



# A Brief Review of Image Inpainting Techniques

Shiva Kamboj<sup>1</sup>, Rajiv Bansal<sup>2</sup>

Student, Dept. of C.S.E., JMIT, Radaur, India

Assistant Professor, Dept. of C.S.E, JMIT, Radaur, India

**ABSTRACT:** INPAINTING is the ability of modifying an image or video in a form that is not (easily) detectable by an regular observer and has become a original area of research in image processing. This paper focusing on how image inpainting works and study of various techniques. Wavelet transform worked on the basis of multi-resolution analysis. The multi-resolution property of wavelet transform from lower spatial frequency to the higher one, to see the element of the image from global-view to local-view respectively.

**KEYWORDS:** Image inpainting, Exemplar, Wavelet Transform, Texture oriented, Structure oriented.

## I. INTRODUCTION

A. INPAINTING is the ability of modifying an image or video in a form that is not (easily) detectable by an regular observer and has become a original area of research in image processing.[9] Many helpful methods for image inpainting have been future and mainly existing approaches mainly rely on local in sequence such as difficulty fast marching method (FMM) and partial differential equation (PDEs). These approaches are called local inpainting algorithms. These methods are simply fitted for image whose damage area is not big, such as deletion of scratches or texts in image. They are lack of kindness the addition of image texture and typically run into problem when working on textured images. The texture area in image, on the large scale, changes evenly and slowly: whereas it on the small scale has many details.[8] The inpainting technique can be partitioned in two categories: (1) texture oriented and (2) structure oriented. Both the technique has their advantages and disadvantages. The wavelet depends algorithm adds the profit to both of these approaches. Wavelet transform is used for various image analysis problems due to its nice multi-resolution properties and decoupling characteristics [1]. This technique proposed to use the benefits of wavelet transforms for image inpainting. The main goal of this process is to reconstruct damaged parts or missing parts in image. This process reconstruct image in such a way that the inpainted region is not detect by an ordinary observer. Wavelets transform shown significant performance in the process of image inpainting. Though many wavelets are available which can be used in image inpainting. Types of image inpainting (1) *Exemplar Based Image Inpainting*: In exemplar based image inpainting each of the pixels has the shade value and also the confidence value, which also reflects the user assurance in the pixel value and it, gets solid after pixels have been filled. When algorithm get proceeded the patches are also given a temporary priority value, which help out the user to choose the order in which they are filled. (2) *Image Inpainting based on Wavelet Transform*

This method as well worked on the basis of multi-resolution analysis. While considering idea of human, after inpainting damaged, defected area of the image repairing need to do with maximum efficiency. The multi-resolution property of wavelet transform from lower spatial frequency to the higher one, to see the element of the image from global-view to local-view respectively. Then, user considers the variance of power of coefficients of wavelet transform within the icon block to find out the priority of image for inpainting the blocks.[5] Wavelet based Inpainting : Wavelet analysis has verified helpful for dealing with a wide class of signals and images with spatially localized features [1]. Wavelets are designed to confine most of the signal energy using a little wavelet coefficients. This property of wavelets is more powerful for signal estimation algorithms that are based on simply shrinking the wavelet coefficients of the noisy signal [1]. Discrete wavelet transforms are used for fast achievement of linear wavelet methods. The techniques utilizing nonlinear operations in the wavelet domain accomplish tasks

# International Journal of Innovative Research in Computer and Communication Engineering

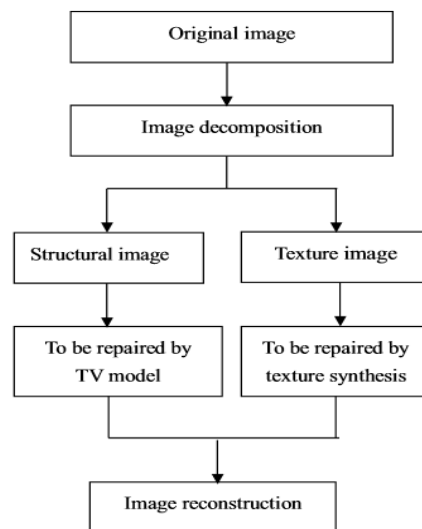
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Vol. 5, Issue 3, March 2017

which are not possible for usual linear Fourier approach to such problems as linear inverse problems, wavelet denoising, nonlinear wavelet packet approximation and nonlinear multiresolution.

Image inpainting based on texture synthesis is another effective method of repair, and it is mainly used to repair large scale defect image. The main idea of this algorithm is selecting a pixel viewed as the center point from the bounds of the defect area, then choosing appropriately sized textures block, and searching for matching texture block in the known area instead of the target texture block.



Fig[1]:processing flow[4]

In the image manually repair times, artists connected the lines and contours of defect area through subjective judgment to complete the structural repair, which was called structural inpainting, and then finished the details of defect area according to the known information of outline, which was called texture inpainting. The original image is decomposed into structural image and texture image through wavelet transformation. The structural part is repaired by TV model; the texture part is repaired by the texture synthesis technology, and the final result is synthesized by wavelet reconstruction. The process is shown in Figure[1]. A wavelet inpainting dilemma refers to the problem of filling in missing wavelet coefficients in an image. Wavelet analysis has established invaluable for dealing with a wide class of signals and images with spatially localized features. Wavelets are designed to acquire most of the signal energy using a few wavelet coefficients. This property is more commanding, signal estimation techniques that are based on simply shrinking the wavelet coefficients of the noisy signal. Wavelet transform is used for different image analysis problems due to its decoupling characteristics and nice multiresolution properties. For the wavelet transform, the coefficients at the course level signify a larger time interval but a narrower band of frequencies. This characteristic of the wavelet transform is very significant for image coding. The active areas of image data is more determined in the spatial domain and in the smooth areas the image data is more determined in the frequency domain. The target region (damaged or lost data or object to be removed) information of the image can be divided into two kinds of conditions. The decision process of the image repair can depend on the characteristic and direction of the neighboring textures. The second is the distribute of the image target part is global and dispersion.

## II. RELATED WORK

Yongsheng Xu In[4] for the duration of the time of manual image repair, people tend to chase the principle of the first repair after the overall structure repair of texture details. In this paper, attractive into account that the partial differential equation model has strong capability of keeping texture synthesis and linear structure, model has good effect in repairing the consistency information, the defect image is decayed into texture image and structural image by wavelet transformation, and then the structural image is repaired by fractional differential equation model; the texture image is repair by texture synthesis technique. The experimental results show that the algorithm can in fact improve the quality of image inpainting. Manoj S Ishi. In [5] author studied and reviewed two algorithms Progressive Image Inpainting and



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Vol. 5, Issue 3, March 2017

Exemplar Base Inpainting based on Wavelet Transform. These algorithms consider the surrounding information of image to get the patch based technique for completing lost region to recover original image. Feng Sun In [6] This paper present a novel two-step exemplarbased image inpainting approach. Firstly, a coarse version of the input image is acquire in a multi-resolution way through the Digital Wavelet Transform and then base on this image, the unique missing region of the input image are inpainted with the exemplar-based method. Faniu Wang In [7] In this paper, author present a new technique for image inpainting using wavelets. Firstly the damage area is roughly resorted by the quick marching inpainting method in spatial area Then the image is projected onto the wavelet domain, the wavelet coefficient equivalent to the damaged block is revalued based upon the known cefficient of its neighborhood in fact subband, while the wavelet approximation is restored by quick marching inpainting method. Zhang Hongying In [8] )A quick and adaptive method is proposed for completing missing parts caused by the deletion of foreground or background elements from an image of natural scenery.Unlike most earlier texture-synthesis based approaches using extensive search to find the suitable texture, we synthesize the missing parts by image patches drawn from horizontally situated areas because of the strong horizontal orientation in natural scenes. On the other hand, author presented an adaptive method to determine the dimension of the template window for capturing features of various scales. A number of examples are given to show the effectiveness of our algorithm. Our results compare favorably to those obtained by existing techniques.Aur lie Bugeau In[9] Inpainting is the ability of modifying an image in a form that is not noticeable by an ordinary observer. There are numerous different approaches to tackle the inpainting problem, though as explained in this paper, the most winning algorithms are based upon one or two of the following three basic techniques: geometric partial differential equations, copy-and-paste texture synthesis and consistency among neighboring pixels. We combine these three building blocks in a variational model, and supply a working algorithm for image inpainting trying to estimated the minimum of the proposed energy functional. Our experiments show that the grouping of all three terms of the proposed energy works better than taking each term individually, and the results obtained are within the state-of-the-art.

### III.SUMMARY OF TECHNOLOGIES AND DIFFICULTIES FACED

The given table contains some of techniques used along with their authors and method given by them.

AUTHOR	METHOD/APPROACH	YEA R	FINDINGS
Aurelie Bugeau	A Comprehensive Framework for Image Inpainting	2010	speeding-up of algorithm by optimizing the search in the patch space.
Zhang Hongying	Image Completion by a Fast and Adaptive Exemplar-Based Image Inpainting	2010	Comparative experiments show fast and adaptive exemplar based image inpainting outperforms the texture synthesis work in terms of both perceptual quality and computational efficiency
Faniu Wang	An New Method for Image Inpainting Using Wavelets	2011	The resulting restored image area is considerably homogeneous with its surrounding
B.H. Deokate	ImageMapping and Object Removal in Image Inpainting usingWavelet Transform	2015	The result is an image in which the selected object has been replaced by a visually plausible background

### IV. CONCLUSION

In this paper we have looked at two different types of image inpainting.while learning each techniques we have reviwed and provided and detailed explanation of the process used for filling obstruction. Comprehensive framework speed-up the algorithm by optimizing the search in the patch space. Fast and Adaptive Exemplar image inpainting Comparative experiments shows fast and adaptive exemplar based image inpainting outperforms the texture synthesis work in terms of both perceptual quality and computational efficiency. Wavelet results shows that restored image area



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Vol. 5, Issue 3, March 2017

is considerably homogeneous with its surrounding. The result of wavelet transform image inpainting in which the selected object has been replaced by a visually plausible background that mimics the appearance of the source region.

## REFERENCES

- [1]. B.H. Deokate<sup>1</sup> Dr.P.M.Patil<sup>2</sup>, "Image Mapping and Object Removal in Image Inpainting using Wavelet Transform", *International Conference on Information Processing (ICIP) Vishwakarma Institute of Technology, Dec 16-19, 2015*.
- [2]. Yang Xian<sup>1</sup> and Yingli Tian<sup>1,2</sup>, "ROBUST INTERNAL EXEMPLAR-BASED IMAGE ENHANCEMENT", IEEE, 2015..
- [3]. LIU Ying, LIU Chan-juan\*, ZOU Hai-lin, ZHOU Shu-sen, SHEN Qian, CHEN Tong-tong, "A Novel Exemplar-based Image Inpainting Algorithm", International Conference on Intelligent Networking and Collaborative Systems, 2015..
- [4]. Yongsheng Xu, Shuwen Wang, "Image Inpainting Based on Wavelet Transformation", IEEE, 2014.
- [5]. Manoj S Ishi<sup>1</sup>, Lokesh Singh<sup>2</sup>, Manish Agrawal<sup>3</sup>, "RECONSTRUCTION OF IMAGES WITH EXEMPLAR BASED IMAGE INPAINTING AND PATCH PROPAGATION", IEEE, 2014.
- [6]. Feng Sun, Kaihuai Qin\*, Wei Sun, "Fast Two-step Exemplar-based Image Inpainting", Seventh International Conference on Image and Graphics, 2013.
- [7]. Faniu Wang, Dong Liang, Nian Wang, Zhiyou Cheng and Jun Tang, "An New Method for Image Inpainting Using Wavelets", IEEE, 2011.
- [8]. Zhang Hongying, Jin Yuhong, Wu Yadong, "Image Completion by a Fast and Adaptive Exemplar-Based Image Inpainting", International Conference on Computer Application and System Modeling (ICCASM 2010).
- [9]. Aurélie Bugeau, Marcelo Bertalmio, Vicent Caselles, *Member, IEEE*, and Guillermo Sapiro, "A Comprehensive Framework for Image Inpainting", IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 19, NO. 10, OCTOBER 2010.
- [10]. A. Efros and T. Leung, "Texture synthesis by non-parametric sampling," in Proc. IEEE Int. Conf. Computer Vision., vol. 2, pp. 1033–1038, 1999.
- [11]. A. Criminisi, P. Perez, and K. Toyama, "Region filling and object removal by exemplar-based image inpainting," IEEE Transactions on Image Processing., 13(9) 1200-1212, 2004.
- [12]. Bertalmio M, Vese L, and Sapiro G. Simultaneous structure and texture image inpainting [J]. IEEE Trans. On Image Processing, 12(8):882-889, 2003.
- [13]. T.-H. Kwok, H. Sheung, and C. Wang, "Fast query for exemplar-based image completion," Image Processing, IEEE Transactions on, vol. 19, no. 12, pp. 3106–3115, dec. 2010.
- [14]. Y.L. Lin, J.H. Zhao, X.F. Zhu, "An improved algorithm for image inpainting based on texture synthesis," Computer Application and Software, vol.27, pp.:11-12, 2010.

## BIOGRAPHY

**Shiva Kamboj** has received her B.Tech in Computer Engineering from HEC, Jagadhri in 2013. She is pursuing M.Tech in Computer Science Engineering from Seth Jai Parkash Mukand Lal Institute Of Engineering And Technology (Autonomous), Radaur. Her research interest includes Image Inpainting.