

Discrete Cosine Transform based Image Inpainting

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Abstract: *This paper proposes a novel scheme for image inpainting based on discrete cosine transform (DCT). The DCT as an orthogonal transform is used in various applications. In this view the rows of a DCT matrix as the filters associated with a multiresolution analysis. In this paper, propose to utilize the noise reduction property of cosine transforms for image inpainting. Current methods may available using time domain analysis by direct spatial image inpainting techniques and those that perform frequency domain analysis by indirect frequency image inpainting techniques. However, both have their own advantages and limitations. This method used for removing noise, filling missing information over regions with sensible sizes, visual quality of image with frequency domain analyses.*

Keywords: Image Inpainting, PDE based method, noise removal, multiresolution, Discrete Cosine Transform

1. Introduction

Image inpainting is the research area in the field of image processing whose goal is to remove some objects or restore damaged regions in a way that observers cannot notice the flaw. There are many applications of image inpainting such as photo editing, video editing, image compression and image transmission. The mostly used inpainting methods are PDE based method, Patch based method and Sparse based method. PDE based method also known as diffusion based method. Patch based method also known as exemplar based method. The redundant system is generated from the discrete cosine transform (DCT) matrix of second type [10]. Patch matching process is done in DCT based inpainting. In that way, the error which is caused by noise is reduced by the noise reduction properties of DCT. However, new error is produced by the gradient-based filling process which roughly approximates the unknown region of the target patch before doing DCT.

In this paper, patch shifting technique is applied, which would provide more informative and reliable target patch, to DCT inpainting.

This paper is organized as follows. In section II, the idea of DCT based image inpainting is discussed. In section III, proposed technique is presented. The experimental result of this technique is presented and discussed in section IV. Finally, conclude this work in section V.

2. Discrete Cosine Transform

A **discrete cosine transform (DCT)** expresses a finite sequence of data points in terms of a sum of cosine functions oscillating at different frequencies. DCTs are important for lossy compression of audio, images and the numerical clarification of PDEs. For compression only cosine function is used, since it turns exposed that fewer cosine functions are desired to approximate a typical signal, whereas the cosines express a particular choice of boundary conditions for differential equations.

A DCT is similar to the discrete Fourier transform (DFT), but using only real numbers. DCTs are correspondent to DFTs of roughly twice the length, operating on real data

with even symmetry but some variant input and/or output data are shifted by half a sample.

There are eight standard DCT variants, of which four are common. The type-II DCT is the most common variant of discrete cosine transform, which is often called DCT, the type-III DCT is inverse from type-II DCT, is often called the inverse DCT.

In some cases, the target patch has not sufficient amount of known pixels for producing a significant image. In patch priority, the quantity of known pixels required more, so this circumstances can occur its affect the final result. On the right column the target patches has improved result than on the left column. In that patch if there are not sufficient amount of known pixels, so the aim is to increase known region for shifting the target patch to that place. In mask image assumed that at known pixel value of pixel is zero and at unknown pixel value of pixel is one. Here assumed that in the way of the known pixel the target patch should be moved. If the amount of known pixels is fewer than threshold then only shifting patch is applied to target patch with highest priority. Then find the best matched patch of the shifted target patch. In shifted patch, if no one of the pixel is in the original patch, target patch cannot be taken. Then choose inferior highest priority of target patch and again patch shifting is done. Continual process is stopped when target patch is established satisfactory. Patch shifting is useful only for partial number of target patches to maintain the remuneration of patch priority.

3. Proposed Method

3.1 For Noise Removal

From the original image find the target region, in which the algorithm is applied. Removing noise from the original image some steps are follows:

Step 1: Take the Original image.

Step 2: List the nodes which are unknown.

Step 3: Apply Discrete Cosine Transform.

Step 4: Then find the Corrupted region.

Step 5: Eliminate the values which are unknown.

Step 6: Then apply Inverse Discrete Cosine Transform.

Step 7: Get inpainted image.

3.2 For Filling Missing Region

From the original image find the target region, in which the algorithm is applied. Filling missing region from the original image some steps are follows:

- Step 1: Take the Original image.
- Step 2: Find the missing region/patch.
- Step 3: Shifting the patch using Discrete Cosine Transform.
- Step 4: Fill the missing region/patch.
- Step 5: Get inpainted image.

4. Experiment Results

4.1 Experiment Results for Noise Removal

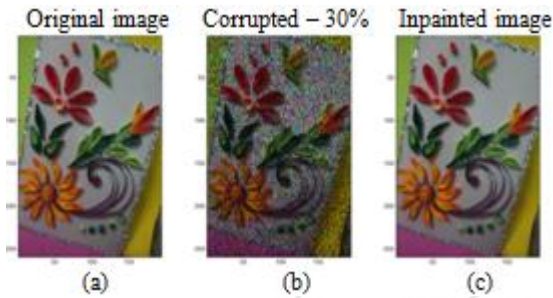


Figure 1: (a) Original image, (b) Corrupted image by 30% noise and (c) Inpainted image

The above fig.1 (a) is an original image, fig. 1 (b) corrupted image with 30% noise. So the aim is to remove impulsive noise from the original image and fig.1 (c) is an inpainted image of the original image. After applying the DCT based algorithm, get result with good accuracy and consuming less time.

4.2 Experiment Results for Noise Removal

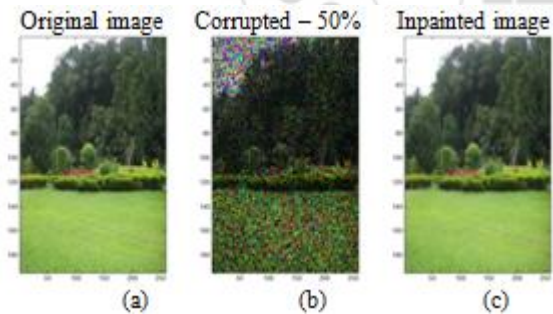


Figure 2: (a) Original image, (b) Corrupted image by 50% noise and (c) Inpainted image

The above fig.2 (a) is an original image, fig.2 (b) corrupted image with 50% noise. So the aim is to remove impulsive noise from the original image and fig 5.2(c) is an inpainted image of the original image. After applying the DCT based algorithm, get result with good accuracy and consuming less time.

4.3 Experiment Results for Noise Removal

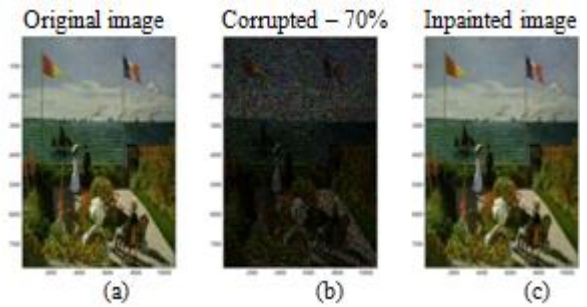


Figure 3: (a) Original image, (b) Corrupted image by 70% noise and (c) Inpainted image

The above fig.3 (a) is an original image, fig.3 (b) corrupted image with 70% noise. So the aim is to remove impulsive noise from the original image and fig.3 (c) is an inpainted image of the original image. After applying the DCT based algorithm, get result with good accuracy and consuming less time.

4.4 Experiment Results for filling missing region

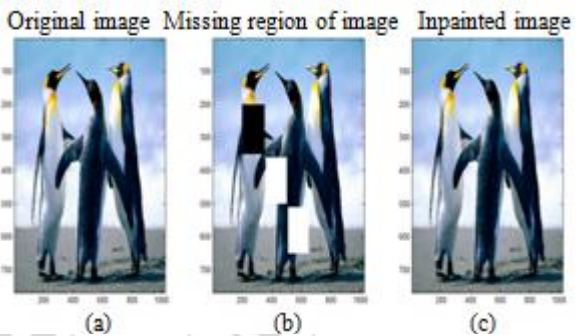


Figure 4: (a) Original image, (b) image with missing region and (c) Inpainted image

The above fig.4 (a) is an original image, fig.4 (b) image with missing region. So the aim is to fill missing region of the image and fig.4 (c) is an inpainted image. After applying the DCT based algorithm, get result with good accuracy and consuming less time.

4.5 Experiment Results for filling missing region

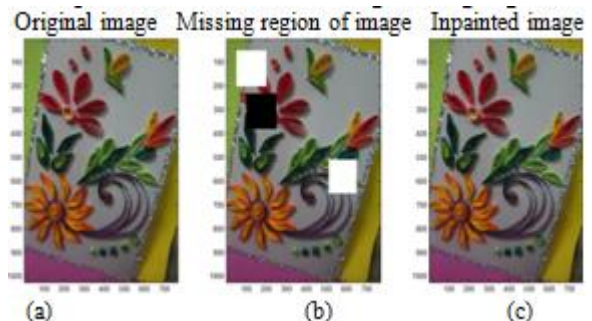


Figure 5: (a) Original image, (b) image with missing region and (c) Inpainted image

The above fig.5 (a) is an original image, fig.5 (b) image with missing region. So the aim is to fill missing region of the image and fig.5 (c) is an inpainted image. After applying the

DCT based algorithm, get result with good accuracy and consuming less time.

5. Conclusion

In this paper, DCT based technique used for image inpainting. Using DCT algorithm the performance improved for removing noise in the image and filling missing information over the regions with sensible sizes and better visual quality. In future, improve the performance of DCT algorithm for removing noise in the image.

References

- [1] S.SherinNelcy, VidyaMol N.A, "Optimal Sparse Representation Based Robust Image Inpainting", International Journal of Engineering Research and Applications, March 2014.
- [2] Sarawut Tae-o-sot, Akinori Nishihara, "DCT Inpainting with Patch Shifting Scheme", The Center for Research and Development of Educational Technology, Tokyo Institute of Technology, 2011.
- [3] Jayesh Patel, Tanuja K. Sarode, "Exemplar based Image Inpainting with Reduced Search Region", International Journal of Computer Applications, Volume 92 – No.12, April 2014.
- [4] Seema Kumari Singh, J.V. Shinde, "Review and Potential of Various Approaches for Execution of Image Inpainting", International Journal of Emerging Technologies in Computational and Applied Sciences, March-May, 2014.
- [5] V. Janarthanan and G. Jananii, "A Detailed Survey on Various Image Inpainting Techniques", in proc. Bonfring International Journal of advances in Image Processing, September-2012.
- [6] M. Bertalmio, G. Sapiro, V. Caselles, and C. Ballester "Image Inpainting", in Proc. SIGGRAPH, 2000.
- [7] Rajul Suthar, Mr. Krunal R. Patel, "A Survey on Various Image Inpainting Techniques to Restore Image", Int. Journal of Engineering Research and Applications, Volume 4, Issue 2 (Version 1), February 2014.
- [8] Antonio Criminisi, Patrick Pérez, and Kentaro Toyama, "Region Filling and Object Removal by Exemplar-Based Image Inpainting", IEEE Transactions on Image Processing, Vol. 13, No. 9, September 2004.
- [9] Pranali Dhabekar, Geeta Salunke, Meenu Gupta, "The Exemplar-Based Image Inpainting Algorithm through Patch Propagation", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 7, July 2013.
- [10] N. Ahmed and K. R. Rao, Orthogonal Transforms for Digital Signal Processing. New York: Springer-Verlag, 1975.