Depth Modeling With Spectral Selective Region Coding For Image Inpainting

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Abstract: Image inpainting, has an evolving approach for image quality enhancement and image visualization. In the process of image inpainting, pixels of similar area variants are considered in a tracing manner to achieve the objectives of unwanted image coefficient which are introduced due to detritions in image handing. To overcome this issue, images are processed in spatial domain, where, images are traced using 8-neighbor region growing method to achieve the objective of image enhancement However, in such approach, the pixel variations are observed in one variation plane. The variation with respect to successive pixel variants is not observed. To develop a new coding in considering with multiple domains, in this paper a new inpainting approach based on image depth coding is suggested.

Keywords: Image inpainting, Region coding, Depth coding.

1. INTRODUCTION

Inpainting is nothing but reconstructing missing or damaged parts of images and videos. For instance, in the case of a precious painting, this job would be carried out by a expert image refurbishment artist. In the digital world, inpainting (known as image interpolation or video interpolation) refers to the application of sophisticated algorithms to improve missing or corrupted parts of the image information (primarily small regions or to eliminate little defects). Reconstructing an image to remove noise, improve brightness, color and information. In cinematography and movies, is used for film restoration to reverse the deterioration (such as cracks in photo's or scratches and damaged part in film). This method is also used for removing the stamped date from photo's, red-eye and removing objects to artistic effect.

This technique can be used to recover the lost data in the coding and transmission of images in a streaming video. It can also be used to remove logos in videos. The previous methods that are suggested like digital repair technology, overall variation model, repair method, CDD method can be achieved good results in a certain type of image, but there are obvious limitations, that is not match for each case and mainly all of them are based on iterative formula, restoration often need thousands of iteration, requires more time and repair one image, it requires cost 3 or 4 minutes to complete which limits their encouragement and purpose. In this paper, we propose a new algorithm based on the 8-neighborhood fast comprehensive method on the basis of continue the effectiveness of rehabilitation to shorten repair time greatly. Reconstruction of misplaced or broken portions of images is an earliest practice used extensively in artwork restoration, also known as inpainting.

This process consists of filling in the missing areas or modifying the damaged ones in a non-detectable method by an observer not well-known with the original images [2]. Applications of image inpainting range from recovering of photographs, movies and paintings, to removal of occlusions, such as, stamps, subtitles, text and publicity from images. Inpainting can also be used to create special effects. In general, image inpainting methods are divided mainly into two methods: structure-based inpainting and texture-based inpainting. Structure-based image inpainting is the process of image inpainting which employs data around broken region to approximation by diffusion method which includes the following models: TV model [1], BSCB model [2], CDD model [3] and elastica model [4] and so on. These models have a good inpainting result on the small area and non-texture damaged regions such as the scratches. This problem can be solved by partial differential equations (PDE) describing information diffusion, while the numerical solution of PDEs requires more number of iterations, therefore the inpainting code execution is very slow. Therefore, how to improve the speed of these models becomes a very valuable research. The fast structure-based image inpainting algorithm has fast marching method [5] and Oliveira method [6].

Fast marching method uses the weighted-average method to inpaint damaged image so that the edge-preserving is not perfect. Oliveira method is faster, but does not maintain the isophotes, directions in the inpainting process. It was approximately no ability to restore the information of the edges. The methods of texture-based inpainting are used to fill missing information by texture synthesis techniques, and are suitable for inpainting having larger damaged parts is divided into image inpainting based on decomposition. It is well-known that image inpainting is an ill-posed problem [7-12], which manifested data around damaged region is unsatisfactory to complete restore missing information. In image processing, connect regularization items is the most commonly used method to eliminate morbidness, having basic idea is to use prior knowledge of physical problems, adding more constraints to the problem, gives idea of the problem continuously depend on the observational data [12-18]. Motivation of the above, we make full use of information around damaged part to iteratively inpaint the damaged part quickly in the inpainting template fixed-size case. In order to get a fast algorithm, we propose a new algorithm based on 8-neighborhood fast sweeping in this paper. The experimental results verify for the same image by using Bertalmio is method and our method and our algorithm is fast and feasibility.

2. IMAGE INPAINTING-NEIGHBOR CODING

Digital inpainting is nothing but reconstructing small damaged portions of an image, has received large consideration in current years. Digital inpainting is a wide range of application area, such as removing text and logos from different images or videos, the reconstructing images by removing scratches or stains, or creating artistic effects. In image Inpainting techniques, select firstly the image regions which is to be inpainted, usually manually. Then, color information is finding out from the region boundaries, i.e., the known image information are used to fill in the missing areas. For proper reconstruction, an inpainting technique continues the isophotes (appearance of equal gray value) is as smoothly as possible inside the reconstructed region.

A second type of method repeatedly convolves a simple 3×3 filter having the missing regions to strew identified image information to the missing pixels. However impressive, this methods have several drawbacks that prevent their use in practice. The

PDE-based methods require implementation of nontrivial iterative numerical method and techniques are anisotropic diffusion and multiresolution schemes. No detailed information is given on practical implementation such as thresholds or discretization methods, although some steps are given that it is numerically unstable. Moreover, such methods are quite slow. In contrast, the convolution-based method described in Oliveira is fast and simple to implement. Also this method has no provisions for preserving the isophotes' directions. High quality image areas must be selected manually before inpainting is applied and treated separately so as not to be blurred. In the process of Bertalmio method, the image is coded in a single plane. The pixels are processed in a linear diffusion manner, however, the image variation with respect to pixel deviation in multilevel pixel variation is not been explored. To overcome this issue, in this paper a depth based modeling in active contour domain is suggested.

3. DEPTH MODELING FOR IMAGE INPAINTING

In this paper we propose a new inpainting algorithm technique based on propagating an image smoothness estimator along the image gradient, similar to Bertalmio. We estimate the image smoothness as a weighted average over a known image neighborhood of the pixel which is to be inpaint. Considering the missing regions as level we use the fast marching method (FMM) described in Sethian to propagate the image information. Our approach has several advantages:

• It is very easy to implement.
• It is very faster than other methods.
• It produces very similar results as compared to the other methods;
• It can easily be customized to use different local inpainting strategies.

Most numerical methods rely on markers, which will track the motion of the boundary by breaking it up into buoys which are connected by pieces of rope. The main design is to move each buoy under the speed F, and rely on the connecting ropes to keep things straight. The rope is that more buoys will make the answer more accurate.

Fig. 1: Pixel movement orientation method

Unfortunately, things get more problematic if the pixels try to cross over themselves, or if the shape tries to break into two as it is very hard to keep the connecting ropes organized. In three dimensions, following a surface like a breaking ocean wave is particular tough. Contour of an image can be obtained from an edge. For the detection of contour all the real corners must be detected. The system should avoid detecting the false corners. The contour evaluator must be effective in finding the true edges. For finding the contour, 8-region neighborhood-growing algorithm is used. In this algorithm following estimation process was used;

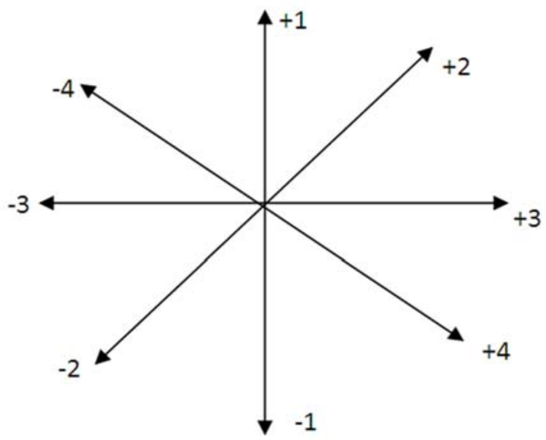

Fig. 2: Orientation pattern for contour evolution

In order to extract the boundary Contour tracing method can be applied to digital images. To extract a shape feature for a given image sample, the process is as outlined;
1. If input mage is color then convert it into gray scale image.
2. Now the gray scale image is binarized. A pixel of the image can either have a value of 1 or 0.
3. Edges from the binary image can be finding out by separating the object information from its background details.

8-point connectivity technique is applied to find Shape signature. This is a one dimensional representation of the shape, which is obtained by applying on the 2D closed edge region. As engineering/ CAD objects have well defined centroid (x_c, y_c) and also recovery has shown to be better with central distance, is used as a shape representation. The feature vector representing the mid distance between point on the contour (x, y) and the centroid (x_c, y_c) is given by,

$$V_c = (x - x_c, y - y_c, 0) \quad (1)$$

Where,

$$x_c = \frac{1}{N}\sum_{i=0}^{N-1}(x_i) \quad (2)$$

and

$$y_c = \frac{1}{N}\sum_{i=0}^{N-1}(y_i) \quad (3)$$

Where, N is the total number of pixel

To find extract depth map, first the contour is determined by following the approach as described. In 3D information is computed. Recovering the 3D information can be done in terms of depth Z, the surface normal (n_x, n_y, n_z), or surface gradient (p, q). A principle of shape from shading is used to obtain the 3D embedding information. In Lamberdian model, assume that equal amount of light is reflected in all direction, is a reasonable approximation for engineering objects. In this algorithm, the reflectance chart is simplified to be independent of viewer's direction. The important parameters in Lambertian reflectance are albedo, to be a constant in illuminant direction and can be computed in general. To recognize the depth-map (called as simply depth) of an image. This approach assumes that the low order components in the reflectance map directs. The linearity of the reflectance map in the depth Z has been used. Discrete approximations for p and q are employed and linearized the reflectance in Z(x, y). The following equations are used and have been presented to find the depth of an image. The reflectance function for the Lambertian surface is as follows:

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$$E(x, y) = R(p, q) \frac{1 + pp_s + qq_s}{\left(\sqrt{1 + p^2 + q^2}\right)\sqrt{1 + p_s^2 + q_s^2}} \quad (4)$$

Where E(x, y) is the gray level at pixel (x, y),

$$p = \frac{\partial z}{\partial x} \qquad q = \frac{\partial z}{\partial y} \quad (5)$$

$$p_s = \frac{\cos\tau \sin\sigma}{\cos\sigma} \quad (6)$$

$$q_s = \frac{\sin\tau \sin\sigma}{\cos\sigma} \quad (7)$$

'τ' is the tilt of the illuminant and is the slant of the illuminant.

4. Experimental results

To estimate the performance of the developed approach, various test samples of different resolution, color density, gray level and random inpaint information were carried out. The process of inpainting is compared with the computation time for processing. The obtained results are as illustrated below.

Case I:

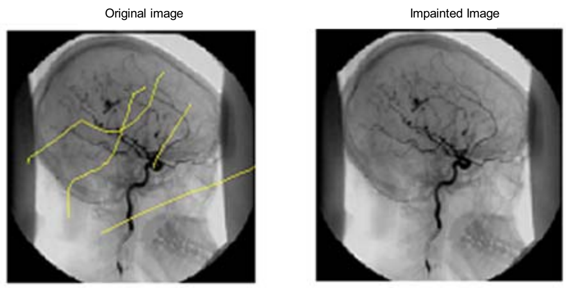

Fig. 3: Original and Inpainted image using neighbor tracing approach

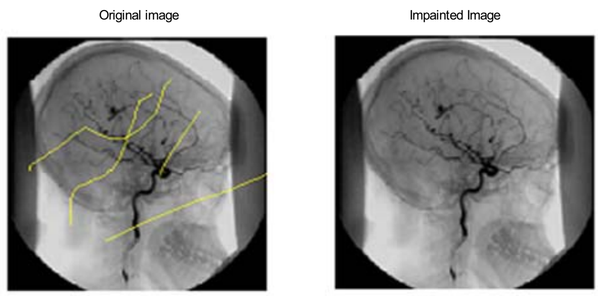

Fig. 4: Original and Inpainted Image using depth coding

A comparative observation in inpainting process is observed for the two developed method. Here, it is observed that the processing accuracy of the proposed approach is proposed to be higher as compared to the conventional coding approach. To derive the computing performance computation time is considered as presented in below figure.

Similar observations are carried out on different color samples with different inpaint details, the observations are as illustrated below,

Case II:

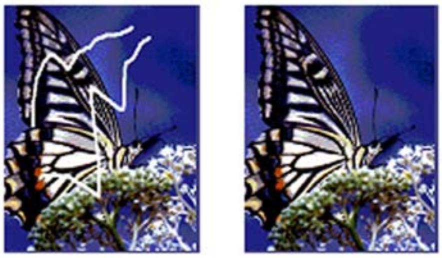

Fig. 5: Original and Inpainted image using neighbor tracing approach

Fig. 6: Original and Inpainted Image using depth coding

Case III:

Fig. 7: Original and Inpainted image using neighbor tracing approach

Fig. 8: Original and Inpainted Image using depth coding

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5. CONCLUSION

This paper presented a new coding approach of image inpainting based on the depth level coding and evaluating the spectral density at the region of image inpainting. The contour derived for inpainting is made more accurate with the analysis of inpainting process in 3rd dimension, where the variant is observed in spectral domain. The obtained result illustrates a higher precision in visual quality as compared to the conventional neighbor tracing base coding method.

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