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RESEARCH ARTICLE

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IMAGE COMPLETION APPROACH THROUGH IN-PAINTINGTECHNIQUE

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ABSTRACT

Image in painting is a process of filling the missing regions (holes) in an image. The problem of in painting occurs when part of the pixel data in a picture is missing or over-written by other means. The goal of image in painting is to restore parts of an image, in such a manner, that a viewer cannot detect the restored parts. Many techniques on image in painting could achieve only when there are small in painting regions. However, performing image painting seamlessly is non-trivial as it is a challenging problem. Recently Olivier et al. proposed an algorithm known as hierarchical super-resolution algorithm that converts low-resolution images that have missing parts into high resolution images through in painting. The algorithm was able to provide satisfactory results. In this paper explore similar solution by considering temporal dimension in the in painting process for improving quality of output image besides achieving high visual relevance. We built a prototype application in MATLAB which demonstrates the evidence of conception. The experimental outcomes are positive.

Index terms –Super-resolution, image in painting, exemplar-based in painting.

INTRODUCTION

Image inpainting refers to the process of fixing holes in an image. It does mean that the image with missing parts can be reconstructured uisng the inpainting approach. There are two main apporaches in doing so. They are diffusion based approaches and examplar based approaches. The first approaches focus on level lines and diffusion based methods in order to reconstruct image. However, they may cause blur when the hole that needs to be filled is bigger. The exampler based approaches on the other hand copy best matching texture patces from known neighborhood of images as explored in [1], [2], [3] and [4]. These approaches that are based on exampler based are influenced by the texture synthesis technqiues as pesetned in [5]. Out of which the first attempt was made in [2] and later it was improved in [3] using priori rough estimate. These approaches are able to analyze missing regions of image and fill the gaps seamlessly. There is the third category of approaches that combine both examplar based and diffusion based approaches for better results [6]. Figure 1 shows an example for image inpainting.

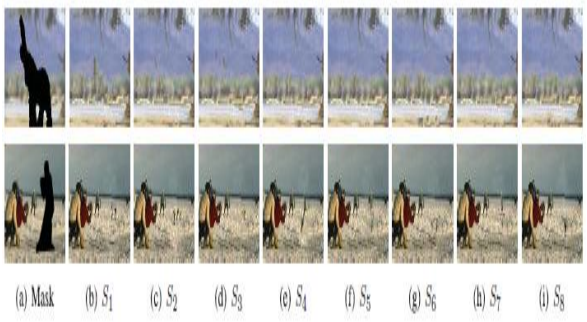

Figure 1 – Illustrates image inpainting for two images (top and bottom)

The technqiues used priority based decisions based on the patches in hand [7]. There are two steps in the algorithm presented in [6]. They are In the first step a course version of the input picture is inpainted while in the second step takes care of creating an improved resoution picture. The exampler based aproches have been around for many years and they perform well. However, they too have certain drawbacks. Very important drawback is relaed to the setting of parameters pertaining to patch size and filling order. A super resolution method is used in [6] for getting final and full resolution image. Interpolation technqiues are also used in [8] for achieving image inpainting. The resaerchers in [9] and [10] also focused on converting low resolution images to high resolution images with image inpainting concept. Other simailr researches include [4], [11] and [10]. Recently Meur et al. [12] proposed an algorithm for image inpaintig which is best known as LR-HR mehtod that makes use of hierarchial super resolution. Their approch is as presented in Figure 2.

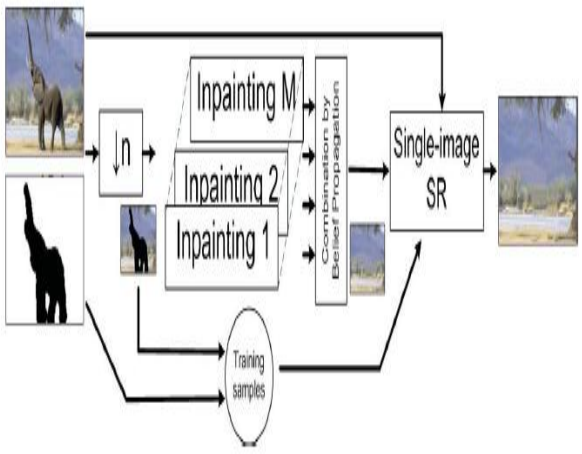

Figure 2 – Image inpainting approach used in [12]

As can be seen in Figure 2, it is evident that the input image has some missing part in the image. The missing part can be called as hole in image. The hole needs to be filled intuitively so as to improve the quality of image. Image inpainting has been used extensively for such purpose. The given input image is taken and inpainting is done for number of times and he results are subjected to belief propagation. Then a single image SR is used with the help of training samples so as to produce a high quality output image which does not reflect any holes in it. It appears like a naturally constructed image with good visual quality.

Here technique used in [12] besides adding temporal dimension for inpainting thus improving the quality of output image further. Our algorithm is presented in section II. The remainder of this paper is structured as follows. Section II presents the proposed approach and prototype application. Section III presents experimental results while section V provides conclusions and directions for future work.

Proposed System and Prototype Application

Here develop a prototype application that demonstrates the proof of concept. The application is built in MATLAB. The approach to solve the problem of image inpainting is similar to the one presented in Figure 3. This method was explored in [12]. The algorithm takes original picture which has one or more holes in it. Then it performs inpainting. Towards this it considers a dictionary of images. It computes filling order which is followed by similarity computation.

After computing distances, similarity is found and the inpainting decisions are made for filing the known part. The inpainting is an iterative process that take certain to complete. The inpainting algorithm proposed in [12] is improved further using temporal dimension which improves visual relevance in the enhanced image. The algorithm is as presented in Figure 4.

Algorithm

In order to include the temporal dimension in the algorithm proposed in [12], itbuilt a new algorithm and implemented in MATLAB in order to enhance the quality in the inpainting process. This is done by considering temporal domain in the algorithm. The algorithm takes an image with missing areas as input and generated high resolution

image after performing inpainting process. It follows the normal procedure that has been presented in Figure 3 besides having some adjustment in priority levels using the knowhow pertaining to temporal dimension. This will lead to improvement in the visual relevance and the overall quality of output image.

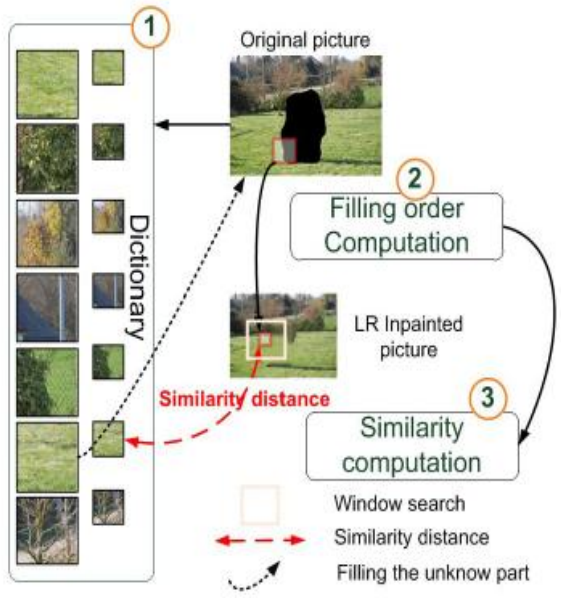

Figure 3 – Image inpainting algorithm [12]

Figure 4 – Proposed algorithm

Algorithm: Image Inpainting Algorithm
Inputs : Image with missing areas
Outputs : High resolution image after inpainting

START
Initialize *i* with given image
Extract patches *P* from *i*
Initialize Prioritized Patches (*PP*)
For each portion of *i*
For each *p* in *P*
  Compute priority of *p*
  Add priority to *PP*
  Adjust values in PP in temporal domain
End For
Find the *p* with from *PP* maximum priority
Find exemplar suitable
Copy image data
Update the data
End For
END

As can be seen in Figure 4, it is evident that the algorithm has many modules such as filing order computation, similarity computation and there is temporal dimension applied in adjusting the order of the priorities to ensure that the visual relevance is improved further.

Experimental Results

Many experiments are made with the prototype application built in MATLAB. The environment used for the experiments include a PC with 4GB RAM, core 2 dual processing running Windows 7 operating system. Many images were considered for experiments and executed the application to test the inpainting process visually. The application demonstrates the process of inpainting by demarcation of the hole being inpainted in iterative fashion. The algorithm takes time to complete the inpainting process based on the size of hole in the input image. The output will be an image with hole inpainted in order to make it intuitive and high quality visual image.

Figure 5 – Experimental results

As can be seen in Figure 5, it is evident that that image inpainting is an iterative process and the user can view the progress. The demarcation of hole is visible in all the screens presented in Figure 5. The demarcation of hole in block color patch gets decreased as there is progress in the process of in painting. The final result will have high resolution and high visual quality.

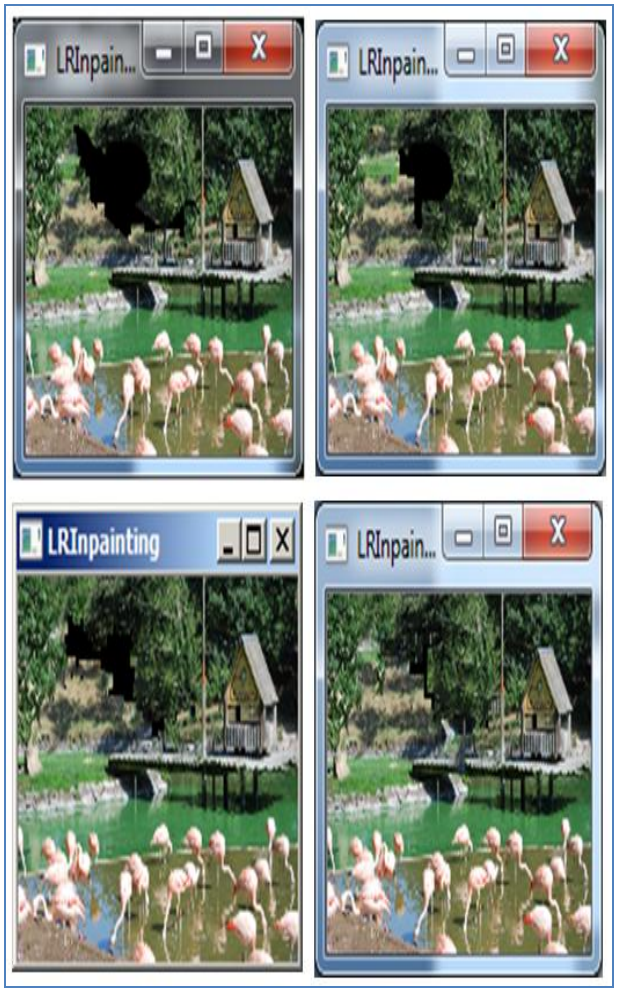

Figure 6 – Experimental results

As can be seen in Figure 6, it is evident that that image inpainting is an iterative process and the user can view the progress. The demarcation of hole is visible in all the screens presented in Figure 5. The demarcation of hole in block color patch gets decreased as there is progress in the process of inpainting. The finalresult will have high resolution and high visual quality.

Conclusions and Future work

The area to be in-painted is chosen supported color, shape, orientation, region selected by the user or a binary image specifying the missing space. The milling portions in the input image are called holes. The holes are filled using the most suitable textures in the neighborhood images. Texture synthesis strategies work well for larger unknown space however typically leading to undesirable boundaries. Here made a framework for achieving high quality results through in painting. The approach is low resolution image to high resolution image with visual quality and intuitiveness as the holes are naturally filled. The inpainting algorithm presented in [12] has been enhanced in this paper with an algorithm that considers temporal dimension. The temporal dimension helps in adjusting the priorities for high visual relevance and overall quality of output image. We built a prototype application that demonstrates the proof of concept. The empirical results are encouraging. Different kinds of inpainting methods could be used to fill in the missing areas of the low-resolution image. In this we can modify the pixel ratio and can put the background or the area of image in a manner we want as per the pixels available in that image.

As future work we focus on the image inpainting for video frames that need filling holes for enhancing quality of video content.

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