Drag-and-Drop Pasting

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Objective

We aim to develop a photo-editing tool that enables user to cut an object from an image by roughly circling the region of interest on the image, and then to simply drag and drop it onto another image. The tool automatically generates a seamless image containing the object the user specified.

The project has achieved the following goals:

I. Minimize the unnatural look when an object cutout (whose boundary is specified roughly by user) is pasted onto another image;
II. Find an optimal boundary automatically based on the rough user input to give a seamless output;
III. Extend to some applications using the functionality in **I** and **II**, such as seamless image completion.

Methodology

The development of the tool was divided into three parts, each achieving the respective objective.

The first part was to develop a function that minimizes any visible seam on the output image after compositing the object cut-out. Computationally, the region specified by the user will be filled with pixels such that no visible seam is observed. By treating the pixels to be filled as unknowns of a system of simultaneous equations, we developed a numerical approach to solve the equations for generating a seamless image.

The goal of the second part is to design and implement an algorithm to find an optimal boundary given the region specified by the user. Since users usually specify their region of interest very roughly, an algorithm was developed to find a boundary that optimizes the result obtained in the function developed in the first part.

Lastly, the above functionalities were integrated into an application which can seamless complete a missing region in an image. Given an image with a missing region (or hole) and another image provided by the user, the tool can automatically find a region on the second image to complete the hole in the first image.

Result

Testing result of conventional drag-and-drop pasting

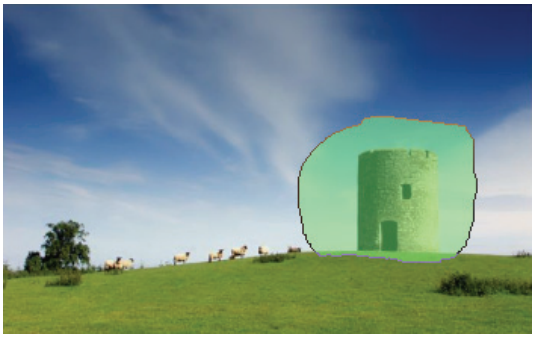
(a) Source image, a piece of wood on shallow water.

(b) Destination image, a sandy beach.

(c) Direct cut and paste result; notice that the color and texture difference of source and destination.

(d) Result after using drag-and-drop pasting, the color of the wood is automatically adapted the sandy environment.

Testing result of seamless image completion



(a) The image with the hole (highlighted here).

(b) The image used to complete the hole.

(c) The result image after scene completion.

(d) The zoomed view of the result image.

Conclusion

We have developed a set of algorithms that can automatically minimize the color difference on the boundary of the user's region of interest. When applied, these algorithms can allow users to easily achieve seamless image completion in photo editing. Our tool sets developed can significantly reduce the amount of user interaction during the object-cloning process.