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SURVEY OF IMAGE SUPER RESOLUTION METHODS

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ABSTRACT

Image Super Resolution has gained a lot of attention in the field of Science and Technology. Many researchers, data scientists and Engineers are studying this technology and bringing new methods and techniques to upscale the quality of an image. Image upscaling is not a new concept in science, but different ways and methodologies have been proposed in the last 5 years only. In this paper we will discuss different methods in Image Super Resolution and state their advantages and disadvantages. We will also discuss which method(s) is/are better for upscaling the image.

Keywords: Super Resolution, Deep Learning, Interpolation, Bibubic, Nearest Neighbor.

I. INTRODUCTION

High Resolution images are a key part in different areas of science and technology. In fact today it's becoming an important research area to produce images of high quality for better results and conclusions. Many researchers are working on this topic and trying to find out the best way to produce high quality images without much computing power. There are different methods to do this and each one has its advantages and disadvantages. In this paper we are going to discuss methods like GAN (Generative Adversarial Networks), bicubic method, Nearest Neighbor Interpolation method and many more.

II. LITERATURE SURVEY

In 2017, a paper titled 'Photo-Realistic Single Image Super-Resolution Using a Generative Adversarial Network' by Christian Ledig, Lucas Theis, Ferenc Huszar, Jose Caballero, Andrew Cunningham, ´ Alejandro Acosta, Andrew Aitken, Alykhan Tejani, Johannes Totz, Zehan Wang, Wenzhe Shi Twitter explain that how we can use GAN (Generative Adversarial Networks) to upscale the images by 4x resolution. They demonstrated how GAN can be used to upscale images and reduce the content loss and get better accuracy at upscaling the images. In this paper they showed comparisons of different models like bicubic interpolation and compared the losses and image quality.

In 2012, a paper titled 'Nearest Neighbor Value Interpolation' by Olivier Rukundo and Hanqiang Cao, described the nearest neighbor interpolation Algorithm which is used for high resolution image interpolation. They demonstrated this method for higher performances in terms of H.R when compared to the conventional interpolation algorithms mentioned. In this paper, first they calculated the mode of the set of neighbors and then they used those modes to calculate the difference between the value and bilinear value. They used a different set of images of different resolutions and calculated their PSNR values for comparison.

In 2017, a paper titled 'Bicubic Interpolation Algorithm Implementation for Image Appearance Enhancement' by Prachi R Rajarapollu, Vijay R Mankar, an iterative multi-scale bicubic interpolation method is introduced which explores texture-relevant semilocal LR pixels in an iterative multiscale way. They performed bicubic interpolation on image and identified aliased areas and then Anti aliased Image is obtained using aliased areas. They compared PSNR values from different Methods.

In 2015, a paper titled 'Bilinear Interpolation over fuzzified images: enlargement' by Petr Hurtik, Nicolas Madrid described a method of fuzzified image enlargement using bilinear interpolation. They applied a combination of Bilinear interpolation and a novel fuzzification procedure on Grey scaled images to perform Enlargement on fuzzified images and also calculated Image enlargement Computation time for Gray scale images.

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III. METHODS

3.1 Nearest Neighbor

Nearest Neighbor Interpolation is also used for image resampling it is the simplest Method to upscale an image in Nearest neighbor Interpolation each pixel is replaced by the nearest pixel to Upscale an image, as it replaces every pixel with nearest pixel Quality of image is Lost its not a Great Option to upscale image to 4x of its original size.

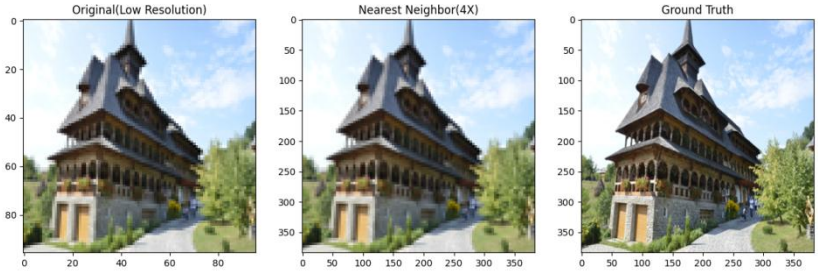


Figure 1: Nearest Neighbor upscaling

3.2 Bilinear Interpolation

In Bilinear Interpolation, Value of New Pixel is Estimated From Average of Four Nearest Pixels. It takes more time as compared to Nearest Neighbor and it is very complex method as compared to Nearest neighbor Interpolation but Results are Good than Previous Method.

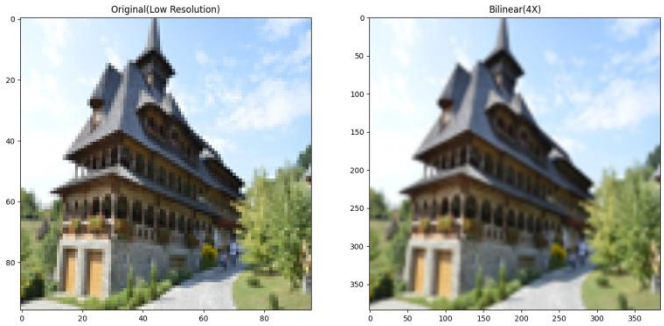


Figure 2: Bilinear Interpolation upscaling

3.3 Bicubic Interpolation

Bicubic interpolation method is one of the traditional Upscaling methods, for 1.5x upscaling it gives acceptable quality for image but when it comes to upscale greater than 2x it just fails to preserve details. On upscaling low resolution images most of the image details are lost, the image just looks blurred. Bicubic is not a good option for upscaling images to greater than 2x of its size.

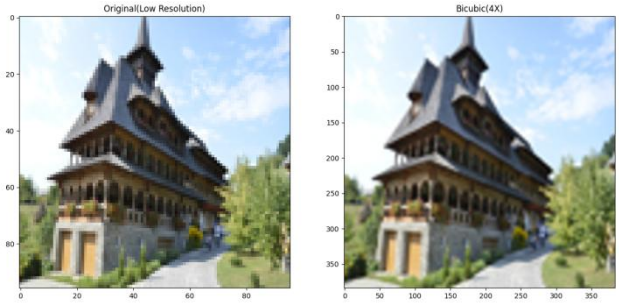


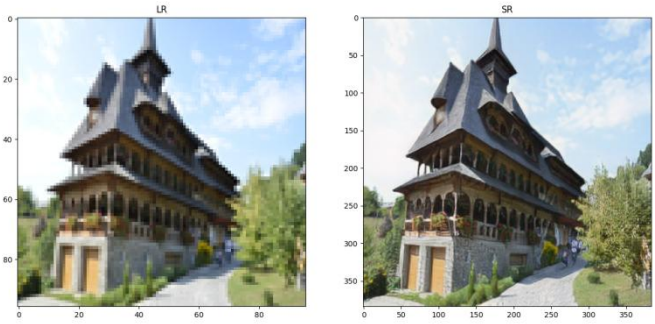
Figure 3: Bicubic Interpolation upscaling

In Above Comparison left one is Original Low Resolution Image and Right one is Upscaled using Bicubic Interpolation. as we can see the image is upscaled to 4x of its size but quality is lost and blurriness is added to the images.

3.4 GAN Based Super Resolution

As we have seen Before, Bicubic Interpolation is Superior to the Bilinear and Nearest neighbor method. It gives the best result but the image looks blurry and details are also lost. There is no way to restore the details of an image other than predicting its Details using any Algorithm.

In the Proposed System we Used Deep learning to predict small features of images like curves and edges and reconstructed them. We used Gan To generate High resolution images From Low Resolution Images and Results are Impressive as Compared to Other Traditional methods.



From Following Results we can Conclude that GAN Based Super Resolution Is Superior to Other Traditional Image Upscaling Methods Including Bilinear Interpolation,Nearest Neighbour and Bicubic Interpolation.

Table 1: PSNR value comparison

Method	PSNR	SSIM
Nearest Neighbor	23.34	0.70
Bilinear	24.23	0.72
Bicubic	24.75	0.74
GAN Based SR	25.22	0.79

IV. CONCLUSION

Different types of methods are invented for upscaling the images and every method has it's way of approaching this problem statement. We mentioned how low resolution images can be converted into high resolution images with the help of different techniques. Every one of this paper has a different approach and different algorithm. However, their purpose happens to be the same. We also mentioned the outputs of different methods we mentioned in our survey paper and each method had a different output and different pixel rate. We also gave a literature survey on the papers we used as a reference to get HR images from LR images. From this survey we can say that GAN appears to be more efficient and gives a better output as compared to other methods.

V. REFERENCES

[1] A survey of Super resolution Techniques Krupali Ramavat1, Prof. Mahasweta Joshi2, Prof. Prashant B. Swadas3.

[2] Single Image Super Resolution Using GANs — Keras, Deepak Birla.

[3] Enhanced Deep Residual Networks for Single Image Super-Resolution Bee Lim Sanghyun Son Heewon Kim Seungjun Nah Kyoung Mu Lee

[4] https://www.mathworks.com/help/vision/ref/warp.html;jsessionid=287b3528bb3707172592ad9d951b

[5] Deep learning based super resolution, without using a GAN, Christopher Thomas BSc Hons. MIAP.

[6] Generative Adversarial Networks and Some of GAN Applications – Everything You Need to Know, Nilesh Barla.

[7] https://www.imageeprocessing.com/2017/11/nearest-neighbor-interpolation.html

[8] Nearest Neighbor Value Interpolation' by Olivier Rukundo and Hanqiang Cao 2012.

[9] Photo-Realistic Single Image Super-Resolution Using a Generative Adversarial Network' by Christian Ledig, Lucas Theis, Ferenc Huszar, Jose Caballero, Andrew Cunningham, ´ Alejandro Acosta, Andrew Aitken, Alykhan Tejani, Johannes Totz, Zehan Wang, Wenzhe Shi