

## Object Removal and Image Mapping Using Daubechies Wavelet-Based Image Inpainting

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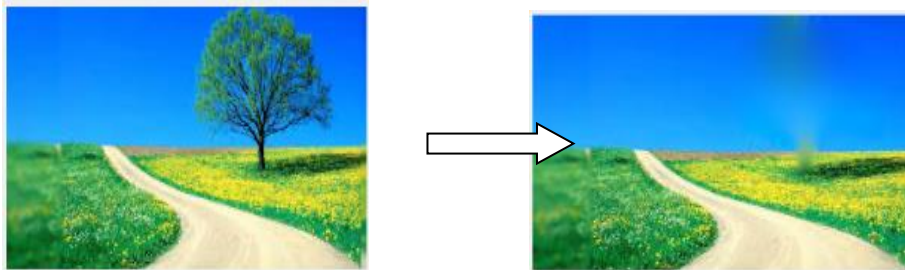
**Abstract**— The filling in of missing region in an image is known as image inpainting. Image inpainting or completion is a technique to restore a damaged image. Now a days various techniques have been proposed. Wavelet transform is used for various image analysis problems due to its nice multi-resolution properties and decoupling characteristics. This paper proposed to utilize the advantages of wavelet transforms for image inpainting. The proposed approach will implement Daubechies wavelets with different basis functions for image inpainting process. The experiments show that our methodology is fast and effective and the proposed algorithm is able to handle various applications, such as image restoration, object removal and image denoising.

**Keywords**— Image Inpainting, Wavelet, Wavelet transform, Object Removal.

### I. INTRODUCTION

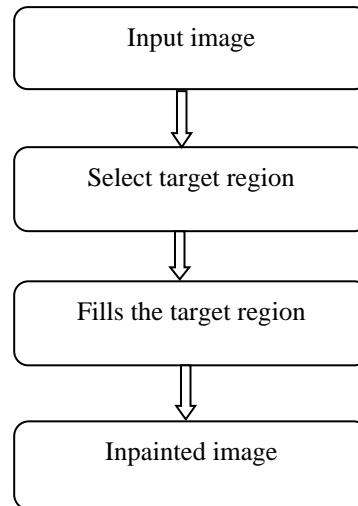
Nowadays, the image Inpainting technology is a hotspot in computer graphics. it has importance in a removing redundant objects, edge preservation, film restoration and television special effects production, etc. In the fine art museums, this Inpainting concept is used for degraded paintings. Conventionally Inpainting is carried out by professional artist and usually its very time consuming process because it was the manual process. The main goal of this process is to reconstruct damaged parts or missing parts of image. And this process reconstructs image in such a way that the inpainted region cannot be detected by a casual observer.

The filling-in of missing region in an image is known as Image Inpainting. Inpainting is the art of reconstructing an image or video in a form that is not easily detectable by an human perception. Image Inpainting has become a fundamental area of research in image processing. The reconstruction of images in a way that is non-detectable for an observer who does not know the original image is a practice as old as artistic creation itself. This practice is called ‘retouching’ or ‘Inpainting’. Also image Inpainting has been widely investigated in the applications of digital effect (i.e. object removal, image editing, image resizing), image restoration (e.g. Scratch or text removal in photograph), image coding and transmission (e.g. recovery of missing blocks). Image Inpainting could also be called as reconstruction process.



**Fig.1. removing large objects from image**

Fig. 1 shows an example of this task, where the foreground person (manually selected as the target region) is automatically replaced by data sampled from input of the image. The process of Inpainting is as shown in fig.2. The input to the algorithm is an image to be inpainted i.e. original image. The user selects the region to be inpainted i.e. the target region. Then the algorithm performs filling of the target region with features around it. The output image is an inpainted image.



**Fig.2. basic block diagram of inpainting process**

M. Bertalmio is one of the legendary names in the field of Image Inpainting, proposed a simple algorithm (2000) where filling in the missing region is carried out by the property of Isophotes.(lines of equal gray value) [4]. In 2001. Chan, Shen and coworkers proposed a variation model for filling in gray level and color images. Later in 2002, Mumford-Shah model has been adopted for good obtaining good approximations from mathematically neat image modelling [17]. These proposed algorithms were structure oriented. These algorithms able to keep good continuation smoothly and broken edge estimation with large gap is fail and detail texture surface is not easily reproducible. Again in 2003 Bertalimo proposed to decompose original image into sum of two functions which are different in characteristics. One of them is processed by texture-oriented scheme and the other by structure-oriented one [16]. In 2007 Ching and coworkers proposed an algorithm using wavelet. This algorithm could be applied to highly lose image. Also in 2008 Wong proposed nonlocal means approach for exemplar based Inpainting algorithm. The image patch is find out by patch priority algorithm to find best matching patch. Also simultaneously in 2008 Dongwook Cho, and Tien D. Bui showed the use of advantages of wavelets to Image Inpainting. The technique presented in this paper uses the advantages of wavelet transform for image inpainting.

## **II.WAVELETS AND THEIR APPLICATION IN IMAGE INPAINTING**

For the wavelet transform, the coefficients at the course level i.e, approximate coefficients represent a larger time interval but a narrower band of frequencies. This advantage of the wavelet transform is very important in image coding. The target region (damaged or lost data or object to be removed) information of the image can be divided into two kinds of regions. The first region, the distribution of the target information of the image is the local and concentration. So the decision method of the image repair can depend on the characteristic and direction of the neighboring textures to decide. The second regions, the distribute of the image target part is global and dispersion. Therefore when the data a great deal of creation lost, we can't clearly repair the repair image through the consult data of the neighboring district. To solves the problem, we use the human vision characteristic which make the basis of the repair. When the reference data is very minimum to repair the image, we zooming out the distorted image and then observe the image shape. In image processing , down-sampling method is used to reach the visual effect. Wavelet transform has been used for various image analysis problems due to its nice multi-resolution properties and decoupling characteristics. The proposed algorithm uses the plus points of wavelet transforms for image inpainting. Wavelet transform has been used as a good image representation and analysis tool mainly due to its multi-resolution analysis, data reparability, compaction and sparsity features in addition to statistical properties [12]. A wavelet is a small wave like oscillations which begins with zero ,increasing and then decreases back to zero. The wavelet contains both the irregular shape and the compactly supported. In order to observe the degree of influence of image on the

reconstructed part, we applied the three-level wavelet transformation to separate an image into three frequency components: medium, and low, high as shown in Fig. 3(a). The original image was processed through a secondary level wavelet transformation analysis, as illustrated in Fig. 3(a), where the highlighted image in the uppermost left hand corner is represented by the section LL2 illustrated in Fig. 3(b). Where analysis is used, the components of the image composition are all taken into consideration. This task can also be used for primary image analysis. The four components LL2, LH2, HL2, and HH2 are then processed through reversed wavelet transformations to heighten the resolution of the image. As shown in Fig. 3(b), where the highlighted image in the upper left hand corner is represented by the section LL1 illustrated in Fig. 3(a). This would result in the increasing of frequency components within the image, which are then used in the depiction of local area textural features.

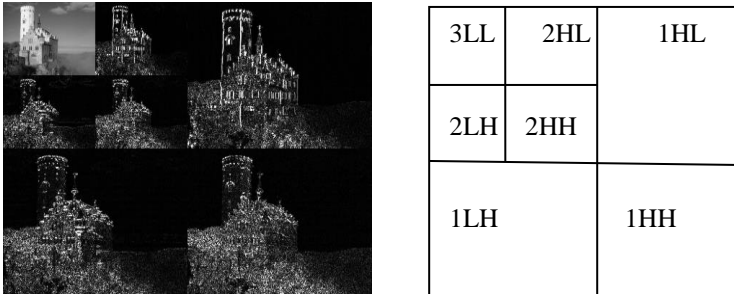


Fig.3. Results of the wavelet transformation analysis derived from various layers of a given image

### III. SIMULATION RESULTS

In simulation result we have performed image inpainting on various images. We have used different wavelets for the image decomposition. Some of the wavelets used are Haar, Coiflet, Bior4, Bior2, Db4, Db2 etc. Different wavelets have shown variation in the parameters of image inpainting.



Fig.4. Distorted Images on the left side along with Inpainted Images on the right side



Fig.5. Distorted Images on the left side along with Inpainted Images on the right side



Fig.6. Distorted Images on the left side along with Inpainted Images on the right side

#### IV. CONCLUSION

The filling-in method is applied to several different types of datasets of missing blocks images. In this paper we have analysed discrete wavelet transforms for image inpainting. Different distorted images were taken and each image was inpainted using Daubechies wavelets. Thus we can conclude that Daubechies wavelet has performed better, for image inpainting, than other wavelets. The results generated by our proposed method clearly illustrates superior image inpainting than other present image inpainting methods.

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