Reproduction of Poisson Image Editing

Xu Diwen

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1 Process of Reproduction

1. Initiation of the Task

1.1. Load the source and target images, change them into matrix form, for which contains three RGB channel.

1.2. Load the mask image, the white region is defined as the domain Ω, black region is the rest, turn it into binary mask.

1.3. Every pixels or the elements in matrix are defined to be the variable p in the domain.

1.4. The nearby four pixels of p is defined as N_p, each one is defined as q, $|N_p|$ is denoted the number of N_p, if the domain contains the pixels on the border of the image, then $|N_p| < 4$.

1.5. The boundary of the domain $\partial\Omega$ is defined as the collection of q's for the condition that $q \in N_p$ and $q \notin \Omega$.

1.6. f_p f_q is the value of p q in the matrix in domain area which is needed to solve and get.

1.7. h_p h_q is the value of p q in the matrix of target image.

1.8. g_p g_q is the value of p q in the matrix of source image.

1.9. v_{pq} equal to $h_p - h_q$ or $g_p - g_q$ determined by the absolute value of which one is bigger and it should be solved by all q.

2. Solve the Discrete Poisson Equation to Produce the Co-domain

2.1 For all p in the domain, according to the equation below to establish a matrix system and solve it and these should be solved for all three RGB channels.

$$|N_p| * f_p - \sum_{q \in N_p \cap \Omega} f_q = \sum_{q \in N_p \cap \partial\Omega} f_q + \sum_{q \in N_p} v_{pq}$$

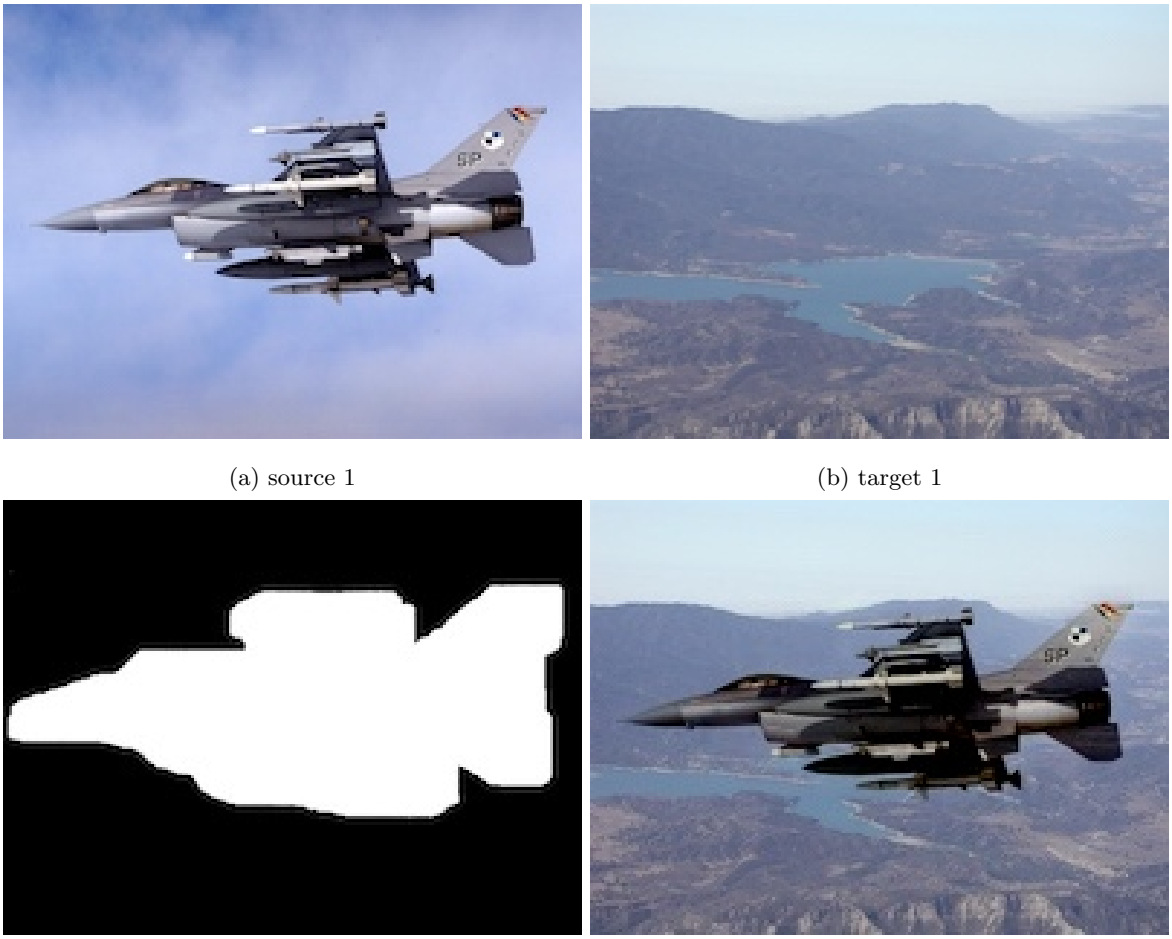
2.2. The white region of the mask image which is the domain is renewed by the matrix solver and combine it with the rest which is still the same content of the target image.

2.3. Output the the new combined seamless cloning image.

2 Test and Result

2.1 Test 1

The result looks good. And of course, the plane in output image will turn to be darker.



(a) source 1 (b) target 1

(c) mask 1 (d) output 1

Figure 1: Test 1

2.2 Test 2

The result shows that the domain part in the output will show much characteristics of the background image if using the mixed gradient. So, the cloning image tends to being seen transparent.

(a) source 2 (b) target 2

(c) mask 2 (d) output 2

Figure 2: Test 2

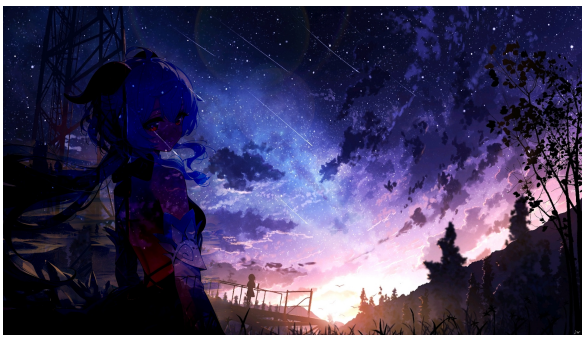
2.3 Test 3

This test shows a bad result. As the color difference between source and target image is big, if using the mixed gradient, the output will be largely influenced by the background image.

(a) source 3

(b) target 3

(c) mask 3



(d) output 3

Figure 3: Test 3

3 Conclusion

The Poisson Image Editing method shows a great advantage in outputting the seamless image. However, the whole part of the co-domain will be influenced by the boundary of the domain, which is something bad. So, defining an algorithm, where the mixed gradient is more influenced by the source image when the pixels are coming closer to the middle of the domain, will be better to show the performance of the cloning. But, this method will be much more complicated. Overall, Poisson Image Editing is quite a milestone.