Accurate Background Replacement on Mobile Devices

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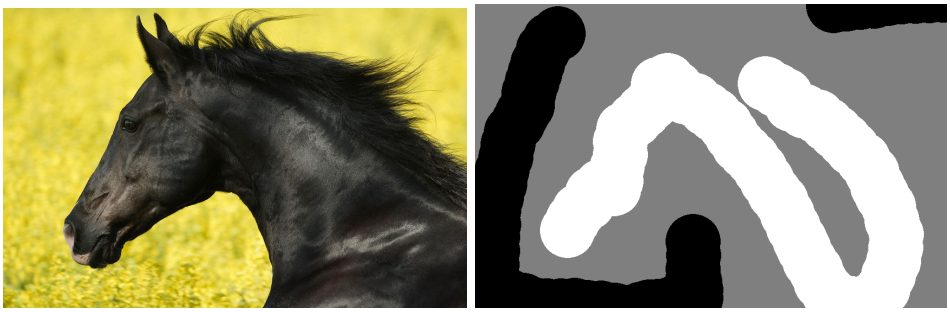
I. Introduction

There are apps such as “Wallpapers” providing beautiful wallpapers for mobile devices such as smartphones or tablets. It would be interesting if we can replace the background of a captured image with a different background. Can we extract the hairy details accurately?

In the app we are developing, the user needs to provide some hints about foreground and background by adding white or black scribbles onto the input image. Then the program computes the alpha matte based on the input image and user input. Finally, the foreground is extracted from the input image and a composite image with a different background is generated to the user. The user can share this synthetic image with their friends.



(a) Input Image (b) User Scribbles

(c) Computed Alpha Matte (d) Composite Image

Fig. 1 Example of how to use the foreground extraction method to extract the interested region. (a) input image “horse” , (b) white and black scribbles to some foreground and background provided by the user, (c) alpha matte for “horse” (d) final composite image by “horse” and another background.

II. Technical Details

We are going to implement the method described in KNN Matting[1]. This paper presents a simple and fast algorithm by solving an energy function which includes a data term and a regularization term. The data term represents the confidence a pixel belongs to foreground or background based on the user input. The regularization terms are generated in this way: for each pixel, we connect it to its k nearest neighbors in the feature space (R,G,B,X,Y) where (R,G,B) is the color and (X,Y) is the image coordinate. The intuition is that if two pixels are similar in color or spatially close, then it is likely that they have similar alpha values. The constructed energy is a quadratic function, so minimizing such a function is equivalent to solving a system of linear equations.

Our target mobile platform is Android.

III. MileStones

5/23 Implement User interface on the Tegra Note.
5/27 Implement KNN matting algorithm for interactive foreground extraction and image composite.
5/31 Debug and testing
6/2 Final report and presentation preparation

IV. References

[1] Qifeng Chen; Dingzeyu Li; Chi-Keung Tang, "KNN Matting," *Pattern Analysis and Machine Intelligence, IEEE Transactions on* , vol.35, no.9, pp.2175,2188, Sept. 2013