ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 4, July 2015

An Efficient Algorithm for the Exemplar Based Image Inpainting

Ms. Pooja Jain
Assistant Professor, Department of Computer Science & Engineering, SVITS
Poojacs35@gmail.com

Aditya Mishra
Research Scholar
adityam335@gmail.com

Abstract

Image inpainting is the process of filling the missing portion of an image or removing an object from a image. In this paper we introduce a literature review of some latest exemplar based image inpainting techniques. The working of each method for inpainting is explained in brief. An overview of image inpainting is also given at the beginning.

We have also proposed a novel exemplar based image inpainting method. The proposed image inpainting method will be capable of removing the complete object from an image or a part of the object & it will produce high quality results.

I. Introduction

Image inpainting is the research area in the field of image processing whose goal is to remove some objects or restore the damaged regions in a way that observers cannot percept the slight change. The image in painting concept is widely used in the photoediting etc.

Exemplar-based approach is originated from the Exemplar- based texture synthesis in [1]. In that work the texture is synthesized by copying the best match patch from the known region. Applying both structures and textures in natural images directly applying Exemplar-based texture synthesis to image inpainting problem may not provide satisfactory result. Bertalmio[2] show that the result of combining restored structural and textural image is better

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 4, July 2015

than restoration by only Diffusion-based inpainting or texture synthesis alone. Criminsi[3] worked on the concept of the patch priority and the most similar patch is used for the inpainting.

II. Literature Survey

A denoising based method is proposed in the work done by [1]. The noise removal will in general not work for filling-in large missing portions in an image.

The most of the inpainting methods work as follows: user selects the region to be inpainted. It is usually done as a separate process and may require the use of separateimage processing tools. Image restoration is then carried out automatically. The open source freely available tools for the image inpainting are [1,10]

Mainly there are three classes of algorithms employed for inpainting. The first class of algorithms is for restoring films or videos, but it is not very useful for image inpainting as there is limited information for inpainting images as opposed to film inpainting where the information may be extracted from various frames. Second class of algorithms deals with the reconstruction of textures from the image [4]. Algorithms utilize samples from the source region to rebuild the image. By using this approach, the most of the texture of the image can be rebuilt. Third class of algorithms tries to rebuild the structural features such as edges and object contours etc. Authors of paper [1] presented a pioneering work in this respect. This was able to recover most of the structural features from the image but failed while recovering huge regions. Author in [8] used the concept of mask to achieve inpainting. Mask that they choose for inpainting is decided interactively and requires user intervention. Method prepare the mask such that the centre element in the mask is zero. It means that no information about a pixel is extracted using its own value. Algorithm uses the values of its neighboring pixels to determine its value. It also works only for small regions and cannot inpaint large regions in the image.

One more algorithm for recovering small regions and noise in an image is proposed in paper [5]. This can inpaint images with very high noise ratio. Method uses Cellular Neural Networks for the same. The noises inside the cell with different sizes are inpainted with different levels of surrounding information. This method achieved a high accuracy in the field of de-noising using inpainting techniques. Mehod provides results that show that an almost blurred image can be recovered with visually good effect. It is not suitable for the larger

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 4, July 2015

regions.

The [11] propose an algorithm using Cahn-Hilliard fourth order reaction equation to achieve inpainting in gray-scale images. Author in [2] enhanced the working of the [11] by introducing variable flow of images.

Method in [4] proposed an inpainting algorithm to fill in holes in overlapping texture and/or cartoon image synthesis. Author constructed a decomposition based method and filling-in stage as two blocks. On the other hand, their approach [1,4] considers these as one unified task.

One more algorithm was proposed in the paper by Criminisi et al. [3,13]. Authors proposed a pioneering approach in this field that combined structural reconstruction approach with the texture synthesis approach in one algorithm by combining the advantages of both approaches.

The work done in [12] proposed an algorithm for video inpainting by implanting objects from other frames. The improved exemplar based algorithms for the same. Another approach [6,7] for video inpainting employs information from adjacent frames and performs interpolation. Authors focus their research towards the restoration of old movies and particularly scratch removal. Method use the block based exemplar based approach and extend it using motion estimation.

III. Problem Domain

The problem of most of Exemplar-based approaches is that, in some cases, satisfied results cannot be achieved because large unknown region is filled by small number of known pixels. The patch shifting technique makes sure that the target patch always contains enough known pixels so it can efficiently compare with the candidate patch in the source region. In this way, more reliable patch is chosen to fill the unknown region.

In robust inpainting algorithm using region segmentation, segmentation map provides local texture similarity and dominant structure region. With boundary information of a segmented image map, the proposed method determines the suitable patch size and selects candidate source regions for reducing unnatural artifact.

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 4, July 2015

Objectives:

We will propose a method:

- Useful in restoring old images
- Will remove complete object from an image or a part of the object
- Will produce high quality results

IV. Solution Domain

The outline of the proposed method is as follows:

- **Select the target region:**
  Selection of the target region is completely a separate activity. It is apart from the image inpainting. It requires a separate and additional image processing tool. Generally, the selection of thetarget region is done by marking the rergion with a special color. Also there should be no loss of generality. In our method, we have used the green color.

- **Locate all the boundaries of the target region**

- **In the target region, select a patch which is to be inpainted:**
  The patch size is generally chosen in such a way that it should be large than the largest distinguishable region of the image. In our method, the default patch size is 9 * 9. It can be changed. Also the patch is denoted by PTCH.

- **Now find a similar patch in the image**
  We use the Normalised Mean Squared Error to find the best matching patch.

The NMSE (Normalised Mean Square Error) is an estimator of the overall deviations between predicted and measured values. It is defined as:

$$NMSE = \frac{1}{N}\sum_{i}\frac{(P_i - M_i)^2}{\overline{PM}}$$

$$NMSE = \frac{1}{N}\sum_{i}\frac{(P_i - M_i)^2}{\overline{PM}}$$

$$NMSE = \frac{1}{N}\sum_{i}\frac{(P_i - M_i)^2}{\overline{PM}}$$

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 4, July 2015

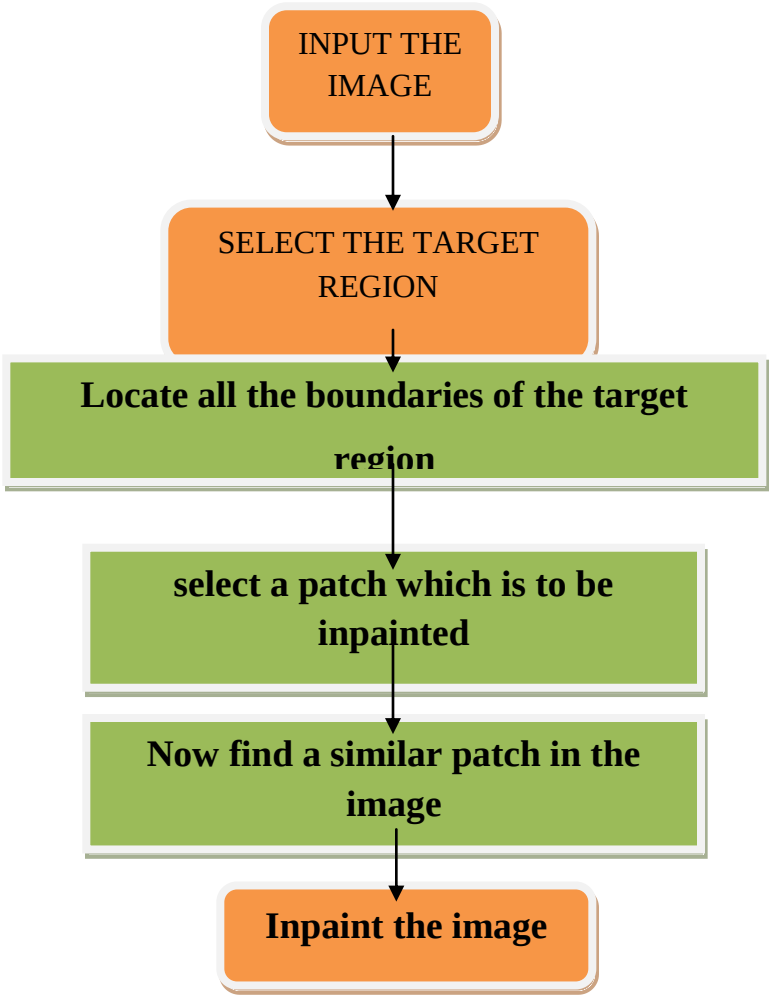
Contrary to the bias, in the NMSE the deviations (absolute values) are summed instead of the differences. For this reason, the NMSE generally shows the most striking differences among models. If a model has a very low NMSE, then it is well performing both in space and time. On the other hand, high NMSE values do not necessarily mean that a model is completely wrong. That case could be due to time and/or space shifting. Moreover, it must be pointed out that differences on peaks have a higher weight on NMSE than differences on other values.

Use of NMSE will select the best patch which will do the task with less space & time.

- **Inpaint the image:**

  In this step the patch is updated according to the image information obtained in the previous step.

The outline of the proposed work is as follows:



ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 4, July 2015

V. Conclusion

In this paper, we have proposed a novel exemplar based method for the image inpainting. It will remove the existing object. Also it is capable of producing high quality output images. This paper also contains an overview of image inpainting. The review of some modern image inpainting technique is presented. Their merits and demerits are discussed in brief. The common problems of modern image inpainting techniques have been identified.

References

[1] M. Bertalmio, G. Saprio, V. Caselles, and C. Ballester, "Image Inpainting," Proceedings of the 27th annual conference on Computer graphics and interactive technique, 417-424, 2000.

[2] M. Burger, H. Lin, and C.B. Schonlieb, "Cahn-Hilliard Inpainting and a Generalization for Grayvalue Images," UCLA CAM report, 08-41, 2008.

[3] 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.

[4] M. Elad, J.L. Starck, P. Querre, and D.L. Donoho, "Simultaneous Cartoon and texture image inpainting using morphological component analysis (MCA) ," Journal on Applied and Computational Harmonic Analysis, 340-358, 2005.

[5] P. Elango, and K. Murugesan, K, "Digital Image Inpainting Using Cellular Neural Network," Int. J. Open Problems Compt. Math., 2(3), 439-450, 2009.

[6] G. Forbin, B. Besserer, J. Boldys, and D. Tschumperle, "Temporal Extension to Exemplar-Based Inpainting applied to scratch correction in damaged image sequences," Proceedings of the International Conference on Visualization, Imaging and Image Processing (VIIP 2005), Benidorm, Espange, , 1-5, 2005.ed. Pearson Education, 2002.

[7] A.C. Kokaram, R.D. Morris, W.J. Fitzgerald, and P.J.W. Rayner, "Interpolation of missing data in image sequences," IEEE Transactions on Image Processing 11(4), 1509-1519, 1995.

[8] M.M. Oliveira, B. Bowen, R. McKenna, and Y.S. Chang, "Fast Digital Image Inpainting," Proceedings of the International Conference on Visualization, Imaging and Image Processing (VIIP 2001), Marbella, Spain, 261-266, 2001.

[9]PhotoWipe, http://www.hanovsolutions.com/?prod=PhotoWipe

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 4, July 2015
[10]RestoreInpaint, http://restoreinpaint.sourceforge.net/
[11] C.B. Schonlieb, A. Bertozzi, M. Burger, and H. Lin, "Image Inpainting Using a Fourth-Order Total Variation Flow," SAMPTA'09, Marseille, France, 2009.
[12] T. Shih, et al., "Video inpainting and implant via diversified temporal continuations," Proceedings of the 14th annual ACM international conference on Multimedia, 133-136, 2006.
[13] A. A. Efros and T. K. Leung, "Texture synthesis by nonparametric sampling," Proceedings of IEEE International Conference on Computer Vision, Greece, 1033-1038, 1999