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Object Duplication in an Image using Texture Synthesis Technique

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ABSTRACT

Texture synthesis is one of the most attractive and modern image processing techniques in the area of computer vision. Now a day Texture Synthesis is used in many applications especially to show more number of objects in an image itself. Sometimes we see more objects in an image than the actual number of objects in many Hollywood films or in a public gathering place where Texture Synthesis technique is used. Most of those methods are cost effective and time consuming. In this paper we have presented a new algorithm to apply texture synthesis for objects duplication in an image to increase the image objects in the same image. By using our method we can minimize the cost and time. This noble method is done by randomly picking up any image portion or the selected portion of the image called tiles or patch and then matching it with the similar tiles of the neighboring image portion by texture synthesis technique. Moreover most of the Texture Synthesis method uses an additional texture image for matching process where our method does not need anything except the input image.

Keywords: *Computer Vision, Image Processing, Object duplication, Texture synthesis.*

I. INTRODUCTION

Texture is an important feature in the field of computer vision and image processing applications. In real world many objects of an image often do not exhibit regions of uniform or smooth intensities. On the other hand we may need to visualize more objects in the image for various applications. Texture is one of the most attractive solutions to make an image with uniform regions or smooth brightness or duplicating objects in an image. In this paper our aim is to use some Texture technique to visualize more objects in the image than the actual number of objects in real world.

There are mainly three major applications of texture processing which are called classification, segmentation and synthesis [5]. Classification involves identifying the given homogeneous regions, segmentation produces a classification map of an input image and synthesis is responsible to make similar image for image compression or image decompression. Synthesis technique is also used to make 3D images, to paint images by various textures etc. In other words texture synthesis may call as image mixing process where one or more than one images are mixed such a way that can make another larger, smaller or different image with attractive colors, shapes and sizes. Different texture techniques are used for different purposes. Most of the texture synthesis techniques are cost effective and time consuming because of the complexity of process. In this paper we have introduced a new method called image duplication to perform texture synthesis with less processing time and less cost.

Object duplication can also be done in various ways such as Photoshop software. To duplicate any selected object in an image we need to match that selected image region with its neighboring pixels which may not be done by Photoshop. But texture synthesis can predict the future pixels based on past and present pixels to solve that neighboring pixels matching problems. Based on this technique we implement our proposed method to make object duplication in the image.
This paper demonstrates object duplication based on texture synthesis technique.
In the next section it will be explained step by step concerning the related works, problem statement, solution as well as conclusion.

II. SURVEY OF RELATED WORKS

Object in an image can be replaced by Heeger's and Bergen's algorithm [2]. Again object can be deduction and stain image improving is carried out by collaborative filtering approach [1]. This exemplar-based propagation [1] algorithm focuses on patch level in sequence and provides high-quality visual output. Multiple seed blocks and support vector machines based texture produce [3] patch left-to-right order in the outcome texture. Markov random field model [4] is used to predict future pixels and dynamic programming method is used to eliminate the overlap pixels.

III. PROBLEM STATEMENT AND MAIN CONTRIBUTION

If we want to increase the number of objects in an image the main problem is the uniform brightness and smoothness of the regions. Image scaling technique can make an image larger but it fails to increase the number of objects. Photoshop or other tools are also used to duplicate object but it cannot match neighboring pixels which make the image ununiformed. Though texture can construct larger digital image than an actual image, it is required to find some technique to increase the number of objects in the image and it can also make the image larger at the same time.

Research question is how to apply texture synthesis technique to increase the number of objects in an image with uniform brightness and smoothness of all neighboring pixels. The hypothesis is that at first we fix the output image size and we divide that output image into a summation of square regions with row and column. Then we randomly take a small portion of the image called tiles or patch from the input image and keep it into the output image. Afterwards, we search a similar image tiles as the neighboring image portion based on brightness matching one after another by texture synthesis technique and put it into output image. By using this brightness matching and/or similar tiles searching and then attaching it in the neighboring image portion can increase the number of objects in an image.

The main contribution of this paper is to design an algorithm and implementing the model using MATLAB which is preceded by Markov random field model (MRF) [4] and dynamic programming method.

IV. PROBLEM SOLUTION

A. Modeling

To model the proposed hypothesis a picture is taken as an input image which is demonstrated in Fig 2. An object is selected from the original image as a square window is called patch or tile. This patch is used as a source of probability to generate the future pixels. Here Markov random field [4] is used to predict the future pixels. The pixels are matched as the brightness value of its neighborhood pixels. New tiles are made by MRF but need to generate one after another. To generate patch from left to right in the outcome texture multiple seed blocks and support vector machines [3] are used. But in the outcome texture some patches are overlapped. As a result pixels brightness is changed in that area. To remove the overlapping error in the boundary area dynamic random method [4] is used.

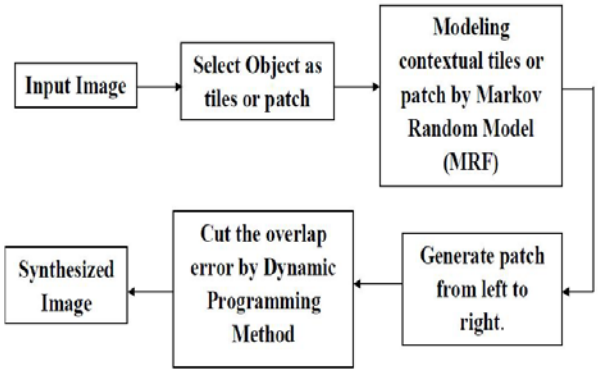

Fig. 1 Block diagram of the model

B. Implementation

Let I be the original image and its sample is taken as I_{sample} and $I_{sample} \subset I_{real}$. I_{real} is the image in the finite texture. Let be pixel $p \in I$. If the square image tile width is ω then centre pixel $\omega(p)$ is $\omega_p \subset I$.

Let assume the space between two tiles is $d(\omega_1, \omega_2)$ and all pixels are known in the original image I except pixel p. Now we use the probability distribution $P(p|\omega(p)|)$ to construct the approximation of the new matching tiles. Using Markov Random Field (MRF) [4] it can be defined pixel value set form the equation

$$\Omega(p) = \{\acute{\omega} \subset I_{real} : d(\acute{\omega}, \omega(p)) = 0\} \quad (1)$$

Including all $\omega(p)$ in I_{real}

Fig. 2 Original Image

Fig. 3 Patch or Tile

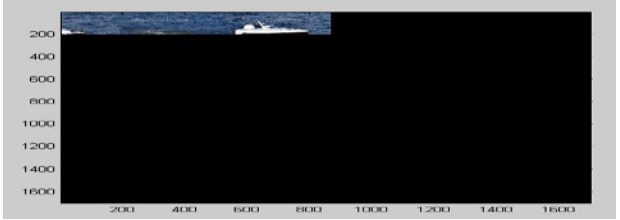

Fig .4. Matching the similar tiles as the neighboring image portion one after another

The overlap between the vertical and horizontal are found as

$$\xi^* = min_{\xi} \left\{ \frac{1}{\xi} \sum_{\forall r \in I_{\xi}} \Psi_r^{\xi} \right\} \quad (2)$$

Dynamic programming method is used to cut the horizontal & vertical overlaps error boundary. The approach of minimal error boundary cut is shown in Fig.5.

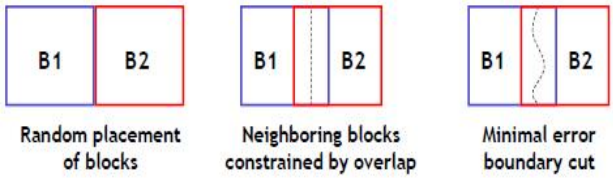

Fig. 5 Dynamic programming method to cut the overlaps error

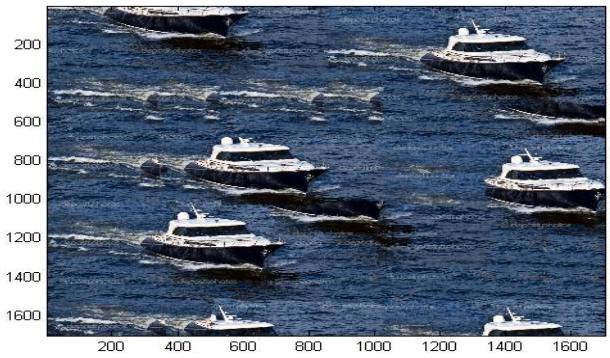

Fig. 6 Synthesized images

C. Validation

This model is implemented using MATLAB version R2007a. Fig.2 illustrates the original image. Selecting the ship as object Fig.3 from the original image and duplicate it by using texture. Fig. 6 demonstrates the synthesized image shows more objects.

In this simulation tile size is used as 200. Fig.4 shows the similar tiles searching and attaching one after another in the neighboring image portion. Here the overlap must be less than the tile size.

V. CONCLUSION

This paper initiates texture synthesis technique to duplicate object in an image as theoretical and experimental shadow. Object duplication through texture synthesis offer a new explanation to the object duplication problem for a certain category of image.

This paper only espouses a simple model to duplicate the object using texture. But this model does not work properly for all tile size. If the tile size is decreased we need more time and if the tile size is increased then the neighboring pixel may not be uniformed. When minimal error boundary cut some pixels are missed. As a result object size and shape may change. So finding appropriate size of the tiles may consider as future research.

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