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ITS Cluster Based Efficient Exemplar Image Inpainting Technique

Kiran R.Sole, Prof. Swati Patil
Department of Computer Science and Engineering
G.H.R.I.E.M. Jalgaon, India
kiransole4@gmail.com
Department of Computer Science and Engineering
G.H.R.I.E.M. Jalgaon, India
swati.patil@raisoni.net

***Abstract* - An Image Inpainting is the art to reconstruct an image by removing scratch, noise, object or any other defect. Fill the region of missing information from a signal using surrounding information and re-form signal is the basic work of Inpainting algorithms. There are various methods to do image Inpainting like exemplar based image Inpainting in which patch of particular size is get selected and that patch is used to fill missing part of an image by calculating highest priority. In this confidence value and data value that is collectively known as priority value of that patch is calculated. And after this most similar patch from the source region is detected and pasted on highest priority patch. Existing technique gives high computation time by searching similar patches in whole source region again and again. Also target region needs to be selected by user. So proposing method can provide better computation efficiency on traditional image Inpainting algorithm for automatic detection and removal of scratch in an image. In this approach whole image clustered using Iterative Threshold Selection algorithm and scratch will be detect automatically. After detecting scratch automatically highest priority patch will be calculated. Due to clustering highest priority patch need not to be search in whole source region again and again, it just need to take most similar patch from this cluster. So due to this source region can be minimized for optimal patch to search. So proposing method can provides better speedy approach for removal of scratch in an image than existing method.**

Keyword: *Exemplar Based Image Inpainting, Image Inpainting, Iterative Threshold Selection, Object Removal*.

I. INTRODUCTION

Line scratches are joint to blotches the major defects in degraded archived motion pictures. They appear in the image as lines of bright or dark intensity. With the recent growth of digital technologies and the ever increasing need for speed and storage, occluded or missing parts in images and is a more and more wide spread problem. This problem can be occurring in several applications such as digital movies. So removals of such errors are very important. There are number of algorithms are developed till are there to remove scratches.

1] *Texture synthesis based image Inpainting*

In this method, holes are filled by sampling and copying neighbouring pixels. Main difference between different texture based algorithms is how they maintain continuity between hole's pixel and original image pixels. This method is only work for selected number of images, not with all. Yamauchi et.al presented algorithm which generate texture under different brightness condition and work for multi resolution [4].

Texture synthesis based Inpainting method not perform well for natural images. These methods not handle edges and boundaries well. In some cases user need to enter which

texture to replace with which texture. So these methods are used for small area of Inpainting.

2] *PDE based Inpainting*

First PDE base approach given by Bertalmio et.a. It uses the concept of isophotes (linear edges of surrounding area) and diffusion process. Main problem with this method is that due to blurring effect of diffusion process replication of large texture is not perform well [1].

3] *Hybrid Inpainting*

In this method, PDE and texture synthesis based Inpainting methods are combined for filling holes. Here main goal is to decompose image into texture and structure region. Then corresponding regions are filled by texture synthesis and edge propagating algorithms respectively [1]. It require more computational time for large holes.

4] *Image Inpainting Using Directional Median Filters*

In this paper a new digital image Inpainting algorithm based on Directional Median filters is proposed. The proposed algorithm is iterative. In the first iteration, median value of known pixels' in each direction is calculated, and then, a damaged pixel is replaced by the median of the obtained values. In latter iterations, median of all pixels' values in each direction is calculated then median of obtained values is copied in place of the damaged pixel. The algorithm is fast and provides adequate results in sharp edges regions. But this method is harder to implement.[2].

5] *Exemplar based Image Inpainting*

Inpainting in exemplar-based Inpainting approach was reported in which missing regions are inpainted on a patch by patch basis. In this, both structure and texture are considered through confidence term and data term in the calculation of patch priority. The Inpainting approach in gave

impressive results especially in the cases of large miss region. Therefore, the exemplar-based Inpainting approach has drawn more and more attention since then and many researchers have involved in the field.

Problem of existing system

1] Not Automatic- In existing system user needs to select those region which he wants to remove. So sometimes it may create confusion if removable area is too small. i.e. existing system is not automatic.

2] Searching Patch-In existing system highest priority patch needs to search whole region again and again , so its waste computation time. So providing better solution on this by clustering similar patches in source region so that highest priority patch need not to search whole search region again and again.

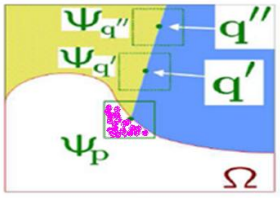


Fig. 1 Searching highest priority patch

Here as given in above fig $\Psi\boldsymbol{\rho}$ needs to search whole region to get most similar patch.

3] Updating Confidence values- As given in Fig.2 first confidence value for red will be calculated and after this for green. As we know confidence value is nothing but highest reliable information in patch, generally patches which are on contour line has highest priority patches no in existing system recalculation on each and every patch takes place. So it gives highest computation time. So proposing system gives solution on that first patched which are on contour line filled and when we get new contour line δΩ' (in Fig 2) ,confidence value for this new δΩ' will be calculated.

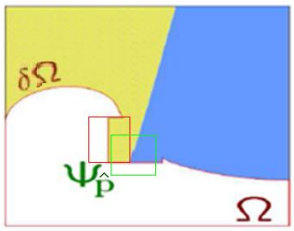


Fig.2 Update confidence value

6] An Effective Exemplar based Image Inpainting Method [3]

`In this paper, author has presented new term i.e. curvature term. Sometimes it might be happened that confidence term of any pixel become zero. So effect of this will be on highest priority pixel. So to avoid zero value author has presented new formula to calculate priority value of pixel.

$$P(p)=C(p)(D(p)+\frac{1}{|K(p)|})$$

Problem of existing system

1] Not automatic

2] Needs user intervention to select region to be remove.

3] Recalculation of confidence value again and again on whole contour line.

4] High computation time.

7] *Performance Analysis of Exemplar Based Image Inpainting Algorithms for Natural Scene Image Completion [6]*

This paper has compared result of 4 papers which are based on exemplar based image inpainting with implementation,

1] Region filling and object removal by exemplar based image Inpainting [6]

2] Object removal by cross isophotes exemplar based image Inpainting (CIEI)[6]

3] An Image restoration with morphological erosion and exemplar-based texture synthesis [6]

4] A Novel Exemplar-Based Image Completion scheme [6]

Author has given good solution. Formulating an accurate evaluation method for determining the success of the above algorithms was a very important yet difficult task. This was because no common method for evaluating inpainting algorithms has been presented in the literature. To try and provide a good and accurate evaluation of the algorithms, it was decided to use both a qualitative and a quantitative approach. The assessment of the results for the qualitative tests was done mainly by visual analysis.

$$MSE=(1/mn)$$
$$\sum_{i=0}^{m-1} \sum_{j=0}^{n-1} ||I(i,j)-K(i,j)||^2$$

Problem with this paper

1] Not automatic

2] Needs user intervention to select region to be remove.

3] Recalculation of confidence value again and again on whole contour line.

4] High computation time.

8] Removal of Film Scratches Using Exemplar-Based Inpainting With Directional Median Filter [7]

This system has observed same drawback that if source region is not effective then what will be solution. So he has used combination of both exemplar and directional median filter for video Inpainting. Algorithm presented here,

1] Automatic detection of scratches

2] Select patch having highest priority

3] Surrounded region of patch will be searched for sufficient data

4] If it is not enough then directional median filtering

5] else Exemplar Based Image Inpainting.

Problem with [7]

1] Threshold value set by manually.

2] Threshold value set by patch by patch.

3] Simultaneously both algorithms are performed on target region.

4] Patch by patch switching is performed between both methods so high computation time.

5] Recalculation of confidence value again and again on whole contour line.

After considering literature survey here giving solution on same problems by detecting scratch automatically and also image segmentation takes place by using Iterative Threshold Selection (ITS) algorithm efficiently. And due to this will get segmented image. Due to this naturally performance of image will be improve.

So for that in II section whole methodology is presented and in III section advantages are mentioned.

II. METHODOLOGY

Step 1] Image will be selected to Inpainting process

Step 2] RGB to gray scale Conversion.

Step 3] Threshold Based Image Segmentation

ITS Algotithm

1] Select T(Avg of highest and lowest intensity pixel of an image)

2] Form C1<T<C2

3] T'= Average of minimum and maximum intensity value of C1.

4] T''= Average of minimum and maximum intensity value of C2.

5]Compute new Tnew= $\frac{T' + T''}{2}$

6] if Tnew=T then stop else T=Tnew and iterate step 2 to 6

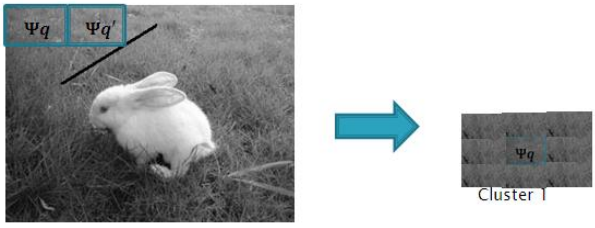


Fig.3 Modified ITS

As given in Fig.3 on gray scale image ITS segmentation will be apply to get segmented image by setting threshold value automatically. Modified ITS is given below.

MSE=$(\sum_{i=1}^{S} \Psi q(i) - \sum_{j=1}^{S} \Psi q'(j)) / S$*S

1.1] Select T= $\frac{Min\,MSE + Max\,MSE}{2}$

1.2] Select patches as a source cluster1<=T

1.3] Select patches as a next region cluster2>T

1.4] Iterate step till whole image to be clustered.

Step 4] Canny Edge Detection of Segmented Image.

Step5] Hough Transformation Algorithm for detection of sctratch.

Then, straight line components are detected from the edge image using Hough transform. Scratches are extracted from the detected straight line components considering the verticality, the pixel values, and sudden appearance.

Step 6] Find most priority patch from detected scratch

Find Patch Having Highest Priority by [3] from detected target edge.

Search optimal patch from this minimized source cluster(C) using

$$\psi_{\hat{q}} = \arg\min_{\psi_a \in \Phi} d(\psi_{\hat{p}}, \text{C}).$$

Step 7] Update the confidence term C(p) for every pεΨ**ρ**∩Ω

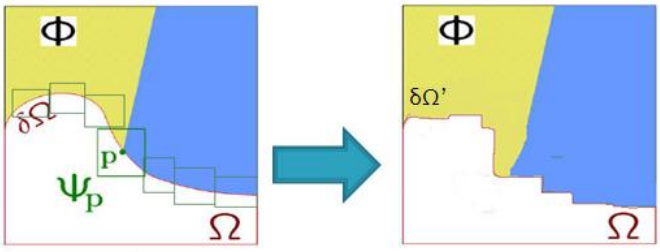
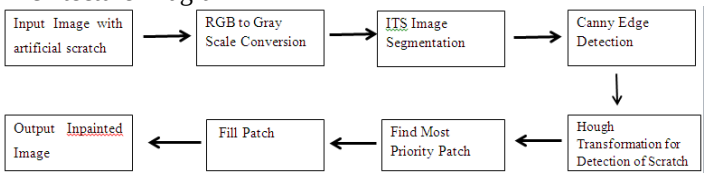


Fig.4 Filling Solution

As given in Fig 4 first patches which are on contour line will be filled and after this when that whole contour filled will get new contour by δΩ'. So now for this contour confidence value will be calculated and so on. So filling takes place in circular order.

Architecture Diagram



III. ADVANTAGES

1] Proposing method is not effective when it needs user intervention.

As we know it is totally dependent upon user that which region he wants to inpaint, then according to that system must be effective to inpaint that region. So proposing system gives better solution for automation detection and removal of scratch.

2] Clustered the source region

Due to clustering of source region highest priority patch will be search in clustered region. So requires less computation time.

3] Threshold value set by automatically.

In existing approach how to set threshold value that will be future research, so here giving new idea to set threshold value automatically by ITS algorithm..

4] Filling order takes place circularly, means recalculation of confidence value takes place very minimum time. So requires less computation time.

IV. CONCLUSION

Existing System is not effective if highest priority patch searches whole region again and again. So it wastes computation time. Again if providing complete automation i.e. from detection of scratch till Inpainting of scratch proposing system may be effective.

Due to clustering highest priority patch need not to be search in whole source region again and again, it just need to take most similar patch from this cluster. So due to this source region can be minimized for optimal patch to search. So proposing method can provides better speedy approach for removal of scratch in an image than existing method.

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