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Exploration of Super Resolution Methods

Sapna Khatter[1], Riddhi Raval[2]
[1]*Lecturer, Computer Department, Christ Polytechnic Institute, Rajkot, Gujarat, India*
[2]*Assistant Professor, Computer Department, iNurture, R.K. University, Rajkot, Gujarat, India*

Abstract: ***Resolution often defines the quality of the image. Resolution also defines the clarity of graphics which simply means, as the resolution is higher, the graphics becomes clearer which is the primary requirement needed in recent applications. Super-resolution methods have become a significant research area due to the swiftly growing interest for high quality graphics in several computer visions and pattern recognition approaches which has lead to the invention of various SR methods. According to the number and sequence of graphics we input, two kinds of super resolution methods could be distinguished: single or multi-input based methods. Certainly, processing multiple inputs could lead to an interesting output. It can be accomplished by use of good sensors and optics, but it's very expensive and also limits the way of pixel density within image. Alternately we can use image processing methods to obtain high resolution graphics from low resolution graphics which can be very effective and reasonable solution. This form of graphics image improvement is called super resolution graphics image reconstruction. Image super-resolution reconstruction is to use one or group of degraded graphics to produce a high resolution graphics, to overcome the limitation or ill-posed conditions of the image acquisition process to achieve better content visualization. Super Resolution is most often useful in forensic imaging, where the extraction of minute details in a graphics can help to tackle a major crime cases.***

Keywords: ***LR-Low Resolution, HR-High Resolution, SR-Super Resolution, Interpolation, Projection onto convex sets.***

I. INTRODUCTION

Super Resolution is a proficiency that is used for enhancing resolution of a digital and electronic imaging system by converting a graphics into a high resolution graphics from a set of low resolution graphics. Super resolution is a strategy which can boost resolution of imaging systems beyond their sensor and optics limit. The high resolution graphics is needed in much application such as medical field, satellites, videos enhancements and various standard conversions of videos and remote sensing .The digital images are taken with the help of CCD (Charge Coupled Devices) and CMOS (Complementary metal oxide semi conductor) Sensors. Super resolution can be carried out in two ways that is single frame and multi frames. Single frame super resolution method simply zooms the graphics in such a manner that it will not be shattered and it contains all mandatory information. Process of integrating several low resolution frames to form a high resolution graphics is called multi frames super resolution. Employing this we can intensify the resolution of any digital or electronic imaging system.

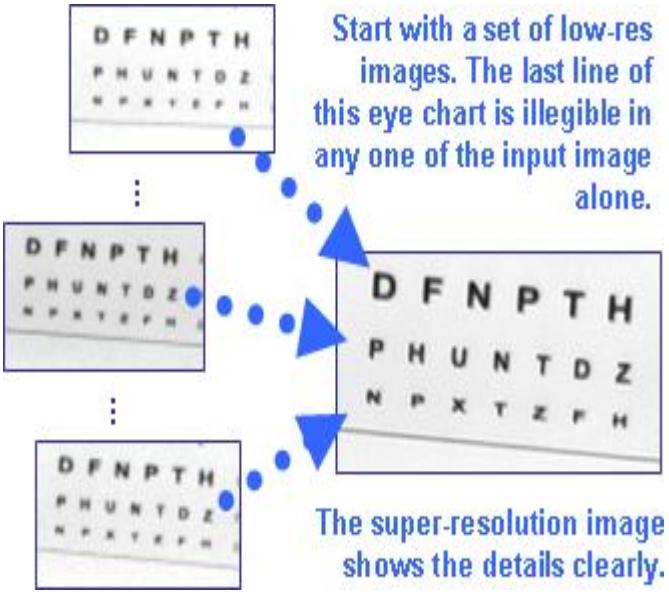

Fig 1 Super Resolution Image

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II. SINGLE FRAME SUPER RESOLUTION METHODS

A. Nearest Neighbour Interpolation

Interpolation is a strategy which is employed for estimating the value of a concealed pixel by the notable value of neighbour pixels. This method is used for searching the nearest pixel value to the missing image value at a location and then allocating that nearest pixel values to the missing image values. This algorithm is the most basic algorithms among all the algorithms which needs minimum processing time among all interpolation algorithms because it ponders only one pixel – the one that is closest to the interpolated point. It simply has the capability of building each pixel bigger. This strategy discovers the grey level value from the closer pixel to the specified input coordinates, and allocat

Fig 2 [A] Original [B] Nearest neighbour Interpolated

B. Bilinear Interpolation

The final image will be polished than the nearest neighbour interpolation. By using this method, every vacant pixel is filled with a value influenced by the adjacent four existing pixels depending on the distance between them. Bilinear interpolation considers the nearest 4 neighbours of familiar pixel values surrounding the concealed pixel. It then takes a weighted average of these 4 pixels to approach at its final interpolated value. This results in much polished looking graphics than nearest neighbour.

Fig 3 [A] Original [B] Bilinear Interpolated

C. Bicubic Interpolation

Bicubic Interpolation is an enhance version of the bilinear interpolation. Bicubic interpolation utilizes a 4 by 4 neighbourhood to discover the missing pixels in the high resolution grid. Therefore, bicubic interpolation constructs enlarged images that are polished and are of higher quality. Bicubic interpolation goes single step ahead bilinear by considering the closest 4x4 neighbourhood of familiar pixels — for a total of 16 pixels. Since these are at various distances from the concealed pixel, nearby pixels are given a higher weighting in the calculation. Bicubic produces undoubtedly sharper graphics than earlier two methods, and is reasonably the

classic amalgamation of processing time and output quality. Because of the above mentioned criteria's this is a standard in many graphics editing software including Adobe Photoshop, printer drivers and in-camera interpolation.

Fig4 [A] Original [B] Bicubic Interpolated

III. MULTI FRAMES SUPER RESOLUTION METHODS

Multi frames super resolution methods incorporates the feature of combining various multiple low resolution graphics images to construct the single high resolution graphics image. By using this technique resolution of any graphics system can be improved and enhanced.

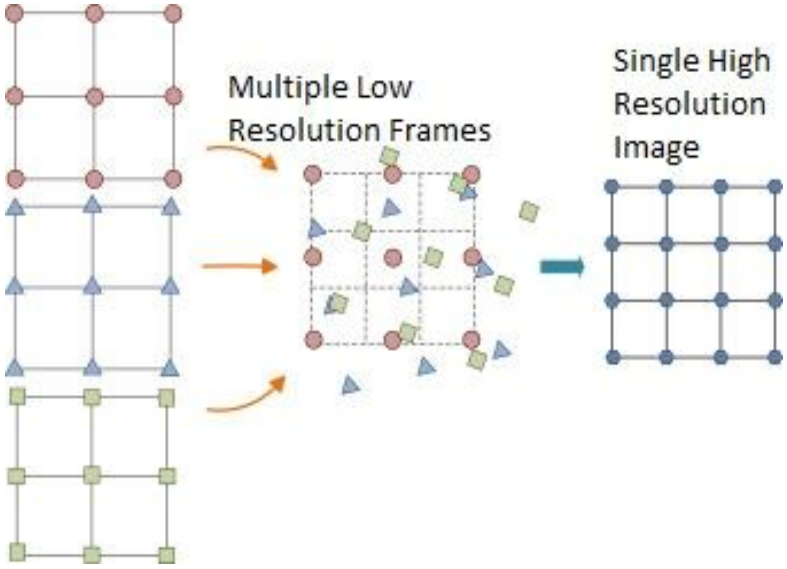

Fig 5 Example Demonstrating Multi Frames Super Resolution

Multi Frames Super Resolution Methods

A. Direct Addition

The ultimate basic strategy to amalgamate these graphics images is to get mean or median of the images, after the enrolment of an input graphics image. These two methods are easy to implement. These methods have constraints of blurring and degradation of details that are not present in every graphics image. As benefits these methods can reduce the effect of misregistrations and noise successfully, because of the low pass filtering nature of the mean and median operations. This method becomes reasonable because of the noise suppression capacity and chance of adding the image restoration methods to algorithm. In addition to these, the two alternatives of direct addition methods have a very low computational complexity. The motion information is eliminated in the direct addition method, after graphics image enrolment and eliminating the information amalgamation leads to removal of noise effect or strengthening of signal quality but does not improves resolution.

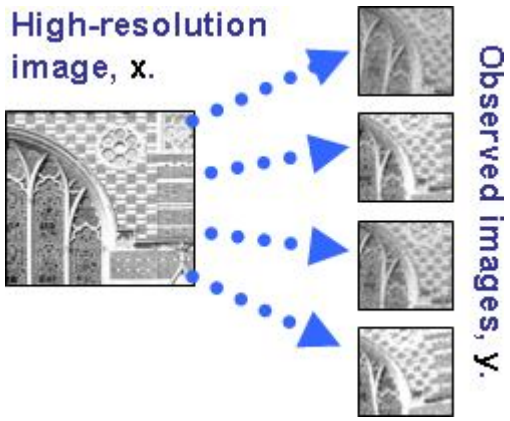

Fig 6 Super Resolution Image Using Direct Addition

B. Iterative Back Projection

Simulated graphics image can be generated using this strategy, constructing LR graphics images from the simulation image to compare them with the observed counterparts and using the error between them to generate a better and high quality simulation graphics. Iterations will continue as long as the given condition is satisfied or it remains true. The condition may be a threshold value, the point where the quality stop increasing, or simply a couple of predefined iterations.

The primary goal of the IBP method is to reduce the error between simulated LR images and the observed LR images iteratively .In addition to this, the noise suppression capacity of the IBP method is not very competent as the quality metrics are considered. This is because the prior graphics image suffers from the noise and the noise present on all of the observed LR images exaggerates the error.

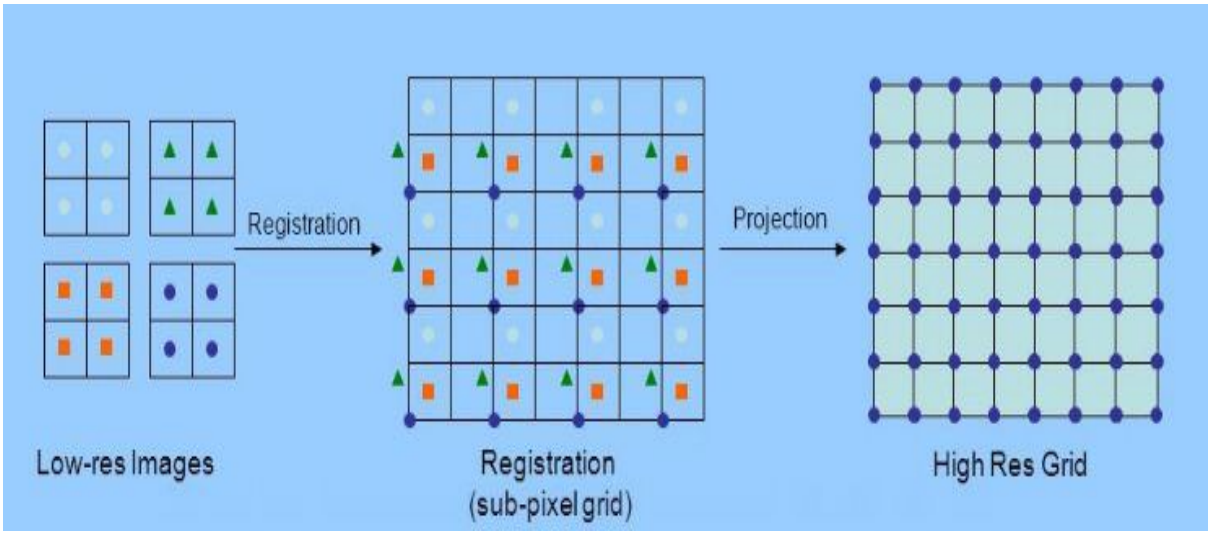

Fig 7 Flow of Iterative Back Projection Technique

B. Projection on to Convex Sets

In Projection On to Convex sets Technique First, the graphics images are registered, and we have the motion compensated coordinates of every pixel. These pixel values must be projected to the HR space and this is done by applying a Gaussian PSF (Point Spread Function) for every pixel. For every image in our set, we have a solution. Then unifying these solutions into the intersection of these sets is the next step. Every pixel value has the prior information and then found value specific to that set. The next thing is to stretch the available estimate to satisfy the solution set we are working on. The pixel value is updated at the level of the threshold to match the projected value as close as possible without disturbing the continuity of the solution. After the prior estimate is stretched to every frame of the input set, first iteration is completed. The solutions are normalized to the intensity space [0,255] and the next simulated HR image is ready.

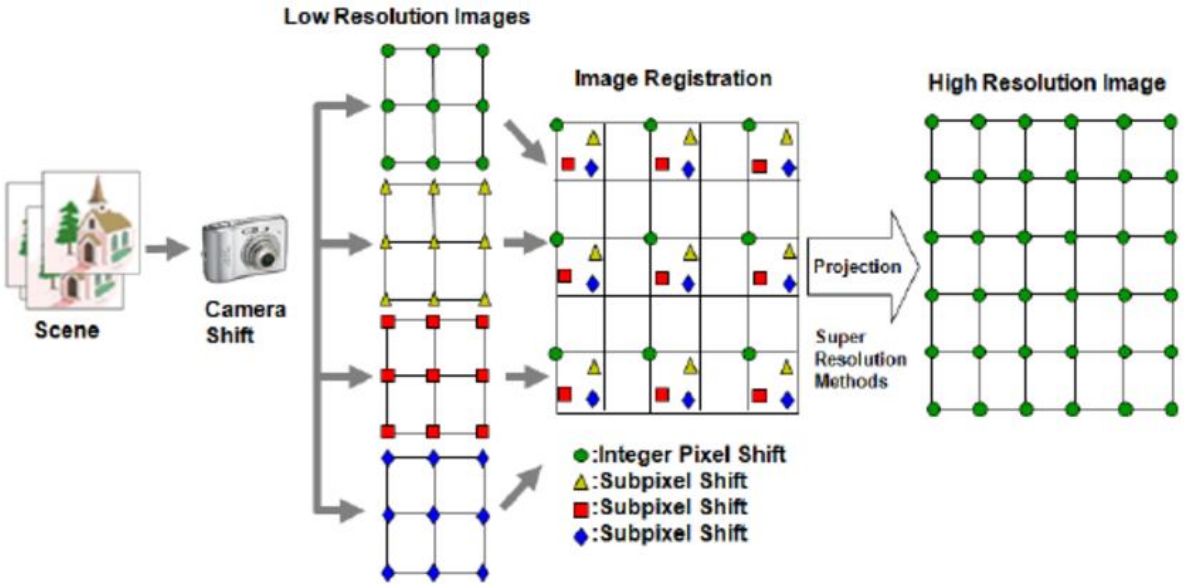

Fig 8 Flow of Projection onto Convex Sets Technique

IV. CONCLUSION

Multi Frames Super Resolution Methods are more powerful and gives better and improved resolution than Single Frame Resolution Methods because it integrates multiple low resolution graphics images to generate single high resolution graphics image.

V. ACKNOWLEDGMENT

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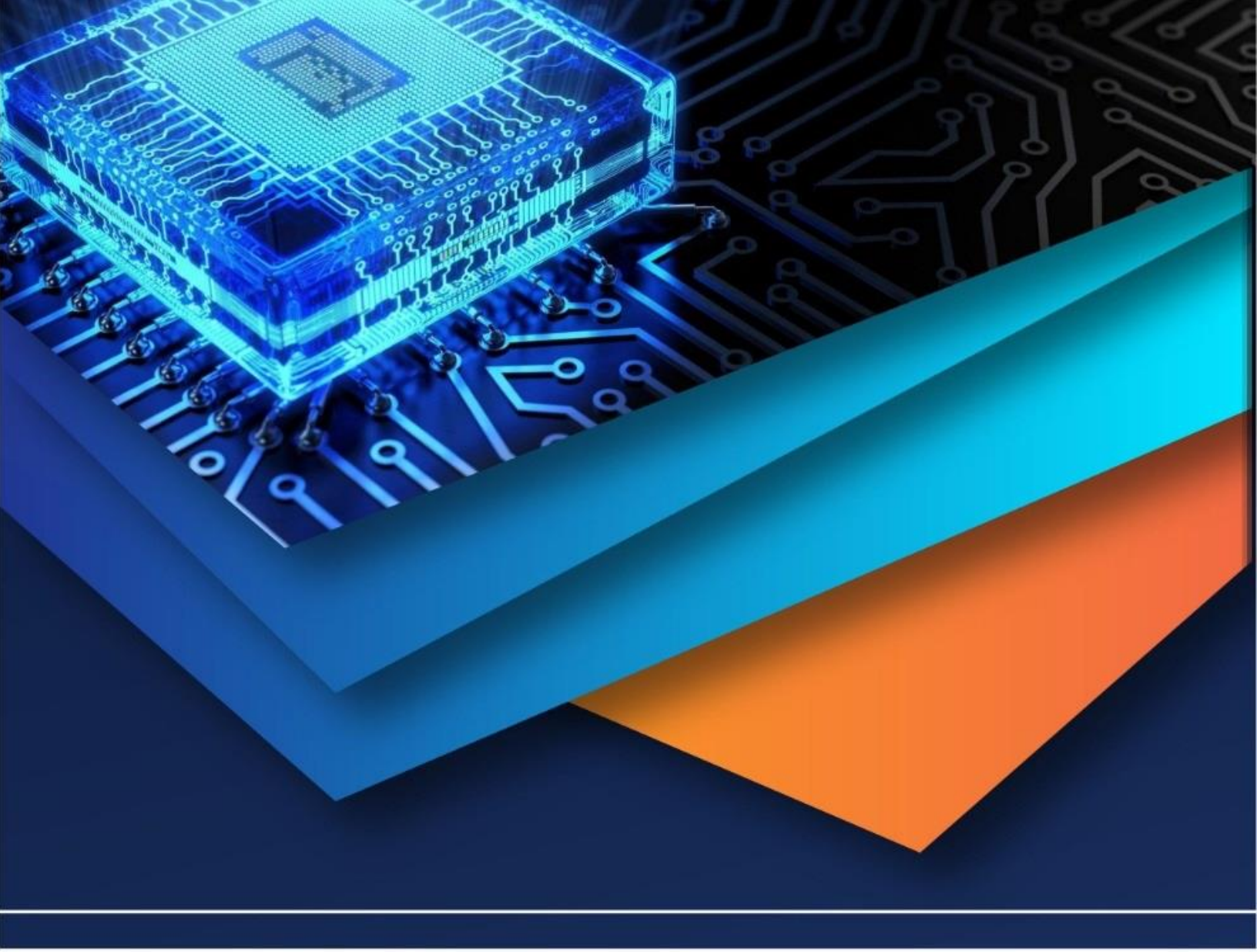

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