Poisson Image Editing

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1. Introduction:

In normal cut and paste algorithms,naive methods like feathering are used which do not completely hide the boundaries between the merged images.Also saliency of the composite image is also affected.Hence the paper proposes a stronger method for blending two images.Here we try to minimize the integral of the difference between the gradient of the source Image and a guidance vector field with boundary conditions.The solution to the obtained equation is a poisson equation.

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

In the discrete domain the equations translates to:

$$\min_{f|_\Omega} \sum_{\langle p,q\rangle \cap \Omega \neq \emptyset} (f_p - f_q - v_{pq})^2, \text{ with } f_p = f_p^*, \text{for all } p \in \partial\Omega,$$

The solution to the poisson equation is:

$$\text{for all } p \in \Omega, \quad |N_p| f_p - \sum_{q \in N_p \cap \Omega} f_q = \sum_{q \in N_p \cap \partial\Omega} f_q^* + \sum_{q \in N_p} v_{pq}$$

2. Approach and methods

Seamless Cloning:

In this method the vector field use is the gradient vector field of the source-image.The boundary condition is applied on the destination image.The guidance vector field here is:

$$\text{for all } \langle p,q\rangle, v_{pq} = g_p - g_q$$

Example:

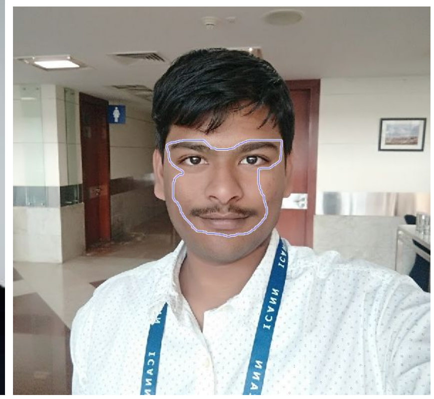
Inputs:

Outputs

Inputs

Output





NOTE : Total 3 iterations.

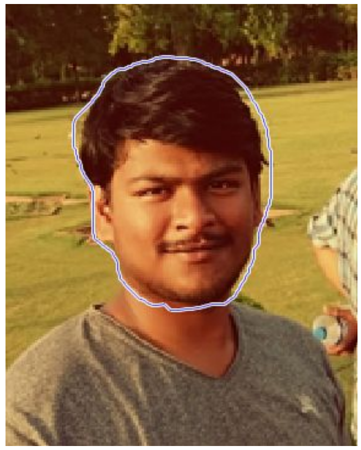
Mixed Seamless Cloning:

In this method the vector field we use is the maximum gradient vector field of both the source image and the destination image.The boundary condition is applied on the destination image.The guidance vector is given by:

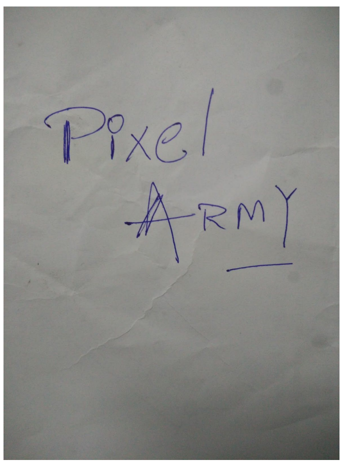
$$\text{for all } \mathbf{x} \in \Omega,\ \mathbf{v}(\mathbf{x}) = \begin{cases} \nabla f^*(\mathbf{x}) & \text{if } |\nabla f^*(\mathbf{x})| > |\nabla g(\mathbf{x})| \\ \nabla g(\mathbf{x}) & \text{otherwise.} \end{cases}$$

Input:

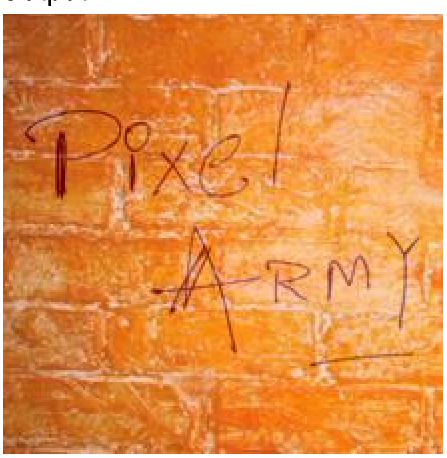

Output

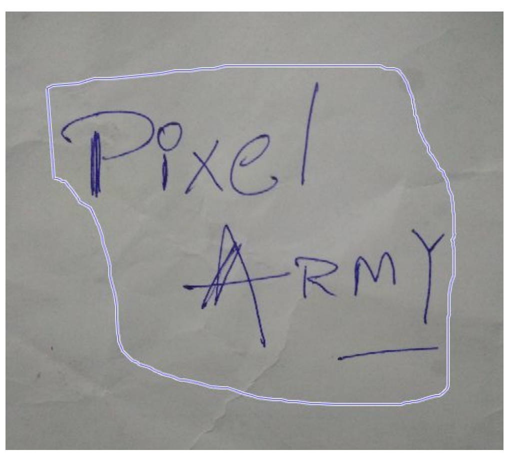


Input



Output



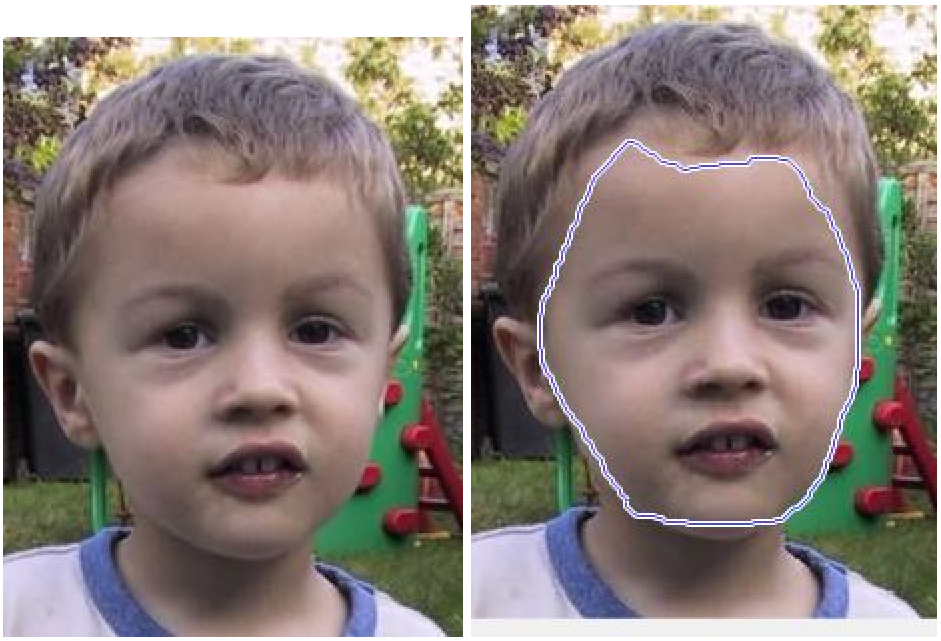


3. Applications:

Texture Flattening:

In this method we preserve the gradients at only at the neighbours at an edge.Here this is used as the gradient vector field.The boundary condition is applied on the laplacian calculated in the image at edge positions.The

Input:



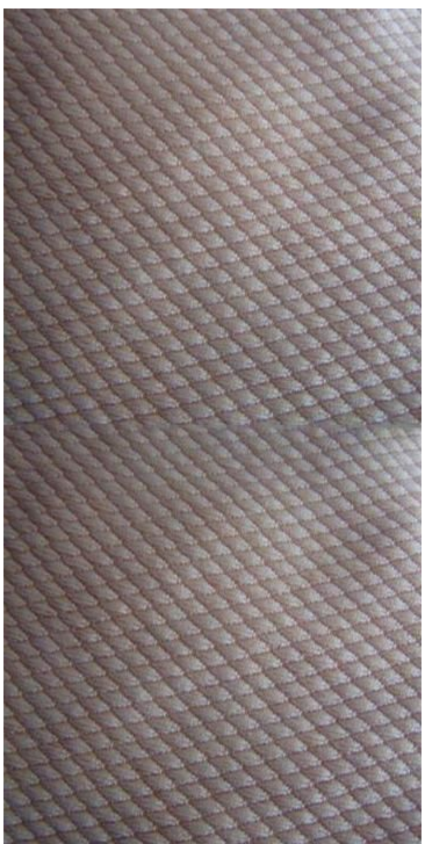
Output

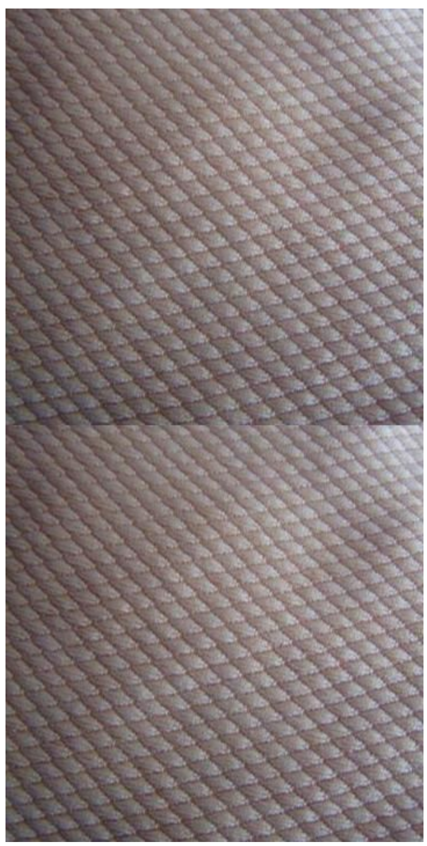
Seamless Tiling:

In this method we preserve the gradients inside each tile but use the average of the boundary pixels for each boundary of the tile as boundary values solve the poisson equation.

Input:

Output:





1. Seamless tiling
2. Cut and paste method

Reference Paper:

http://www.cs.jhu.edu/~misha/Fall07/Papers/Perez03.pdf