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Removing objects and filling region in color images

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ABSTRACT

Image in painting is very significant area for researchers in image processing; Image in painting is the art of filling in missing data in an image. The purpose of in painting is to reconstruct missing regions in a visually plausible manner so that it seems reasonable to the human eye .In this paper we presents a novel approach for the problem of image in painting through the combining of image completion technique using exemplar based algorithm and texture synthesis method.

Keywords: In painting, exemplar based, texture synthesis, Object removal.

1. INTRODUCTION

Image in painting is the process of reconstruct the missing regions within an image in such a way that it is visually plausible to an observer. In most cases, the missing region (called the target region) is filled by using information from the rest of the image (called the source region). Image in painting is an important part of image processing applications such as scratch and object removal from a photograph. In real world, many people need a system to recover damaged photographs, designs, drawings, art works etc. damage may be due to various reasons like scratches, overlaid text or graphics etc.. In painting technique has many applications such as, object removal in digital photos, removal of occlusions (date, stamps, logo etc.), such as large unwanted regions, red eye correction, super resolution, restoration of old films and paintings etc.[1]. Another use of image in painting is in creating special effects by removing unwanted objects from the image. Unwanted objects may range from microphones, ropes, some unwanted person and logos, stamped dates and text etc. in the image. During the transmission of images over a network, there may be some parts of an image that are missing. These parts can then be reconstructed using image in painting.[1] [2]

2. EXEMPLAR- BASED INPAINTING

The exemplar based image in painting is an efficient technique of in painting algorithms that fills gap in the image by searching for similar patches in a nearby source region of the image, and copying the pixels from the most similar patch into the gap [3].These approach is applicable to both the small and large image gaps [4].Let us denote the target region as Ω (the region to be in painted) and the source region as Θ (the region from which information is available to reconstruct the image). Generally, $\Phi = I - \Omega$ Suppose we wish to fill in a patch Ψp, centered on pixel p, that is at least partially within the target region Ω. The size of this patch may vary depending on the situations and can be greater than or equal to a single pixel. In exemplar-based in painting , a neighbourhood surrounding Ψ p (whose size is greater than or equal to Ψp) is compared using a similarity measure to other neighbourhoods centered around other points within the image (eg., Ψq and Ψr)as shown in figure[1].

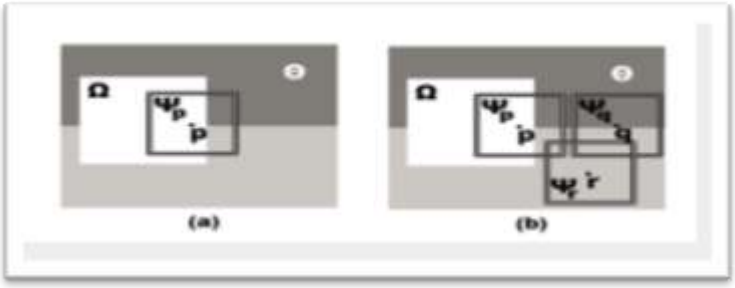


Figure (1): Information propagation using exemplar-based in painting :
a) Original image, with source region Θ and target regionΩ. We wish to fill in patch Ψp centered at p.
b) Neighbourhood surrounding Ψp is compared to other neighbourhoods such as Ψq and Ψr.

Generally an exemplar based in painting algorithm involves the following steps:

i. Initialize the target region. This is generally performed separately from the in painting process and requires the use of an additional image processing tool. This is performed by marking the target region in some special colour.
ii. Find the boundary of the target region.**[2]**
iii. Select a patch from the region to be in painted. That is select the best matching patches from the well-known area, whose similarity measured by certain metrics, and paste into the target patches in the missing region. this technique fills structures in the missing regions using spatial information of neigh boring regions**[5]**
iv. Update the image information according to the patch found in the previous step. **[2]**

3. TEXTURE SYNTHESIS METHODS

Texture synthesis is the process of algorithmically constructing a large digital image from a small digital sample image by taking advantage of its structural content. It is an object of research in computer graphics and is used in many fields, amongst others digital image editing, 3D computer graphics and post-production of films. Texture synthesis can be used to fill in holes in images (as in in painting), create large non-repetitive background images and expand small pictures.[6]

Given a texture sample, the texture synthesis problem consists in synthesizing other samples from the texture. The usual assumption is that the sample is large enough to capture the stationarity of the texture. There have been many works extending texture synthesis to in painting. [7] texture synthesis techniques could be employed to repair digitized photographs Especially if a damaged area needs to be filled with some pattern or structure, texture synthesis does a good job given that the sample area in the same image is large enough.

Image in painting techniques are, in a way, complementary to texture synthesis. Pioneered by Bertalmio et al. [8], approaches have been presented that propagate information from the surroundings of masked areas into their interior. Unlike texture synthesis, image in painting handles color/intensity gradients correctly, but fails to reconstruct areas that should contain textures with fine detail. Texture synthesis is reproduction of a texture from a sample. Firstly, statistical model based methods were proposed for texture synthesis, then pixel and patch-based sampling techniques were developed, preserving texture structures better than statistical methods.

3.1 Patch-Based sampling algorithm

Patch-Based sampling used to copy patches of pixels rather than single pixel. [9]

Pixel-based synthesis yielded good quality results in reasonable time. However, especially computer graphics applications require better preservation of local structures, and faster, real time algorithms. This led the way to studies that consider copying entire patches instead of pixels. This approach takes the texture synthesis as a jigsaw puzzle: Putting together patches from sample texture seamlessly to produce more of the texture.

1. Randomly select first texture patch.
2. Choose the next patch from the input image to fill in the gap that existing in the image.
3. Repeat previous step until the gap is fully covered.
4. Blend pixel in the boundary zones.

Boundary zone blending has been used to smooth the transition between adjacent patches.[10]

4. THE METHODOLOGY

We apply our Methodology on different two dimensions (2D) and three dimensions (3D) color image that presented in results passage.

1. First, read the input image and select the target Region Ω to be removed and filled.
2. Create the mask for the target region Ω .
3. Applying inpainting technique using exemplar based methods.
4. For best result to the human vision we Apply the texture synthesis with different samples to the exemplar based image output.

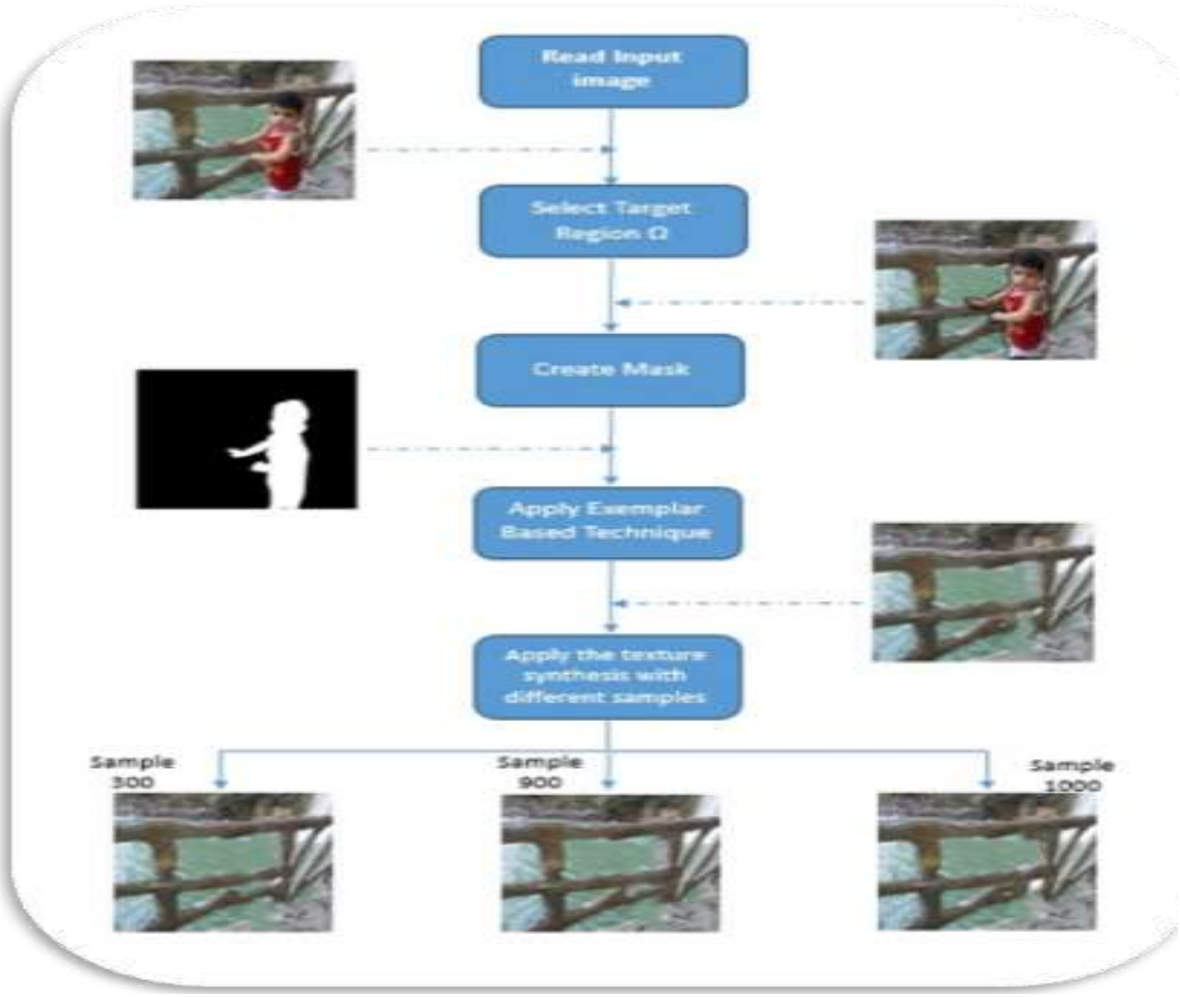
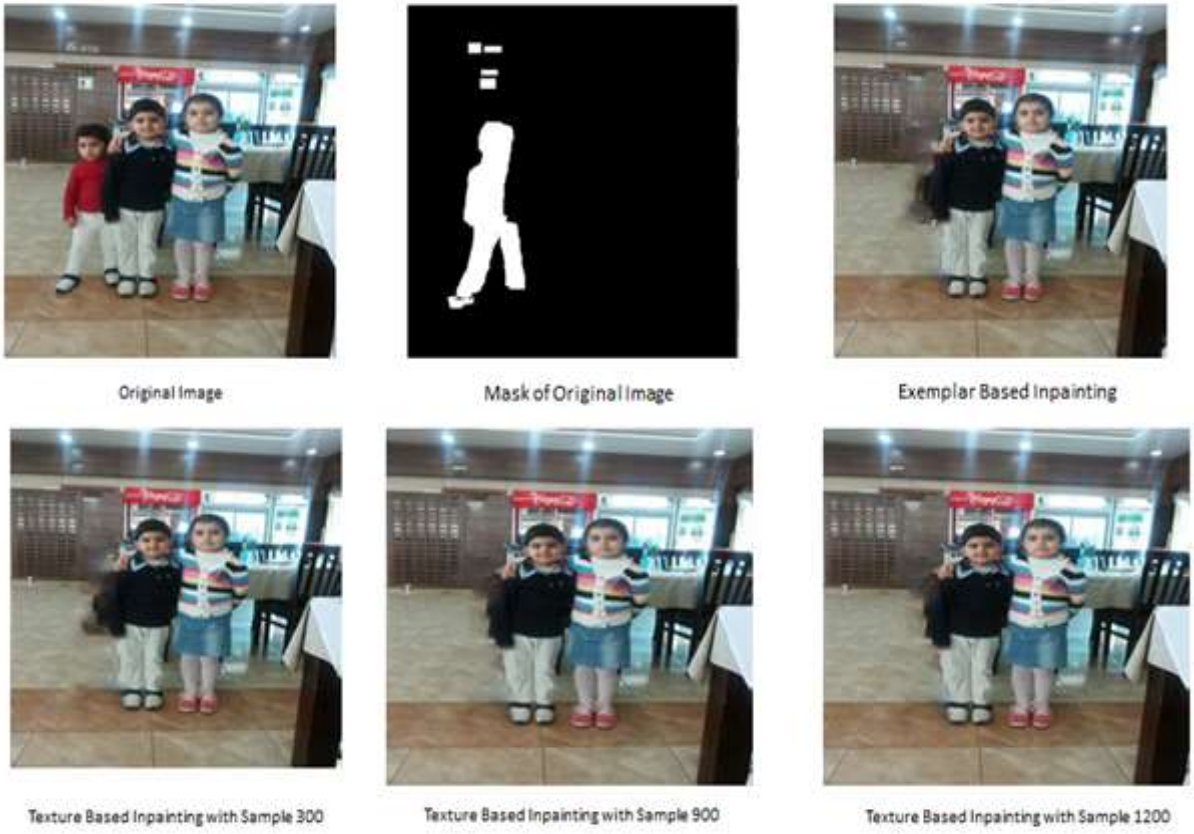


Figure (2): Block Diagram of Methodology

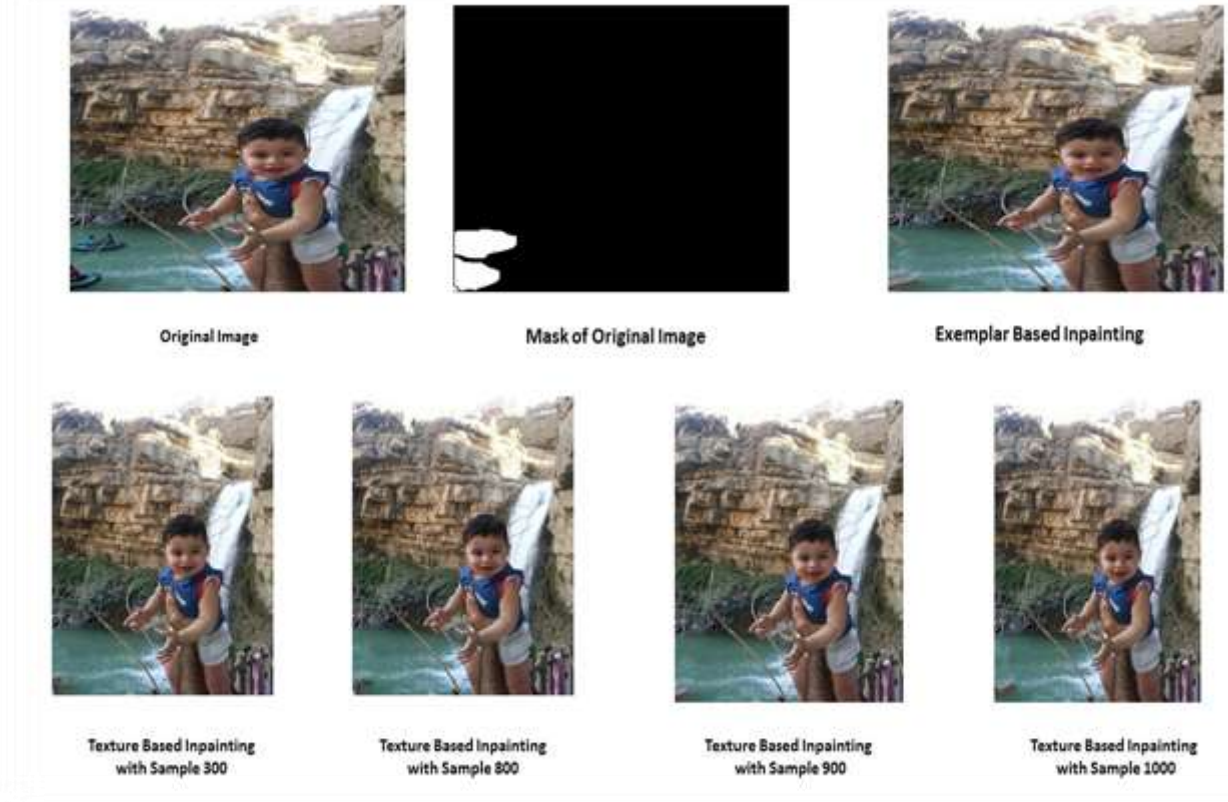
5. RESULTS

Now we present a few more examples from real life scenes which are captured by us showing removing an unwanted object from the photograph; see figures below :

(a)



(b)



(c)

Figure (3): a, b, c Example of Unwanted Object

Now, We Presented an example for remove unwanted text from image :
Now, We Presented an example of remove unwanted object from three dimensions image.

Fig 4: Example of Unwanted Text

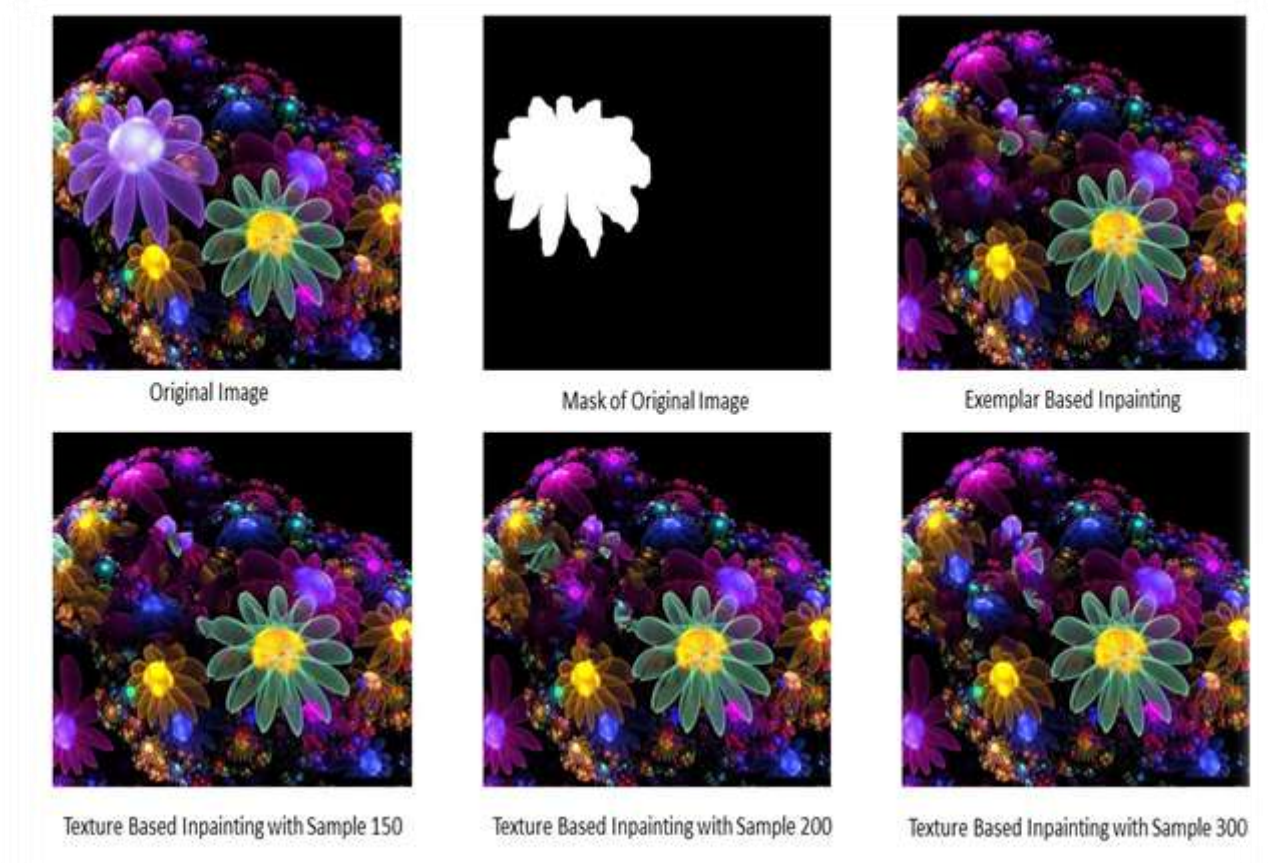


Figure (5): Example of Unwanted Object from (3D) image

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