Technical Review of Comparative Study on Different Algorithms of Image Inpainting

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Abstract:-

Image inpainting is the technique of restoring the lost or damaged regions or modifying the image contents imperceptibly. Image inpainting can be used to fill in the missing area in an image which is visible to human eyes, reinstallation of old images, correction of red-eye, object elimination in digital photographs, removal of spots of dust in image, creative effect by removing objects, privacy protection. The different techniques of image inpainting are exemplar based image inpainting, texture synthesis based image inpainting, PDE based image inpainting, Hybrid Inpainting techniques. This report contains the detailed study about image inpainting, survey of image inpainting techniques and comparative analysis of different techniques.

Keywords:- PDE- Partial Differential Equation , CDD- Curvature Driven Diffusion, TV – Total Variation

I. Introduction

An image may be defined as a two-dimensional function, f(x, y), where x and y are spatial (plane) coordinates, and f(x,y) is the location of image is called Digital Image Processing.[1] Digital Image inpainting is the process of filling-in missing or damaged image region.[1] Inpainting discovers the problem of filling detected cracks and missing thin parts of images, paintings, pictures.[8]

Image Inpainting[8]

We are used the various types of algorithms to defined like

1] Exemplar based Inpainting algorithm :- In this algorithm, It fills holes in the image by searching for similar patches in a nearby source region of the image, and those pixels copying from the most similar patch into the hole. The exemplar based consists of two basic steps 1) Priority assignment is done 2) The selection of the best matching patch.

2] PDE based Inpainting algorithm :- This algorithm defined which are arriving at the border of the region should be smoothly inpainted, from the outside of the border to the inner region.

3] Texture Synthesis based Inpainting algorithm :- In this algorithm, texture is synthesized in a pixel by pixel, so in that pixel is picking from existing with look like similar neighbourhood pixels. This algorithm work very slow. This algorithms have difficulty to handling natural images.

4] Hybrid based image Inpainting algorithm :- The hybrid approaches combine both texture synthesis and PDE based Inpainting for completing the holes. The main purpose these approaches is that it decomposed the image in two separate parts first Structure region and secound texture regions.

5] Sparsity based algorithm:- In this algorithm, an image is presented by a sparse combination of an over complete set of transformations. Using this algorithm can effectively fill in the regions with structure and texture.

6] Convolution based image Inpainting algorithm :- In this algorithms, the mask coefficients are calculated using the gradient of the image to be inpainted image. This algorithm is perfome fast, iterative, simple to implement, and give the passable results to inpainted image.

7] TV regularization blind image restoration algorithm :- Iterative blind deconvolution (IBD) is a kind of algorithm on the frequency domain. In image restoration, its main to develop the knowledge of the real image and PSF. In blind image restoration is on the premise of the unknown PSF, maximum recovery the original image from the blurred image.

8] Standard regularization algorithm

The total variation regularization and iterative blind deconvolution is combined. It can overcome poor effect of traditional regularization blind restoration methods to complex fuzzy type or a complex image restoration, and poor reliability of iterative blind deconvolution.

Methodology :-

two techniques of algorithms are to be used for image inpainting:

CDD - Curvature Driven diffusion

TV -Total Variation

CDD Technique: To fill in missing portion in the region under consideration, the solution is based on partial differntial equation of isophote intensity.[3]

δu (or 0) = ∆[g(|k|) ∆u] , x *Ɛ D*

δt |∆u|

u=u° x Ɛ D‘

domain D is mathematically considered as an open set ,ie not including its boundary; and u is available part of the image. If we solve the time marching equation ,then the initial condition can be any compatible guess, that is any u(x,0)that satisfies

u(x,0) = u°(x), x Ɛ D‘

The flux field for the curvature –driven diffusion is

j = -Ď∆u = - (g(|k|) /|∆u|) u,

Physically we can treat the image function u as density function of certain type of particles. The available part of original image u° acts as a constant source or sink of particles.

TV Technique: It technique is based on texture inpainting. The automatically filling process is done in regions completely containing different structures, textures, and surrounding backgrounds.[3]

min TV(X) subject to || X(Ic) - B(Ic) ||_F <= delta

where B is a noisy image with missing pixels, Ic are the indices to the intact pixels, X is the reconstruction, and delta is an upper bound for the residual factor. The TV function is the 1-norm(factor)of the gradient magnitude, computed with help of neighbour pixel differences.

The parameter delta should be of the same size as the norm of the image noise. If the image is m-times-n, and sigma is the standard deviation of the image noise in a pixel.

II. Literature Review

Digital image inpainting is used in many applications like computer graphics, image editing, film postproduction, image restoration etc... It can be used to give special effects and the restoration of old photographs and damaged film, removal of text and the removal of entire objects from the image. In this paper, an algorithm is proposed for removing target objects from digital images. In addition, algorithm was proposed to

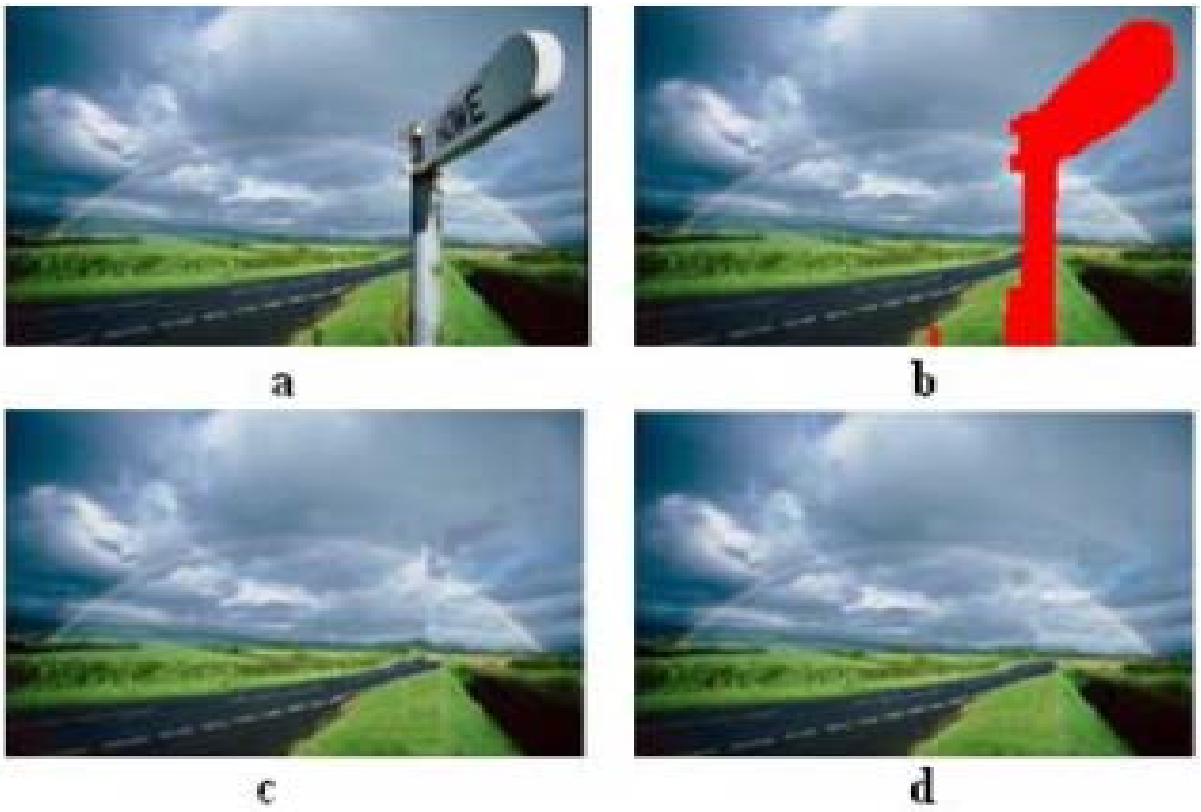
synthesize the structure & texture as well as fill the hole that is left behind in an undetectable form. An attempt has been made to compute actual color values using exemplar based synthesis and patch priority. [2]

Digital inpainting techniques are used for every kind of image repairs, like removing text from a picture, erasing lines/object from a scenic read, or repairing cracks and scratches. Image in-painting aims to revive pictures with partially info loss and tries to create in-painting results as these missing elements in such some way that the reconstructed image appearance natural. Many various varieties of image in-painting algorithms exist within the literature. But no recent study has been undertaken for a comparative analysis of those algorithms to supply a comprehensive image. In this paper compares different kinds of image inpainting algorithms. The low-resolution input image is inpainted many times with totally different configurations. [4]

Image inpainting is the process of restoring the lost or damaged regions or modifying the image contents imperceptibly. The technique presented is for detection and remove of text from image. The system detects text using morphological operation, connected component labelling and a set of selection criteria which helps to filter out non text regions. Text inpainting is done in two steps.1) Text- Detection 2) Exemplar based Inpainting. [5]

The process of image formation, transmission and recording transmission medium and the equipment is not perfect, the key of blurred image restoration is to estimate the Point Spread Function. Point Spread Function cannot be obtained and cannot get the fuzzy model. We can use blind image restoration method, the total variation regularization. We also use the image and Point Spread Function constraints in the iterative process. [6]

Exemplar based algorithm is proposed for removing large objects from digital images. To fill in the hole that is left behind in a visually plausible manner by dividing the image and In less time we get good result as compare to the without dividing the image.[11]



It presents comparison between two methods of image inpainting for image restoration. The input image is inpainted using CDD inpainting technique and also by TV inpainting technique. Image is often corrupted with noise; hence removal of the noise is another important objective of this paper. These methods will be applied to gray scale and RGB images.[3]

Application of image inpainting include old film restoration, video inpainting, for privacy protection. For that many algorithm used in the past is that :Diffusion based algorithm ,Texture based algorithm, Exemplar and search based algorithm, Sparsity based algorithm.[10]

Conclusion

From the above literature review we conclude that exemplar based algorithm is best for image inpainting. We will work to reduce the time and increase the accuracy of exemplar algorithm.

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