Image Inpainting Software

Yesheng Ma, Hu Hu, Yikai Zou
Shanghai Jiao Tong University
{kimi.ysma, mihawkhu}@gmail.com, zouyikai1014@163.com

Abstract

Image inpainting is the technique to modifiy an image where the inpainted area is unpredictable. There are already numerous methods introduced by former researchers to handle image inpainting including partial differential equations and Markov random fields. These methods all root in smoothing and have a immediate drawback of blurring.

In this paper, we look deep into another kind of inpainting technique: examplar-based inpainting algorithm and further propose a method inspired by the idea of priority queue. When we inpaint an image, we give different priority to the patches around the area to be inpainted and in this way we inpaint patches that capture the structure of the image better.

Our experiments show that the idea of priority queue works well and is suitable for inpainting images with complex structure.

Index terms — Image Inpainting, Priority, Patch-Based Method

1. Introduction

Image inpainting is the technique of modifying an image in an undetectable form. Some of the common cases image inpainting are: (i) the restoration of old photographs and damaged films (ii) the removal of unwanted text from an image (iii) the removal of an object in purpose. The existence of the image inpainting technique dates back to the beginning of human art and we can see that the application of image inpainting by computer saves a lot of time compared with hand-carfted image inpaiting in museums.

There are alreay several researches on this topic. One kind of technique is based on smoothing, *i.e*. we inpaint that image based on the color of nearby pixels. This method has an intrinsic problem of blurring since the color chosed to inpaint the missing area are all based on the smoothing of nearby colors. Another approach is kind of patch-based image inpainting, where we choose a small patch around the edge of target area and propagate it into target area. In this method, in contrast to the smoothing-based algorithm, can better capture the texture of the image and will not lead to the problem of blurring.

With regard to the patch-based method, every patch around the target region are assigned a priority. When we propagate the patch into target region, the patch with highest priority is chosed. In this paper, we propose an efficient priority assginment strategy that can better capture the structure of the whole image. Kimi: TODO: add illustration of our proposal

2. Related work and our contribution

First we should make it clear that image inpainting and image denoising are actually different tasks. In image inpainting, we aim to remove part of an image and a person needs to explicitly specify the area to be inpainted. In constrast, as regard to image denoising, the task is to remove the "random" noise of an image, which often does not need human supervison.

2.1. Related work

There are mainly two kinds of works on image inpainting: smoothing-based and patch-based.

The research on image inpainting emerges on 2000, Marcelo Bertalmio *et al*. [1] first deals with the problem of image inpainting. Their method is mainly based on intuition: propagate color information in the direction of normal. However the limitation of the algorithm is that the texture of its environment is unlikely to be reproduced.

Roth and Black [5] later come up with a more general framework called *Field of Experts* which is a Markov random field model. This work relies on the result of Hinton [4], where Hinton discovers that a factor in MRF can be modeled by a field of "expert" distributions. In this work, they first learn the model and then apply the learned model to Bertalmio's propagation method. Although this work in some sense captures image structure, the blurring problem is also serious after our experiment.

Another different way to tackle this problem is proposed by Criminisi *et al*. [2, 3]. They note that exemplar-based texture synthesis contains the essential process requred to

replicate the structure of image. They introduce a priority for each exemplar and propagate according to the priority of each exemplar. This technique does not have the problem of blurring and can restore texture well, but may still fail for large object removal.

2.2. Our contribution

add our contribution

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