IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 2, February 2016

A Review: Comparison of Different Algorithms to Improve the Quality of Image

Mayur M. Sonavane[1], Dr. S. S. Agrawal[2]

M.E. Student, E&TC, SKNCOE, Pune, India[1]

Assistant Professor, E&TC, SKNCOE, Pune, India[2]

Abstract: The main aim of Single Image Superresolution (SR) is to build a high resolution image from a sequences of single low resolution (LR) images. The SR is a classic and active image processing problem which aims to generate a high resolution (HR) image from low resolution input image. The SR is challenging because of the missing details in the given LR image. Thus it is very difficult to explore effective prior knowledge for boosting the reconstruction performance. To solve this problem it is necessary to have the prior knowledge of image to make the problem solvable and to improve the quality of generated image. The main goal of SR is to generate the HR image with good visual perception as similar as original image. These algorithms will evaluate the subjective visual effect, objective quality computational time and PSNR, etc. These algorithms will improve quality of image like better visual effect quality, lower reconstruction error and acceptable computation efficiency, etc.

Keywords: Super-resolution (SR), Visual Effect, PSNR, Computational Efficiency.

I. INTRODUCTION

To explore the high resolution imaging systems, Super-resolution technique is introduced. To capture the high resolved image it is necessary to use high quality sensors in the camera but this becomes more expensive and costly. Super-resolution is the term generally used to solve the problem of use of high quality sensors systems instead the use of image processing algorithms, which is relatively less expensive to implement. The application of such algorithms will certainly continue where the low quality sensors are used and high-quality imaging systems necessary. The basic idea behind Super-Resolution is the fusion of a sequence of low-resolution images and produces a high resolution image. Early works on Super-Resolution showed that the aliasing effects in the high-resolution fused image can be reduced (or even completely removed), if a relative sub-pixel motion exits between the under sampled input images. In general, super resolution is a computationally complex and numerically ill-posed problem. That is main reason to make Super-Resolution one of the most popular research area for image processing researchers.

The limitation of image resolution is the sensors used in the camera or the image acquisition device. The image sensor is typically a charge-coupled device (CCD) or a complementary metal-oxide-semiconductor (CMOS) active-pixel sensor. These sensors are typically arranged in a two dimensional array to capture two-dimensional image signals. Quality of image is depend on the size of sensor used or number of sensors element used per unit area. Higher the density of sensor element higher the quality of image but this is most costly. If we decrease the number of sensor elements per unit area quality of captured image also decreases. While the image sensors limit the spatial resolution of the image, the image details are also limited by the optics, due to lens blurs, lens aberration effects, aperture directions and optical blurring due to motion. Another way to improve the quality of image is use the sequences of degraded images and fuse all these sequences using signal processing algorithm.

II. LITERATURE SURVEY

There are many techniques are introduced for Super-resolution of Image. The main aim of Super-resolution is to construct the high resolution image from the sequences of low resolution images using Signal processing algorithm. Super-resolution is mainly divided into two processes that is image registration and image reconstruction. Image super-resolution reconstruction is mainly attracted by the researchers. The reconstruction algorithms are grouped into three categories.

1. Interpolation based methods estimate the missing pixels in the high resolved grid using their known neighbours to upscale the input low resolved image. The complexity of these methods is low but they produces the blurring effects along the edges and this is not sufficient for high quality Super-resolution reconstruction.
2. Learning based methods estimate a High resolution image by measuring the mapping relationship between low resolution and high resolution image patch pairs from external training dataset.
3. Reconstruction based methods focus on exploiting prior knowledge on the Super-resolved image and the reconstruction constraint that is the estimated high resolution image degraded by blurring and down sampling should be close to the input low resolution image.

The objective of Super-resolution is

i. Image Registration is critical for the success of multi frame Super-resolution where complementary spatial sampling of the high resolution image are fused.

The image registration is a fundamental image processing problem that is well known ill-posed.

ii. Computational efficiency is another main objective or Super-resolution of image due to large number of unknowns requires expensive matrix manipulation.

iii. Robustness of Super-resolution is of interest because the image degradation model parameters cannot be estimated perfectly and sensitivity to outliers may result in visual disturbing atrifacts, which are noticeable in many applications.

iv. Traditional Suer-resolution techniques are vulnerable to the presence of outlier due to motion errors, inaccurate blur models, noise, moving objects, motion blur, etc. Improve the quality of image due to these effects

A. Using Directional Features

In this method [1], [2] the sharp edges in image are oriented in less number of directions and an image pixel can be estimated by the weighted averaging of its neighbours. The major advantages of this type of technique is these preserve the edges and supress the artifacts in resultant images. This technique is basically depends on the observation that sharp in images are often oriented in limited directions. This is because the nonzero element in image gradients are sparsely grouped along different directions.

Jaggy atrifacts which may be introduced by strong constraints often exist inn resultant images and significantly affect reconstruction quality. To suppress the jaggy atrifacts between the sharp edges each target pixel can estimated by weighted averaging of its neighbours. In weighted averaging we use the pixel values of local image patch as well as the directional features of the center position. We exploit the directional group sparsity in image gradient to extract the main direction of the sharp edges on the desired high resolution image which result in reliable SR quality and outperforms the total variation (TV) method and DTV method. The group sparsity structure allow us to design an effective regularization term that enforces the global consistency between sharp edges in small number of directions. Using only pixel values in the neighbour search may lead to low matching. Therefore utilize both the pixel values and directional features to compute the similarity weights.

There are mainly three contributions of this method

1. To fully exploit the group sparsity property of image gradient in key directions, a combined total variation (CTV) regularization term is used and effectively used to preserve the sharp edges in 16 different directions.
2. A directional non-local means (D-NLM) regularization term is used to effectively select those neighbours with similar pixel as well as similar direction information.
3. A SR framework incorporates the reconstruction constraint, CTV and D-NLM regularization terms. An optimal solution to this SR reconstruction problem is obtained by applying the TFOCS framework.

B. Based on Non-local Pairwise Dictionaries and Double regularization

A non-local pairwise dictionary learning model [5] generally include an estimated dictionary and residual dictionary. This method is typically used in remote sensing images for SR reconstruction process. These dictionaries are trained from Low resolution remote sensing images. Remote sensing images are basically poor in quality. Remote sensing images covers the large area and they are real time images. Remote sensing images mostly used in Military applications in target recognition. The Non-local Pairwise Dictionary Method learns the dictionary from given low resolution images through the nonlocal method, which is capable of retaining the structure as well as edge information of image. The previously discussed SR method base on spare representation [3], [4] usually obtain HR dictionary from external HR example images and usually ignored the prior information of the observed LR image, which is help to obtaining the higher quality reconstruction images. In order to enhance the quality of the output reconstructed image by using the dictionary [5], [6] pair incorporate the improved image local and nonlocal prior as constrained regularization terms to make use of the structure information of the LR image.

In the NL-means algorithms the observed image patch can be estimated by similar patches in its NL neighbourhood. In this method we take the center of the observed patch as the center point and a certain radius as the neighbourhood. We regard the weighted average patch as the common structure of a NL area. The estimated dictionary is then trained from the NL area. However the estimated patch and observed image patch are not entirely consistent. Therefore the residual part is considered as the specific information of the observed image patch. The residual part can be weighted by NL-means using the difference between the image patches obtained from different subtraction of the observed image patch and its similar image patches. As dictionary need to be updated in an iteratively process.

C. With Zooming Motion

Typically SR approaches consider registration and HR reconstruction [7] as two disjoint process. The methods typically consist of two disjoint processes namely:

1) Image registration based on a specific motion model to calculate the motion parameters and

2) HR reconstruction that incorporate the estimated motion parameters into an inverse estimation.

Generally accurate registration is challenging task for image SR reconstruction as motion parameters are often calculated from captured aliasing LR images. The aliasing effect among the low resolution images may reduce the accuracy of registration. It is difficult to estimate the accurate registration parameters of the captured LR images by using 2-D plane motion model. Hence this motivates the study of techniques that can be used to deal with zooming motion between the captured images, including optical flow technique and parametric motion models.

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 2, February 2016

Among the existing zooming SR literature Li [10] proposed an SR approach for synthetic zooming. In this method all LR images are related to each other by employing a line geometry model and the zooming factors are estimated based on this model. Joshi *et al.* [9] presented a zooming SR algorithm using both the Markov random field and a simultaneous auto regression model under the assumption that the SR field is homogeneous.

In this method integrate the image registration and zooming SR reconstruction into single estimation process. This is more promising when compared with other two stage SR methods such as the estimation of motion parameters. In this method mainly focus on translation and rotation. The proposed method takes into account the relative zooming between the acquired LR images.

TABLE I: SUBJECTIVE TEST FOR VARIOUS METHOD

	Farsiu's Shift and Add method [11]	**Joshi's method [9]**	**Proposed method**
Average Score	4.0	4.3	4.7

III.CONCLUSION

In SR via Directional features method [1],[2] reconstruction of image taking directional group sparsity and self-similarity with directional features into consideration. Both pixel values of local image patches and directional features at each pixel position are used to estimate the similarity weights. The Non local pairwise dictionary method [5] is used for remote sensing images in the application of military. When low resolution image is down sampled version of its HR image SR reconstruction becomes serious problem. The image registration and reconstruction are disjoint process of image SR. The SR with zooming motion method [8] performs these two processes simultaneously.

ACKNOWLEDGMENT

I would like to the express my true sense and sincerest gratitude to my respected guide Dr. Mrs. S.S. Agrawal for her dynamic and valuable guidance. I am grateful to her for constant encouragement in fulfilment of paper. This work is result of combined efforts put in by my guide and me. I would also like to thank her for providing me with all necessary infrastructure and facilities to complete the review paper. I extend my special thanks to PG HOD of Electronics & Telecommunication Dr. S.K. Shaha and all staff members.

REFERENCES

[1] Xiaoyan Li, Hongjie He, Ruxin Wang, and Dacheng Tao, "Single Image Super resolution via Directional Group Sparsity and Directional Features", IEEE transaction on image processing, Vol. 24, No. 9 Sept 2015

[2] J. Yang, J. Wright, T. S. Huang, and Y. Ma, "Image super-resolution via sparse representation," IEEE Trans. Image Process., vol. 19, no. 11, pp. 2861–2873, Nov. 2010.

[3] K. I. Kim and Y. Kwon, "Single-image super-resolution using sparse regression and natural image prior," IEEE Trans. Pattern Anal. Mach. Intel., vol. 32, no. 6, pp. 1127–1133, Jun. 2010.

[4] X. Li and M. T. Orchard, "New edge-directed interpolation," IEEE Trans. Image Process., vol. 10, no. 10, pp. 1521–1527, Oct. 2001.

[5] Shuiping Gou, Shuzhen Liu, Shuyuan Yang, and Licheng Jiao, "Remote Sensing Image Super-Resolution Reconstruction Based on Nonlocal Pairwise Dictionaries and Double Regularization", IEEE JOURNAL of selected topics in applied earth observations and remote sensing, VOL. 7, NO. 12, DECEMBER 2014.

[6] K. Zhang, X. Gao, D. Tao, and X. Li, "Multi-scale dictionary for single image super-resolution," in Proc. IEEE Conf. Comput. Vis. Pattern Recognition., Jun. 2012, pp. 1114–1121.

[7] S. C. Park, M. K. Park, and M. G. Kang, "Super-resolution image reconstruction: A technical overview," IEEE Signal Process. Mag., vol. 20, no. 3, pp. 21–36, May 2003.

[8] Yushuang Tian and Kim-Hui Yap, "Joint Image Registration and Super-Resolution from Low-Resolution Images with Zooming Motion", IEEE transactions on circuits and systems for video technology, VOL. 23, NO. 7, JULY 2013

[9] M. V. Joshi, S. Chaudhuri, and R. Panuganti, "Super-resolution imaging: Use of zoom as a cue," Image Vision Comput., vol. 22, no. 14, pp. 1185–1196, Dec. 2004.

[10] Yu He, Kim-Hui Yap, Li Chen and Lap-Pui Chau, "Nonlinear least square technique for simultaneous image registration and super resolution", IEEE transactions on image processing, VOL. 16, No.11, NOV 2007

[11] Farsiu, D. Robinson, M. Elad, P. Milanfar. 2003a. Fast and robust Super-Resolution. Proc 2003 IEEE Int Conf on Image Process 2003, pp. 291–294.

BIOGRAPHIES

Mayur M. Sonavane received the B.E. degree in Electronics & Telecommunication engineering from VPCOE Baramati, Pune, India, in 2013. He is currently pursuing the M.E. in Signal Processing from SKNCOE Pune, India. His current research interest includes image/video processing and image Super-resolution.

Dr. S.S. Agrawal has completed PhD. From Saint Tukadoji Maharaj University, Nagpur in Feb 2015. She is associate professor in SKNCOE Pune since 2000. Her area of interest is in communication network. She has also published 30 international paper in various topics.

 DOI 10.17148/IJARCCE.2016.5253