE Along Column 2	MSE Along Column 3
OG Image and Model Predicted Image	24.39102	23.836807	21.772045
OG Image and Bicubic interpolated image	81.4683	25.0627	72.3014

- 1) We were able up to remove 70-80 percent of noise from the noisy image.
- 2) Minimum Square error was found to be minimum for SRCNN model in comparison between the SRCNN model and Bicubic interpolated model.

V. CONCLUSION

As we can see from the above results, there are many cases such as removing noise, increasing resolution etc a combination of which fulfills the task of image super resolution. We need to create a model which undertakes all of these tasks and gives us the final output which is desired by us.

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