Automatic Image Retargeting

Vidya Setlur*
Northwestern University

Saeko Takagi†
Wakayama University

Ramesh Raskar‡
Mitsubishi Electric Research Labs

Michael Gleicher§
University of Wisconsin

Bruce Gooch¶
Northwestern University

Figure 1: *left) The source image containing three areas of importance, the two boys, and the ball. center) The source image retargeted to fit a PDA display. right) The source image retargeted to fit a cell phone display. In the retargeted images, our algorithm is able to keep both boys in the image and maintain the relative positions of all shadows.*

1 Introduction

We introduce a non-photorealistic algorithm for automatically *retargeting* images, that is, adapting them for display at different sizes and/or aspect ratios, while preserving the images' important features and qualities. Our method accommodates images with multiple important regions by minimizing the unimportant space between regions. The motivation for this work is the need for tools that allow us to author imagery once, and then automatically *retarget* that imagery for a variety of different display devices.

Increasingly, our computing and communications infrastructure is evolving to support images and video. Image manipulation techniques such as linear resizing and cropping work well for images containing a single important object [Suh et al. 2003]. However, problems such as degradation of image quality and important information loss occur when these techniques have been automatically applied to images with multiple objects. In such cases, valuable image area in the target image may be wasted with unimportant regions between important features. Our algorithm addresses the case of multiple important objects in an image.

One can imagine a variety of retargeting applications such as: entertainment images for cellular phones, training images for PDAs, and status information for "heads up" displays.

2 Implementation

Our algorithm takes as input a source image and a specification for the size of the output image. We first apply the mean-shift algorithm to segment the source image into regions [Comaniciu and Meer 2002]. We then combine adjacent regions based on their spatial distribution of color/intensity. In order to identify important regions, we generate an importance map of the source image using saliency [Itti et al. 1998] and face detection [Robotics Institute]. If the specified size contains all the important regions, the source image is simply cropped. Otherwise, the important regions are removed from the image, and the resulting "holes" are filled using inpainting [Harrison 2001].

The updated background is then resized to fit the input specification. The importance regions are then "pasted" back onto the updated background. If all the important regions are not able to fit within the new image, they are resized in inverse proportion to their importance.

3 Results and Discussion

Our results demonstrate that our non-photorealistic algorithm tends to move noticeable regions closer together while retaining key feature relationships in the image. Since our method is completely automatic, it may not be optimal if an important feature is on a similarly textured background, such as a single face in a crowd of people. Emotional connectedness between objects is another aspect that our system cannot address at this point. In addition, our system does no establish semantic correlation between objects and their shadows. In Figure 1, the shape of the ball's shadow in the retargeted image is not consistent with the shape of the ball. This is because our system identifies the ball and not its shadow to be important, leading to the resizing of the shadow along with the background.

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*e-mail: vidya@cs.northwestern.edu
†e-mail: saeko@sys.wakayama-u.ac.jp
‡e-mail: raskar@merl.com
§e-mail: gleicher@cs.wisc.edu
¶e-mail: bgooch@cs.northwestern.edu