Content-Aware Display Adaptation and Editing for Stereoscopic Images

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1 Introduction

We propose a content-aware stereoscopic image display adaptation method which simultaneously resizes a binocular image to the target resolution and adapts its depth to the comfort zone of the display while preserving the perceived shapes of prominent objects [Chang et al. 2011]. This method does not require depth information or dense correspondences. Given the specification of the target display and a sparse set of correspondences, our method efficiently deforms the input stereoscopic images for display adaptation by solving a least-squares energy minimization problem. This can be used to adjust stereoscopic images to fit displays with different real estates, aspect ratios, and comfort zones. In addition, with slight modifications to the energy function, our method allows users to interactively adjust the sizes, locations, and depths of the selected objects, giving users aesthetic control for depth perception.

2 Algorithm and results

Our algorithm is based on warping-based image manipulation methods with two stereoscopic constraints: vertical alignment and horizontal disparity consistency. Figure 1 illustrates the overview of our method. Our method first detects a sparse set of robust correspondence points and then optimizes the warping fields of the image pair according to the target display parameters, correspondence constraints, and saliency constraints that prevent the results from distortions. Our method can achieve various retargeting scenarios, including changing the display size, aspect ratio, allowable depth range, and viewing configuration. It can also achieve effects not supported in traditional depth adaptation methods, such as changes to the scene depth that do not affect its scale. In addition, by modeling the user interaction as constraints, our system can be extended to an interactive stereoscopic image editing system. The user can specify the transformation of the disparity/depth values, and our system accordingly warps the input to generate a new stereoscopic image. The user can also select a single object and specify its position, depth, or even explicit 3D location. Our system automatically identifies the depths of other regions and warps the input to match user’s intention. The resultant system is the first content-aware system to simultaneously allow retargeting, depth adaptation, and interactive editing of stereoscopic images.

Figure 2 shows the resizing results. The traditional scaling method could cause distortions on the perceived object shapes. By considering saliency and stereo constraints, our method maintains better perceived shapes of the flowers. In Figure 3, the user edits the position and shape of the boat. User studies show that the method is effective at editing depth and reducing occurrences of diplopia and distortions.

References