

Image In-painting

Course: Software Engineering

Group Member: Hu Hu mihawkhu@gmail.com

Yesheng Ma kimi.ysma@gmail.com

Yikai Zou zouyikai1014@163.com

Instructor: Bin Sheng

Project Period: 9/2016 - 12/2016

Contents

| | | |
|----------|---|----------|
| 1 | Background and Analysis of the Problem | 3 |
| 2 | Proposed Goal, Objectives, Target Population | 3 |
| 2.1 | Goal | 3 |
| 2.2 | Target Population | 4 |
| 3 | Implementation Plan | 4 |
| 3.1 | Traditional Algorithm | 4 |
| 3.2 | CNN Model | 5 |
| 4 | Project Scope | 5 |
| 4.1 | Project Goal and Task | 5 |
| 4.2 | Project Costs | 5 |
| 4.3 | Project Deadline | 5 |
| 4.4 | Possible problem | 6 |
| 5 | Benefits | 6 |
| 6 | Methodology | 6 |
| 7 | Hardware and Software Resources | 6 |
| 8 | Task Distribution | 7 |

1 Background and Analysis of the Problem

Several techniques that former researchers has developed includes:

1. Partial Differential Equation (PDE) based algorithm is iterating and propagating information about the graph to restore the graph.
2. Texture synthesis based Image In-paintinging is to to produce more of that texture
3. Wavelet Transform in two dimensions based in-paintinging algorithms to fix images
4. Semi-automatic and fast in-paintinging fixes the graph with the help of human assistance.
5. Using Markov random fields (MRF) to model the image and do image in-paintinging based on Bayesian learning in acyclic graphs.

Problems in these image in-paintinging algorithms are that there is no universal and efficient algorithms to solve all kinds of image in-paintinging problems. All currently available algorithms are all limited to a specific area of image in-paintinging, for example text in-paintinging.

2 Proposed Goal, Objectives, Target Population

2.1 Goal

This project managed to implement the image in-painting algorithm which is mentioned in previous papers. We will try to solve the problem that they meet and give the better method to do the image in-painting. The proposed goal is that when given a picture and a chosen area, ie, draw a area on smart phone. Then we will remove the object in this area and inpaint the picture, which we con't find there is something removed.

Just as the following two images shows, the left one is the origin image and the right one is the image after in-painting, you can find that the landmark is removed from the latter image.



(a) image before in-paintinging



(b) image after in-paintinging

Figure 1: Two images to illustrate image in-painting

Finally, we should be able to make an application both on the Android platform and as an application in web page.

2.2 Target Population

Because we are going to make a smart phone application and a web page application, our target population is those who use smart phone and computer and want to inpaint their pictures.

3 Implementation Plan

We will do this project as following steps.

1. First, we will look into the method to see what previous people did to accomplish this goal.
2. Then we will summarize their work and find the advantages and disadvantages of them.
3. Next, we will try to solve the problem that haven't been solved and give a better method. For example, we would like to train this topic by convolutional neural network, which haven't been implemented by others up till now.
4. Finally, we will transform our result to practical implementation such as Android application and web application.

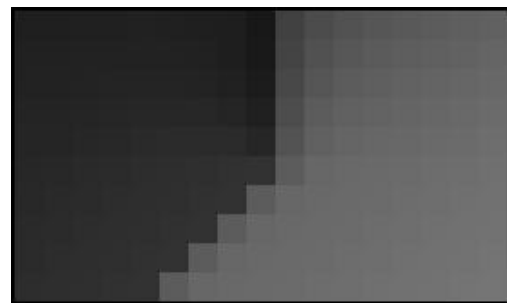
3.1 Traditional Algorithm

In traditional algorithm, using some graphic operation, the pixel in image that will be in-painted depends on the neighbor pixel of it.

Due to the context limitation, we don't present concrete formulas here, but following graphs will illustrate it.



(a) detail of the original image, region to be in-painted is in white.



(b) restoration

Figure 2: The restoration of image pixel

3.2 CNN Model

We plan to design a convolution neural network to solve this problem. According to our paper research, there is no previous people who used deep learning method to do image in-painting. We will try to design a CNN structure to solve it.

A typical CNN model is shown below.

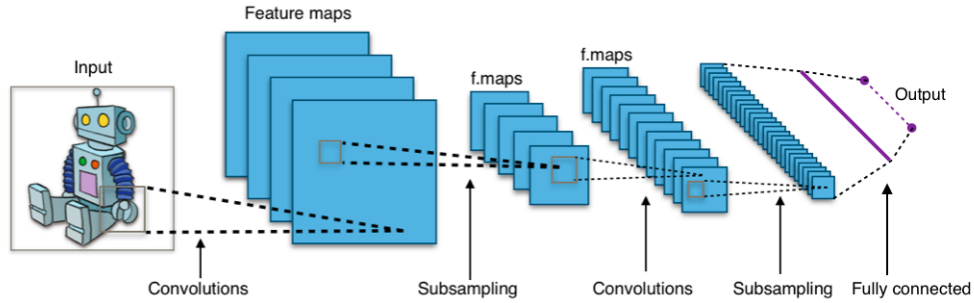


Figure 3: A typical CNN model

We are going to get training data from Internet and generate by ourself. Also, we plan to use Tensorflow as our development tool.

4 Project Scope

4.1 Project Goal and Task

1. Implement image in-painting algorithm. When it is given an image and a chosen area, it can remove the object in the area and inpaint the image.
2. Implement the CNN model, and get data to train this modle. Finally, we plan to get a better result than traditional algorithm.
3. Transform the implementation code to frond end application, such as Andorid application and web page application. We are going to do a perfect demo in the presentation.

4.2 Project Costs

In our project, there is no too much money cost needed. But in our CNN model, it may need a lot of time to train the neural network model. Also, it may need GPU to decrease the training time cost.

4.3 Project Deadline

The concrete time schedule is shown in section 6.

The deadline of this project is 1/10/2017.

4.4 Possible problem

There are some possible problem that we may meet when do this project.

1. There is no previous people who do image in-painting using CNN model. So it is really a big challenge for us. We plan to try our best to get a great CNN model about image in-painting, but it may have some problem. But we will try out best to solve it.
2. It may need too much calculation that can not be done on embedded system such as Android phone. But we will try our best to optimize it.

5 Benefits

In our daily life, there may be something that added to image for some intention, or something that exists on the image that we want to remove. Our software will help them solve these problem. In our plan, we will make an application that can inpaint the image with a novel algorithm and we can not find and trace.

6 Methodology

| Major Mission | Date | Finished or Not |
|--|---------------|-----------------|
| Paper research, UML design, Requirement analysis | 9/15 - 11/16 | Finished |
| Prototype design, Network structure design, | 11/17 - 11/30 | TODO |
| Backend developement, Algorithm implementation | 12/1 - 12/14 | TODO |
| Frontend implementation, UI design | 12/14 - 12/28 | TODO |
| Test and refactoring | 12/28 - 1/10 | TODO |

7 Hardware and Software Resources

In this project, we have to deal with hardware and software resources since in a software development, these resources are critical.

Hardware:

1. 1 Android and 2 iPhone devices
2. GPU to train neral networks
3. 3 laptops for software development

Software:

1. use Python/Java as backend programming language

2. deep learning training platform: tensorflow
3. use Javascript to build frontend logic
4. use CSS/html for UI design

8 Task Distribution

| Student Name | Student ID | Task Assigned |
|--------------|------------|--|
| Hu Hu | 5140519019 | Frontend and backend implementation |
| Yesheng Ma | 5140209064 | Backend implementation and UI design |
| Yikai Zou | 5140309276 | Documentation, paper research and UML design |