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A NEW TEXTURE SYNTHESIS BASED IMAGE RESTORATION APPROACH WITH IMAGE FILTER

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ABSTRACTION: *Restoration of a Corrupted image has always been an important part of image processing and finds use in a surfeit of spheres. The process can be done manually or by using some digital image processing techniques. Image inpainting is one such technique which helps us to accomplish these objectives by means of filling up the missing regions in the damaged images. We click many images and always want to keep them preserve for long time, but after some time those pictures may be damaged (starches, cracks, Scratch, image data-loss), the solution is image Inpainting. This technique can restore the damaged area of an image and reconstruct them on the basis of neighbor's information. Here I will use texture synthesis based image restoration technique with Image Filtering Approach'. The proposed methodology aims to use of exampler based inpainting technique with image filtering process to produce more efficient results and performance.*

INTRODUCTION

Image in painting can also be called image completion, where the missing region of an image is filled in a visually plausible way. We can also define image inpainting that it is a way of filling unwanted area in an image according to the area specified by the user. Here the area which is not required is marked by the user and our process will fill those areas on the basis of neighbor's values. Existing algorithms is good but I am try to get better results in terms of time, quality, MSE and PSNR values.

Their application in this field leads to

- Poor performance in terms of time.
- Poor visual quality.
- Less Accuracy.

IDEA BEHIND IT

Image in painting means to repairing of a corrupt image/picture from lost of the information. As described in Figure 1, for an image with lost information, where the inpainting domain D is missing and the content outside D (Ω) is known, image inpainting is to fill domain D which makes the whole picture "meaningful" and looks like undamaged.

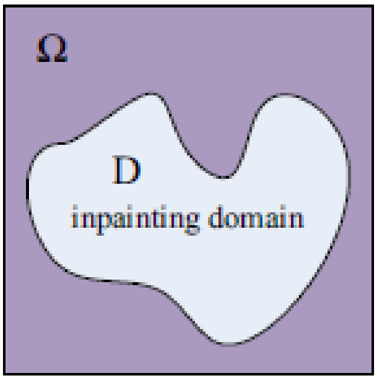

Figure 1: D is the lost Region on the basis of known region Ω [1]

USE OF RESTORATION

Object Removal

This technique can also works better for object removal/manipulation/addition from a scene. Objects may be removed from pictures so as to extract the background or create other optical illusions, special effects etc. next figure is showing the object removal example:

(a) (b)

Figure 3: Object removal Image inpainting (a) Original Image (b) Inpainted Image[2]

RECOVERY OF DISTORTED IMAGE

Apart from removal of an object , this technique works good in recovering image from scratches, scribbles, folds, etc. Defects may be present in the image or maybe induced synthetically to check the accurateness of the inpainting algorithm to produce the output or inpainted image. Next figure showing the use of inpainting to remove unwanted scribbles.

(a) (b)

Figure 4: (a) Original Distorted Image(b) Inpainted Image[3]

Manual in painting would directly be carried out on a painting but for using image inpainting technique a mathematical illustration of the same is required i.e. a digital image. A digital image is essentially a matrix of numerical values, where each value represents the color or grayscale component. Cracks and holes within the image are denoted by unknown values within the matrix. Inpainting fills in these unknown values by the support of the values of known nearby pixels.

LITERATURE SURVEY

Were the pioneers in the field of image in painting they proposed a method that attempted to restore the lost regions of damaged images by manually demarcating them by the use of some color It used diffusion of information from its exterior parts along with the application of partial differential equations at the edges of the corrupt area [4]. Formulated their respective in painting algorithms The

Total Variational (TV) model has used an Euler Lagrange equation for inpainting smaller regions and is very efficient for noise removal, but broken edges could not be repaired. The extension of TV algorithm, Curvature-Driven Diffusion (CDD) model was aimed at obtaining the broken connectivity [5]. Provided JLBNM approach i.e. Jump & Look around Best Neighborhood Matching. This method aimed to lower down the computational cost of BNM approach and make it faster by using two different search methods along with certain optimizations for restoration. It provided better quality and computation time as compared to BNM approach [6]. Proposed unendorsed information theoretic, adaptive filters (UINTA) that enhance expectedness of intensities of pixels from their respective neighborhoods by reducing their combined entropy. Thus being nonlinear, nonparametric, adaptive, and unsupervised, it can restore a wide range of images with almost no parameter tuning data [7]. Presented exemplar based inpainting by using the natural image patch's sparsity. In contrast to traditional exemplar inpainting this method performs better in terms of distinguishing the structure and the texture and also sharper and consistent inpainted regions are obtained due to sparse representations. The results were demonstrated on both real and synthetic images [8]. Presented an exemplar-based inpainting technique based on a locally linear embedding algorithm with a low-dimensional neighborhood representation (LLE-LDNR). The technique initially locates the K nearest neighbors (K-NN) of the region to be inpainted and linearly combines them with LLE-LDNR to recover the unknown pixels values. To improve the nearest neighbor method, linear regression is then introduced [9]. Propose algorithm which extracted edges using the raw depth data and the color image. These edges are used after optimization to aid in depth map inpainting. This obtains the unknown depth values of invalid portions of the depth map obtained by Kinect sensor that helps in 3-D measurement [10].

OBJECTIVES OF THE STUDY

This process is to restoring/reconstruction and regenerating unknown regions in the image from the known regions by using their available information. There are techniques also; however each Technique has its own set of advantages and shortcomings.

The objectives of our work will be developing an improved algorithm having a:

- To study and analysis of different image inpainting methods
- To implement a new filter based technique.
- Evaluate the performance of proposed technique with the existing technique in terms of time, MSE, PSNR values compare to previous exampler based method
- To produced the Good visual quality.

PROPOSED WORK

Here to improve the results of previous algorithms we will use image filtering to filter the mask image than the new filtered mask image will be given to the exampler based image inpainting method with the damaged image and the results will be better in terms of time, MSE and PSNR values as describe via the next proposed flowchart. The next figure will explain all the steps which are required to complete this research work.

Flow Chart of Proposed Work

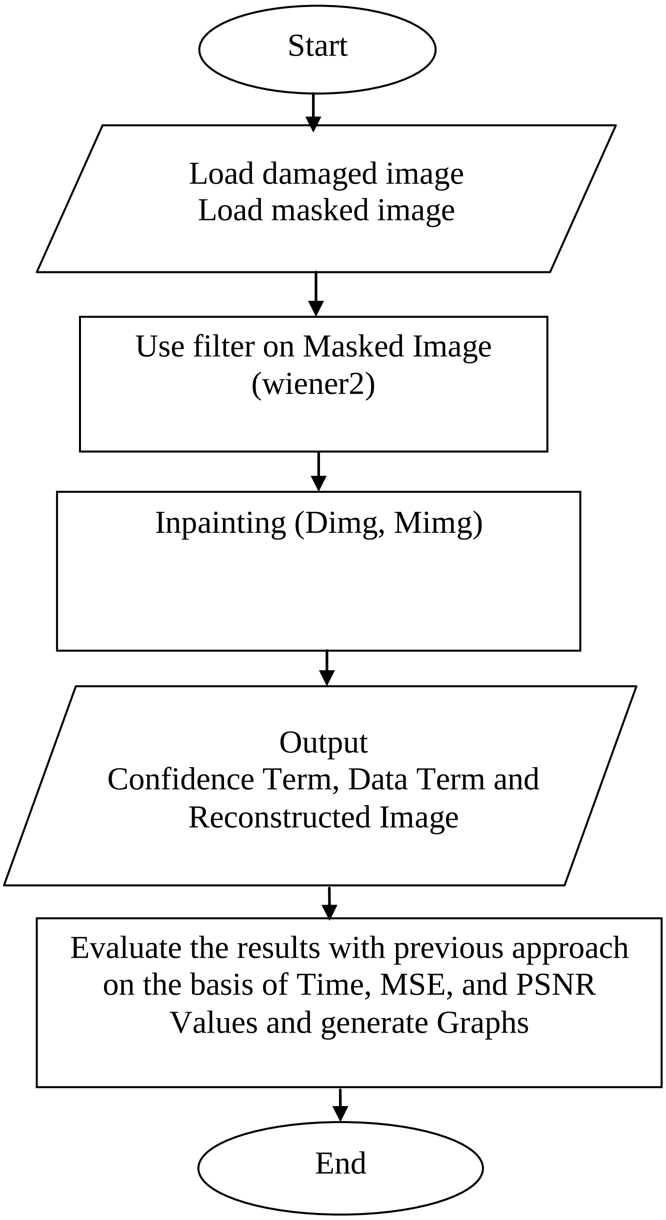

Figure 6: Workflow of the Proposed Approach

As is clear from the flowchart the steps to be carried out are

- A database of damaged images (Dimg) and another for the masked images (Mimg) shall be constructed for which restoration is to be carried out.
- GUI implementation will be done followed by development of a code in MATLAB software for loading the image file from the database.
- Develop a code for the proposed improved Texture synthesis based inpainting method using filter approach and to evaluate the performance.

RESEARCH METHODOLOGY

As the image inpainting approach can be classified into two categories as shown:

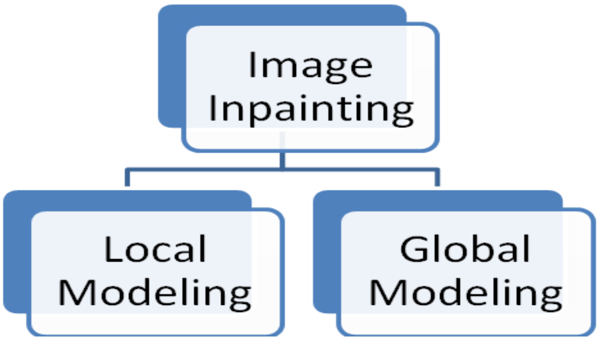

Figure 7: Inpainting Methods

Local Modelling

It is based on the structural image properties, e.g. edges, from the known to the unknown region for inpainting to fill up the missing information in the image. Such type of information processing works at pixel level and is good at restoring small defects and thin structures. Partial differential equations (PDE) is the most frequently used technique for inpainting research as they interpolate structural image properties in a manner, to achive better results in terms of the refurbished image perceived visual quality and coding efficiency, despite being computationally heavy [11]

Global Modelling

It is considered to be the alternative to local modeling for image inpainting. It is supported by texture synthesis procedures which are responsible for searching the most texture-compatible source segments matching the textural information of the target pixels vicinity [12]. Unlike local, global modeling does not work at pixel level, but rather at a more global level and, therefore, it is suited for filling-in large regions because such models focus at region levels instead of the pixels.

In order to gain maximum utility from both the ways of modeling, in terms of the restored image visual quality and efficiency, hybrid model is proposed for inpainting. The following approach are applied for achieving better results

- Filling-in the spoiled region is done according to the global features which helps preserving the texture
- Continuing structural local properties from the source area into the damaged area which allows achieving better results in terms of the restored image perceived visual quality with the enhanced edges.
- For pursuing this hybrid approach classifier SVM is proposed in order to avoid consideration of non-useful parts of the image for inpainting, thereby reducing the processing time.

TEXTURE SYNTHESIS APPROACH

There are basically two fundamental principal in this algorithm. One is, exemplar-based texture blend is sufficient to promulgate extended linear structures and an additional synthesis mechanism is not required for handling is ophotes (line of equal gray values). Another is, the order in which the patches are filled is of fundamentally important. [13-14].

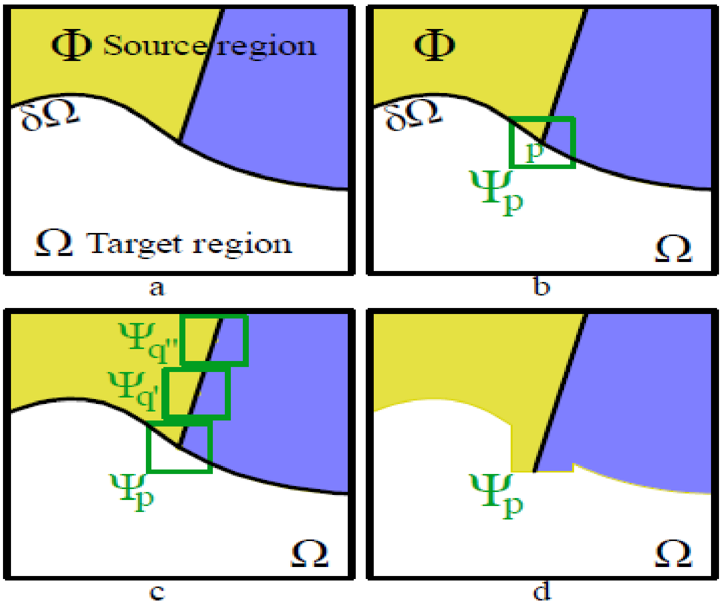

Figure 8: (a) Original image with the goal region Ω, filling front δΩ, and the source region Φ, (b) The patch Ψp Centered at point p that has to be inpainted, (c) The most alike candidate patches for the source region, (d) The best similar patch has been copied into Ψp [13]

Image Filtering

Image filtering means removal of unwanted noise to an image we have many filters which help us to remove those added noise. For better results by our proposed method we have used filter technique which help us to remove unwanted noise from our image.

Noise Removal Filter wiener2

Wiener 2 is a noise-removal filter and it is a 2-D adaptive. wiener2 lowpass-filters a grayscale image that has been corrupted by regular power additive noise. This filter uses a Wiener method which is pixel wise adaptive and based on statistics estimated from a local neighborhood of each pixel.

Algorithms

Wiener 2 estimates the variance and local mean around each pixel.

$$\mu = \frac{1}{NM} \sum_{n_1, n_2 \in \eta} a(n_1, n_2)$$

and

$$\sigma^2 = \frac{1}{NM} \sum_{n_1, n_2 \in \eta} a^2(n_1, n_2) - \mu^2,$$

Where η represents the N-by-M local neighborhood of each pixel A wiener2 then creates a pixelwise Wiener filter using these estimates,

$$b(n_1, n_2) = \mu + \frac{\sigma^2 - \nu^2}{\sigma^2}(a(n_1, n_2) - \mu),$$

Where ν^2 is the noise variance If the noise variance is not given, wiener2 uses the average of all the local estimated variances.

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