International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 06, Issue 05, May 2017, ISSN: 2278 – 1323

Reliable Completion of Images: A Survey

Rahul Ahiray, Pavan Ambhure, Parthasarthi Bapat, Akshay Avhad, Prof. Shital Bhandare

Student, Computer Department, KKWIEER, Nashik, Maharashtra, India

***Abstract*—Image inpainting is technique used to fill the missing portions of image. The technique removes the unwanted portion of an image and replaces it with the surrounding area of image using patch similarity. In this paper, a survey has been made on existing image inpainting techniques. There are various approaches like the co-matching algorithm, texture synthesis and nearest neighbor search techniques. This paper emphasizes on the exemplar based inpainting approach.**

***Index Terms*—Image completion, image generation, image matching, inpainting.**

I. INTRODUCTION

Every day thousands of pictures are clicked but not every image is clicked perfectly. Most of the times, an unwanted object or person is captured in the image. Editing these images manually using photo editing tools such Adobe Photoshop, CorelDraw or other software is difficult and also requires the user to learn those tools. Image Inpainting is a technique of removing such undesirable patches of images and filling those regions with appropriate patches. While existing work is able to patch images successfully, the success rate is relatively low. Reconstruction of surrounding area is still a problem in most image inpainting techniques.

This paper introduces an image completion technique which aims to reliably reconstruct the missing portion of the image. The previous work also tried using existing images of the same places to fix the input image but using existing databases of the images or making new one was time consuming. Inpainting using input image itself is efficient and fast. The region to be removed is selected from the input image and the surrounding area is used to fill the missing region. The result is obtained using RGB values of surrounding areas which best suits missing region of the image. Experiments and results demonstrate that our method can effectively generate complete images.

II. LITERATURE SURVEY

Literature survey was an important step as there are many different approaches in image inpainting.

Zhe Zhu et al. [1] proposed a technique to produce factually correct images using co-matching technique. The technique uses existing databases on scenic landmarks. Line and point correspondences are found and the images are inpainted. This technique is only limited to the images of scenic landmarks.

Wexler et al. [2] introduced a technique to complete the missing or corrupt portions of video by using the available parts and frames of the video. The texture from available frame is analyzed and the corrupt regions are consistently completed which results in realistic video frames.

Barnes et al. [3] present a way to find the nearest-neighbor matches between image patches. A degree of randomness is used in this system. The technique uses randomized sampling because image coherence makes it easy to find patches to be propagated. This purpose of this algorithm was to be fast and be usable in interactive image editing tools.

Hays et al. [4] demonstrated how millions of images collected from the internet can be used in image inpainting. The algorithm is mostly data-driven. It relies on the photographs collected from the internet and finds one or more images containing scenes similar to the input image. Unlike other algorithms, this algorithm generates more solutions and allows user to select the suitable one.

Bertalmio et al. [5] proposed an automated approach to inpaint images. The approach does not require user intervention and the textures are automatically selected. The automation couple with the texture synthesis is used to obtain desired results. This approach successfully removes unwanted subtitles, dates and logos.

Criminisi et al. [6] introduced a novel best first algorithm for image inpainting. The technique concentrates on creating a visually plausible result. The structure and texture are propagated using a single algorithm. This reduces the blurring of artifacts as in previous approaches. Exemplar based image inpainting also allows faster computations and results.

Shi-Min Hu et al. [7] demonstrated a patch based and library driven image inpainting. Like previous approaches this also relies on the image library.

III. INPAINTING APPROACHES

A. Data-driven approach:

This approach makes use of existing images having similarities to the input image. Similarity is identified and the dissimilar regions are patched using the images in the database. The problem with this approach is that enough images of the place where the picture has been clicked must be available. This approach works best for images that contain monuments or other famous places. This technique uses the co-matching algorithm which finds the point and line correspondences between two images.

Corrupt videos and films can be fixed using this approach as the image data is available in the form of different frames in the video. A corrupt frame can be fixed using the data from other complete frames.

B. Input-driven approach:

This technique uses the same image to fill the existing regions of the image. The patch that is most suitable is identified and propagated to the missing portion of the image. There are many ways to achieve this and these are few of them-

1. Texture synthesis – In this way of inpainting, the textures in the rest of the image are analyzed and a texture that is suitable for the missing portion is either specified by the user or is automatically selected as in [5] and the texture is synthesized at the missing portion.

2. Nearest neighbor – This technique uses the nearest neighbor algorithm to find the most suitable patch for the replacement of the unwanted object. This technique works best if there is good coherency in the image. Sometimes a randomized nearest neighbor algorithm is used to find suitable patches from the image.

3. Exemplar based inpainting – This technique finds different patches and the patch is give a score. The patch with the best score is then used directly propagated. The structure and texture are propagated with the same algorithm. Though this technique does not necessarily produce accurate results, the inaccuracies are not detectable for the human eye.

C. Adapted Exemplar Based Approach:

Previous exemplar approaches find different patches that can be used to replace the unwanted object or person. Each patch had a property which described its error score. The patch with the least error score was then used to patch the missing portion of the image. The previous exemplar approach did not specify which patch to use when two patches with the same error score were encountered

The proposed technique uses a well-defined error score with better range and finds the better patch easily. The probability of two patches having the same error score has been reduced. Even if the new technique finds patches with the same score, it uses the patch that was found earlier.

The adapted exemplar approach finds it easier to find the best exemplar patch. The search for the best patch is done in the largest distinguishable texture in the image. The patch is selected such that it is larger than the target region. This may sometimes cause blurring of artifacts but such differences are not detectable to the human eye. The technique results in visually plausible results in very short amount of time.

The adapted exemplar based approach is Faster than other techniques but moderately accurate. No data or human intervention is required as the technique is automated.

Technique	**Speed**	**Accuracy**	**Data Required**	**Human Intervention Required**
Data Driven	Slow	High	Huge	Yes
Texture Synthesis	Slow	Medium	None	Yes
Nearest Neighbor	Medium	Medium	None	No
Randomized Nearest Neighbor	Medium	High	None	No
Exemplar Based	Medium	Low	None	No

Table 1: Comparison Table

IV. LIMITATIONS

The adapted exemplar approach is faster than other approaches but is only moderately accurate. Blurring of artifacts is caused but generally undetectable to the human eye. The algorithm slows down when the image size increases. The size of the target region also affects the speed of the algorithm. Larger target regions slow down the inpainting process drastically.

V. CONCLUSION

An Adapted Exemplar based approach is used in this paper to remove unwanted objects and fill the missing portions of an image. The comparison of different image inpainting techniques data-driven as well as self-driven are discussed. It was found that adapted exemplar based approach is best in practical applications as it gives visually plausible results in very short amount of time without any human intervention. The speed and visual plausibility of its results make it an efficient and practically usable approach in image inpainting.

VI. REFERENCES

[1] Zhe Zhu,Hao-Zhi Huang, Zhi-Peng Tan, Kun Xu, and Shi-Min Hu, "Faithful Completion of Images of ScenicLandmarks Using Internet Images", IEEETrans. Visualization *and* Computer Graphics, Vol. 22, No. 8, Aug 2016.

[2] Y. Wexler, E. Shechtman and M. Irani, "Space-time completion ofvideo," IEEE Trans. Pattern Anal. Mach. Intell., vol. 29, no. 3, pp. 463–476, Mar. 2007.

[3] C. Barnes, E. Shechtman, A. Finkelstein and D. Goldman,"Patchmatch: A randomized correspondence algorithm for structuralimage editing," ACMTrans. Graph., vol. 28, no. 3, pp. 24–34,2009.

[4] J. Hays and A. A. Efros, "Scene completion using millions of photographs,"ACM Trans. Graph., vol. 26, no. 3, pp. 4:1–4:7, 2007.

[5] M. Bertalmio, G. Sapiro, V. Caselles, and C. Ballester, "Imageinpainting," in *Proc. 27th* Annu. *Conf.* Comput. *Graph.* InteractivTech. InteractiveTechn., 2000, pp. 417–424.

[6] A. Criminisi, P. Perez, and K. Toyama, "Region filling and objectremoval by exemplar-based inpainting," IEEE Trans. Image Process,vol. 13, no. 9, pp. 1200–1212, Jan. 2004.'

[7] S.-M. Hu, F.-L. Zhang, M. Wang, R. R. Martin, and J. Wang,"Patchnet: A patch-based image representation for interactivelibrary-driven image editing,'' ACM Trans. Graph., vol. 32, no. 6,pp. 196:1–196:12, Nov. 2013.

Rahul AhirayBE Computer K.K.Wagh College of Engineering Nashik

Pavan AmbhureBE Computer K.K.Wagh College of Engineering Nashik

Parthasarthi BapatBE Computer K.K.Wagh College of Engineering Nashik

Akshay AvhadBE Computer K.K.Wagh College of Engineering Nashik