Deliver 3
Poisson Editing

Team 12

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Summary

Mandatory tasks

- Part I: Implement the importing gradients method
  - Step I: Read the Patrick Perez's paper
  - Step II: Face the problem. Going into *start.m* file
  - Step III: From Laplace equation to Poisson equation

- Part II: Test it with your own images

Optional tasks

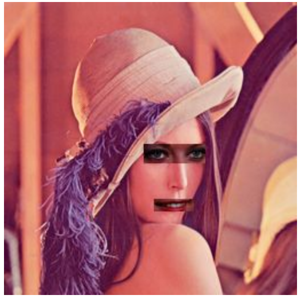
- Part I: Implement the mixing gradients method

Mandatory tasks
Part I: Implement the importing gradients method

In this deliver we were asked to solve the image editing problem of cloning areas from one image to another one, where these areas could present discontinuities. We coded the importing gradients method from Patrick's paper to inpaint an area using seamless cloning.

The idea is that we have to use a generic interpolation machinery based on solving Poisson equations. It permits the seamless importation source image regions into a destination region.

These changes can be arranged to affect the texture, the illumination, and the color of objects lying in the region.



VS

Mandatory tasks
Part I: Implement the importing gradients method

So far, we did methods to fill regions only using the boundary conditions. We know from previous delivers that it works pretty well in some cases. Although, for image editing applications, this simple method produces an unsatisfactory, blurred interpolant, and this can be overcome in a variety of ways.
We added a guidance field vector field, ***v,*** as a new constraint for the well know inpainting minimization problem. Being ***f*** an unknown function in the inpaiting domain Ω and ***f**** the destination function outside the domain Ω.

$$\min_{f} \iint_{\Omega} |\nabla f - \mathbf{v}|^2 \text{ with } f|_{\partial\Omega} = f^*|_{\partial\Omega},$$

The basic choice for the guidance field v is a gradient field taken directly from a source image, ***g***.

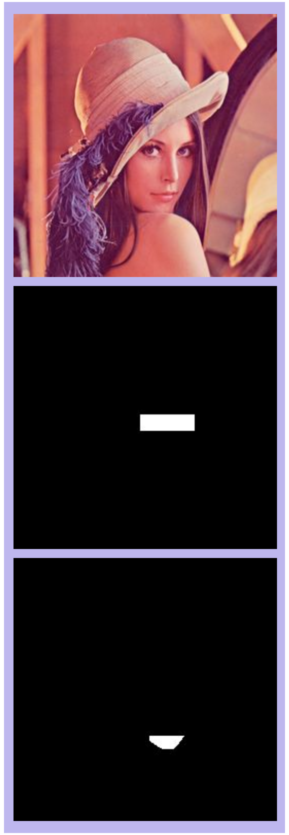
$$\mathbf{v} = \nabla g,$$

We ended up with a solution that is the unique solution of the following Poisson equation with Dirichlet boundary conditions:

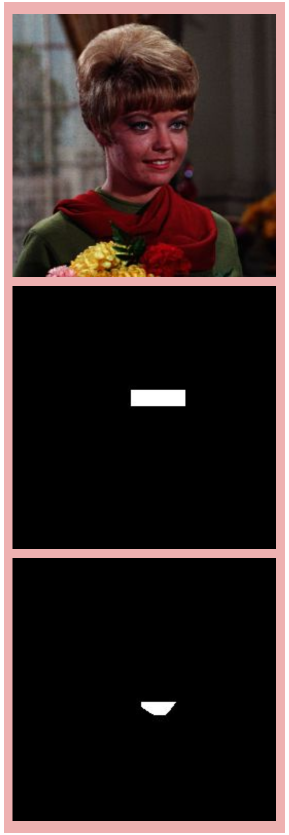
$$\Delta f = \Delta g \text{ over } \Omega, \text{ with } f|_{\partial\Omega} = f^*|_{\partial\Omega}.$$

Mandatory tasks
Part II: Test it with your own images

dst



src



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Mandatory tasks
Part II: Test it with your own images (I)

Mars landscape

Shanghai skyline

Random Martian city

Mandatory tasks
Part II: Test it with your own images (II)

Barcelona from air

UFO

Independence Day 3. Now in Barcelona

Mandatory tasks

Part II: Test it with your own images (III)

Sergio Sancho

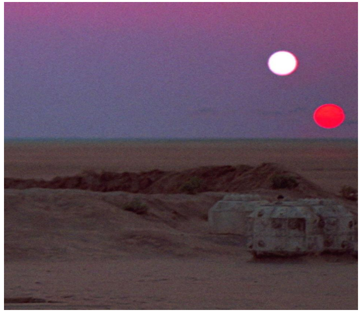
Someone

Barney Stinson

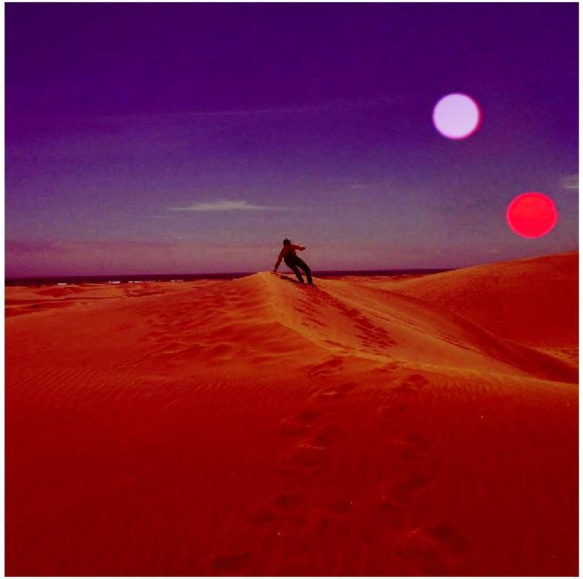
Mandatory tasks
Part II: Test it with your own images (IV)

Desert hiking

Tatooine



Tatooine desert hiking

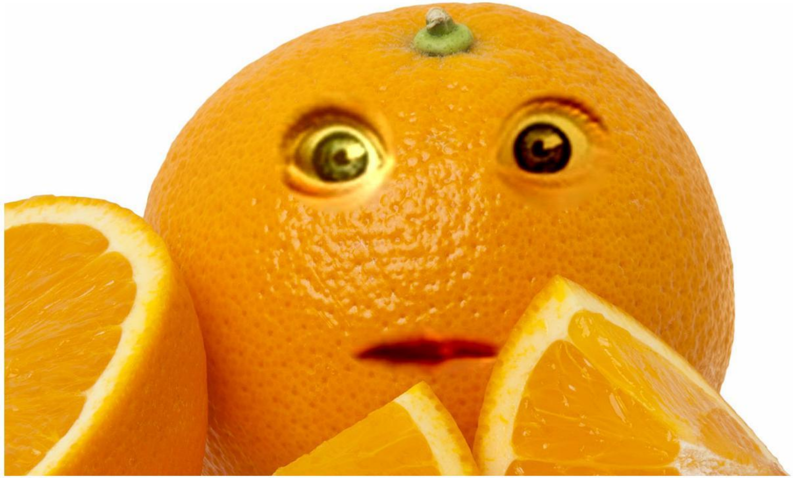


Mandatory tasks
Part II: Test it with your own images (V)

Orange

Excited baby

Excited orange



Mandatory tasks
Part II: Test it with your own images (VI)

Mountains

Hot-air balloon

Different color intensities depending on the position

It is a interesting to see how the intensities changes depending on the boundary conditions. In this set of images, we go from lighter to darker intensities

Mandatory tasks
Part II: Test it with your own images (VII)

White wall

Banksy's drawing

Banksy's Graffiti

Optional tasks

Part I: Implement the mixing gradients method

As we saw in the previous examples, the importing gradient method has some limitations. No trace of the destination image ***f**** is kept inside the inpainting domain Ω.

In this situation is desirable to combine properties of ***f**** with those on ***g***. In our image, on the transparent or on the flat regions we would like to see the texture from the ***f**** image.

The Poisson methodology allows non-conservative guidance fields to be used, which gives scope to more compelling effect. We only need to change the guidance field ***v***.

$$\mathbf{x} \in \Omega, \mathbf{v}(\mathbf{x}) = \begin{cases} \nabla f^*(\mathbf{x}) & \text{if } |\nabla f^*(\mathbf{x})| > |\nabla g(\mathbf{x})|, \\ \nabla g(\mathbf{x}) & \text{otherwise.} \end{cases}$$

Optional tasks
Part I: Implement the mixing gradients method

The image below is the result of doing the mixing gradient method. We can see how the color information of the source image distorsiones the result.

We come up with a solution. We transfer the intensity pattern from the source, not the color. We turned the source image monochrome beforehand. We only keep the color information in the flowers region.