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Hybrid Approach for Single Image Super Resolution using ISEF/CANNY/Anisotropic Diffusion and IBP: Specific Reference to License Plate

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Abstract: *There are many applications which require high quality images. The applications are remote sensing, enlarging consumer photographs, medical imaging, surveillance systems. If we look at the problem of super resolution from the manufacturing side then increase in number of pixel per unit area by reducing sensor size or increasing the chip size to get super resolution image. . But reducing pixel size technically increases the shot noise and increasing chip size increases the physical size of imaging system which further increases the cost of the system. So, there is always a trade off exits between physical size, cost and spatial resolution of the imaging system. A new approach to get high resolution image which overcomes this above mentioned limitation is the use of image processing to get super resolved image. This image processing technique is known as the super resolution (SR). Super resolution is the method of obtaining high resolution image from one or more low resolution images. In this paper, a hybrid approach for single image super resolution for vehicle license plate is presented. It is based on Iterative Back Projection(/ibp) method combined with edge preserving Infinite Symmetrical Exponential Filter(ISEF). Though IBP can minimize the reconstruction error significantly in iterative manner and gives good result, it suffers from ringing effect and chessboard effect because error is back projected without edge guidance. ISEF provides edge-smoothing image by adding high frequency information and gives more better results. Further we have used Anisotropic Diffusion with this hybrid approach.*

Key Words*: Super Resolution, ISEF, CANNY, Anisotropic Diffusion.*

I. INTRODUCTION

The corruptions in a picture quality are because of recording movement, for example, optical contortion, movement obscure brought about by limited screen speed, commotion and associating things. The regular picture procurement framework is, where diverse variable influences the picture quality, for example, over the air (OTA), charge-couple gadget (CCD), pre-processors and environment. Optical Blur is a non-symmetric create of the lens and a gap sooner than or at the back the optic focus of the lens lead to picture mutilations. Movements obscure results when the picture being recorded changes amid the recording of a solitary casing, either proper to fast development or long introduction.[2] Clamor in a picture is likewise an undesirable by result of picture catch which includes spurious and superfluous data.

Now, Super Resolution is a technique that increases the image resolution and makes it clearer for human and machines both in view for improved information extraction which are not visibly cleared in LR image. Super resolution can be obtained either by processing on multiple low resolved images as input and breeding a high detail holding a single SR image as output or boosting the details of a single low resolved image and developing a high resolved image for analysis. In SR from multiple LR images, it is a assembly of HR image from several LR images, thus increasing the high frequency components. The crucial idea behind this is to unite.[3]

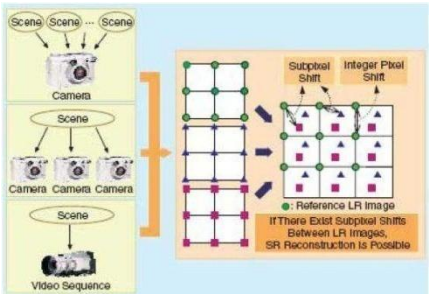


Figure 1. Basic concept for super resolution[1]

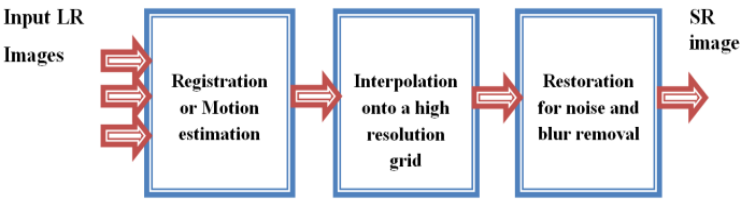


Figure 2. Basic steps in super resolution[5]

The principle favourable position of SR methodology is that, a HR picture can be obtained even with the current LR imaging with lower expense and less power utilization. In SR reproduction from numerous LR pictures, the indispensable theory is that the LR ought to have enough moved in review the same scene. In the event that LR has minor movement around then the HR remade picture won't encase any new data. Expect that four pictures are taken and one picture out of

four can be taken as reference and rest be moved evenly, vertically or slantingly to a size of half pixels. By satisfying that one picture as reference, other three picture pixels can be interleaved and a higher determined picture can be acquired.

II. METHODOLOGY

1. Hybrid approach: IBP integrated with ISEF/CANNY

This is a hybrid technique for single image super resolution. The methodology is joining an Iterative back projection (IBP) system with the edge preserving Infinite symmetrical exponential channel (ISEF). In any case IBP can reduce the error significantly in iterative way and gives great result, it experiences ringing impact and chessboard impact in light of the fact that error is back-projected without edge guidance. ISEF commits an edge-smoothing picture by including high recurrence data. It coordinates ISEF with IBP that enhances visual quality with fine inconspicuous edge points of interest. In same manner we have used CANNY edge detection.

Canny Edge Detection Algorithm:

1. Smoothing: Blur image in order to remove noise.
2. Finding gradients: The edges should be marked wherever the gradients of the image has huge magnitudes.
3. Non-maxima suppression: simply local maxima should be marked as an edges.
4. Double Thresholding: Prospective edges are determined by Thresholding.
5. Edge tracking using hysteresis: Final edges are defined by suppressing all edges which are not connected to a most strong edge.

ISEF algorithm steps :

1. Read the input image.
2. Translate RGB image into gray scale image.
3. Apply ISEF filtering in X and Y direction on gray image.
4. Apply zero crossing binary Laplacian method.
5. Apply non maxima suppression method.
6. Apply gradient and hysteresis Thresholding on image.

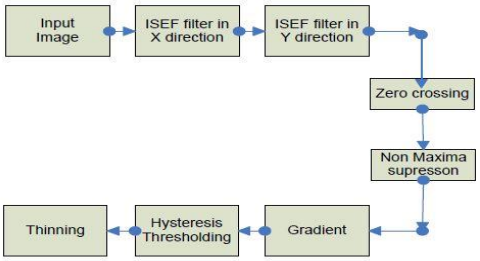


Figure 3. ISEF Algorithm

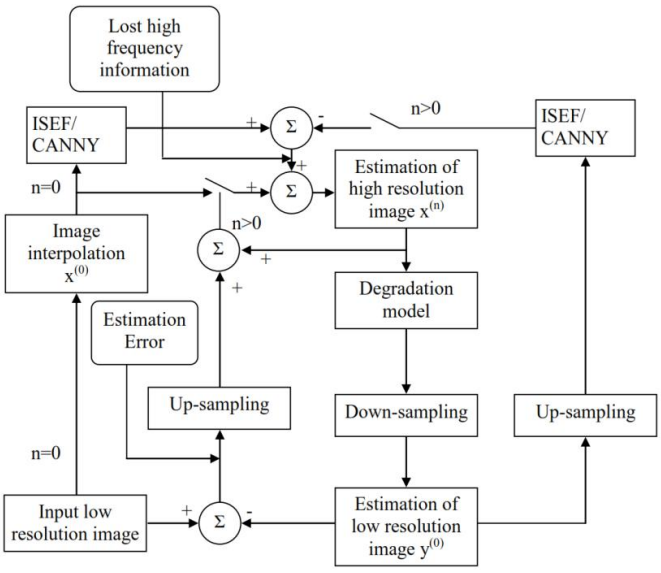


Figure 4. hybrid Approach: IBP integrated with ISEF/CANNY

2. Hybrid approach: IBP integrated with ISEF/CANNY using Anisotropic Diffusion

Anisotropic diffusion is also known as Perona Malik diffusion. It is having definite goal of reducing image noise without removing significant parts of image content, usually edges, lines or other details that are important for interpretation of image. It is non liner and space variant transformation of original image. This resembles the process of creating the scale space, where an image generates a parameterized family of successively more and more blurred images based on

diffusion process. It is inhomogeneous and non linear diffusion process. Hence, anisotropic diffusion can work as an edge preserving approach without noise being added. Steps for algorithm is as shown in figure.

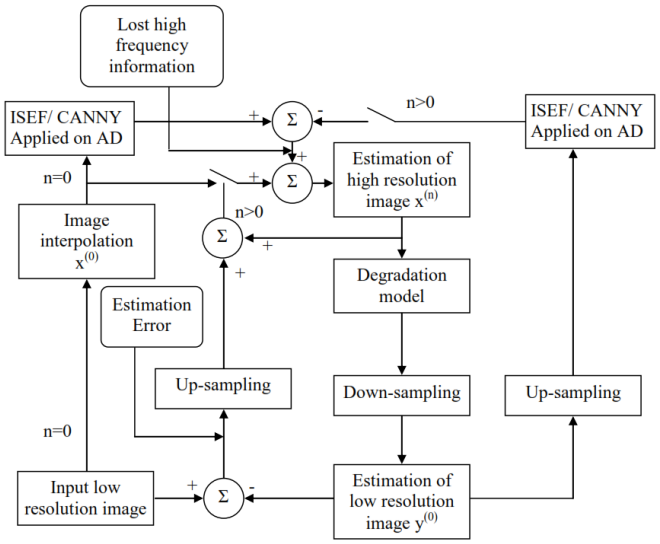


Figure 5: Hybrid Approach using Anisotropic Diffusion

III. RESULTS

1.IBP integrated with ISEF

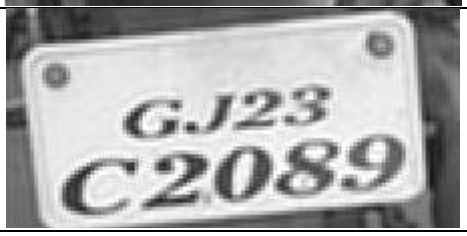
Here, simulation of hybrid approach is presented. Among database of 100 images, results of few images are shown with the parameters PSNR, MSE, SSIM and computational speed.

Input LR Image	Output HR Image	Analytical result
		PSNR=19.66 MSE=28.47 Execution time=0.94sec SSIM=0.466
		PSNR=19.86 MSE=28.26 Execution time=0.97sec SSIM=0.460

		PSNR=21.42 MSE=27.41 Execution time=0.826sec SSIM=0.383
		PSNR=19.84 MSE=26.83 Execution time=0.67sec SSIM=0.515

2. Hybrid Approach : IBP integrated with CANNY

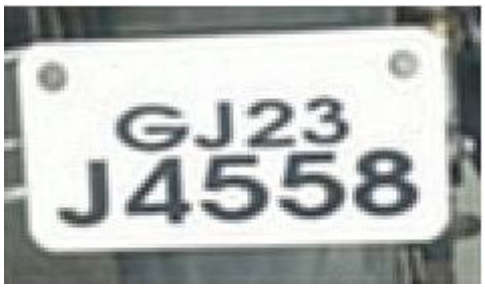
In this hybrid approach an edge preserving algorithm CANNY has been implemented with an Iterative Back Projection algorithm.

Input LR Image	Output HR Image	Analytical Results
		PSNR=20.33 MSE=28.80 Execution time=2.62sec SSIM=0.620
		PSNR=23.17 MSE=24.95 Execution time=3.82sec SSIM=0.821
		PSNR=22.72 MSE=25.40 Execution time=1.52sec SSIM=0.780

		PSNR=23.80 MSE=24.32 Execution time=3.32sec SSIM=0.846

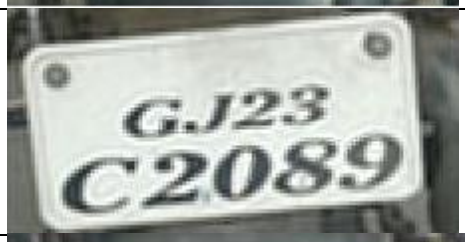
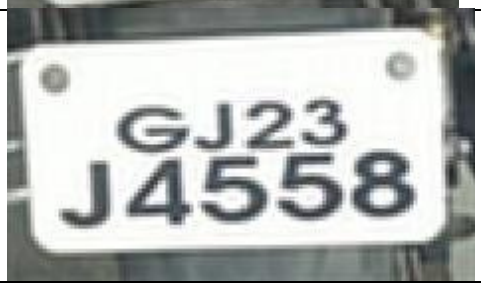
3. Anisotropic diffusion integrated with hybrid iterative ISEF based approach

Here, we have implemented hybrid approach based on ISEF integrated with anisotropic diffusion. some of the results are shown here along with performance parameters.

		PSNR=25.35 MSE=22.77 SSIM=0.814 time=3.62min
		PSNR=19.12 MSE=29.00 SSIM=0.718 time=3.62min
		PSNR=22.71 MSE=25.41 SSIM=0.810 time=3.62min
		PSNR=23.45 MSE=24.67 Execution time=3.62min SSIM=0.797

4. Anisotropic diffusion integrated with hybrid iterative CANNY based approach

In this method, we are integrating anisotropic diffusion with hybrid approach based on CANNY. Some of the results are shown here along with quality metrices PSNR,MSE,SSIM and computational speed.

Input LR Image	Output HR Image	Simulation Results
		PSNR=19.12 MSE=29.00 SSIM=0.756 time=3.62min
		PSNR=22.89 MSE=25.23 SSIM=0.827 time=3.62min
		PSNR=22.61 MSE=25.51 SSIM=0.787 time=3.62min
		PSNR=23.59 MSE=24.53 SSIM=0.839 time=3.62min

IV. Comparative Analysis

Here, we have shown comparative analysis of all implemented methodologies on the database of 50 images. We can conclude that anisotropic diffusion with hybrid(CANNY+IBP) gives better results among all. For more accurate results we can take database or more than 100 images.

Average comparative Analysis of hybrid approaches	PSNR	MSE	EXECUTION TIME (in sec)	SSIM
IBP integrated with ISEF	20.91	27.21	6.78	0.4514
IBP integrated with CANNY	24.63	24.14	35.47	.6987

Anisotropic diffusion integrated with Hybrid(IBP+ISEF) approach	25.27	23.85	61.26	0.7838
Anisotropic diffusion integrated with Hybrid(IBP+CANNY) approach	26.48	21.64	73.47	0.8347

V. Conclusion

In this paper, we have discussed and implemented Anisotropic diffusion integrated with Hybrid ISEF/CANNY based approach. We are getting better visual quality compared to simple iterative and hybrid approach but computational speed decreases compared to that. Further improvement upon the computational speed can be achieved using compressive sensing paradigm with same or even better visual quality.

VI. References

[1] S.C.Park, M.K. Park, and M.G. Kang, "Super-Resolution Image Reconstruction: A Technical Overview", IEEE Signal Processing Magazine, Vol. 20, pp. 21-36, May 2003

[2] S.C. Park, M.K. Park, and M.G. Kang, "Super-Resolution Image Reconstruction," IEEE signal processing magazine, 2003.

[3] Vaishali Patel , Chintan K. Modi , Chirag N. Paunwala , Suprava Patnaik, "Advances in Image Super Resolution: A Survey", International Conference on Signals, Systems & Automtion(ICSSA-11)

[4] Vaishali Patel , Chintan K. Modi , Chirag N. Paunwala , Suprava Patnaik "Hybrid Approach for Single Image Super Resolution using ISEF and IBP: Specific reference to license plate", IASTED/2011International Conference on Computer Tomography

[5] Marcelo Victor Wüst Zibetti , Joceli Mayer , "A Robust and Computationally Efficient Simultaneous Super-Resolution Scheme for Image Sequences", IEEE Transactions On Circuits And Systems For Video Technology, Vol. 17, No. 10, October 2007

[6] M. Elad and A. Feuer, "Restoration of a single super resolution image from several blurred, noisy, and undersampled measured images," IEEE Trans. Image Processing, vol.6 , no. 12, pp. 1646-1658, Dec. 1997

[7] William T. Freeman, Thouis R. Jones, and Egon C. Pasztor, "Example-Based Super- Resolution", IEEE, March/April 2002

[8] Vaishali Patel , Chintan K. Modi , Chirag N. Paunwala , Suprava Patnaik, "Hybrid Approach for Single Image Super Resolution using ISEF and IBP" 2011 International Conference on Communication Systems and Network Technologies

[9] Y. Jie, D. Si-dan, and Z. Xiang, "Fast Super-resolution for License Plate Image Reconstruction," IEEE Conf. Pattern Recog. 2008, pp. 1-4.

[10] Nhat Nguyen , Peyman Milanfar , Gene Golub ,"A Computationally Efficient Super-resolution Image Reconstruction Algorithm", IEEE Transactions On Image Processing, Vol. 10, No. 4, April 2001

