
# Quality Assessment of Retargeted Images by Salient Region Deformity Analysis

Maryam Karimi, Shadrokh Samavi, Nader Karimi, S.M. Reza Soroushmehr, Weisi Lin, Kayvan Najarian

PII: S1047-3203(16)30266-8
DOI: http://dx.doi.org/10.1016/j.jvcir.2016.12.011
Reference: YJVCI 1915

To appear in: *J. Vis. Commun. Image R.*

Received Date: 20 August 2016
Revised Date: 16 November 2016
Accepted Date: 20 December 2016

Please cite this article as: M. Karimi, S. Samavi, N. Karimi, S.M. Reza Soroushmehr, W. Lin, K. Najarian, Quality Assessment of Retargeted Images by Salient Region Deformity Analysis, *J. Vis. Commun. Image R.* (2016), doi: http://dx.doi.org/10.1016/j.jvcir.2016.12.011

# Quality Assessment of Retargeted Images by Salient Region Deformity Analysis

Maryam Karimi, Shadrokh Samavi, Nader Karimi, S.M. Reza Soroushmehr, Weisi Lin, Kayvan Najarian

***Abstract*— Displaying images on different devices, requires resizing of the media. Traditional image resizing methods result in quality degradation. Content-aware retargeting algorithms aim to resize images for displaying them on a new device with the goal of preserving important contents of the image. Quality assessment of retargeted images can be employed to choose among outputs of different retargeting methods or help the optimization of such methods. In this paper we propose a learning based quality assessment method for retargeted images. An optical flow algorithm is used to find the correspondence between regions in the scaled and retargeted images. Three groups of features are defined to cover different aspects of distortions that are important to human observers. Area related features are used to detect how the areas of salient regions are retained and how much geometrical deformities are produced in the image. Also, to better assess the retargeted image we introduce features to show how well the aspect ratios of objects are retained. More importantly, we introduce the concept of measuring the homogeneity of distribution of deformities throughout the image. Experimental results demonstrate that our quality estimation method has better correlation with subjective scores and outperforms existing methods.**

***Index Terms*— image quality assessment, image retargeting, geometrical distortions, homogeneity of deformities, saliency preservation.**

## I. Introduction

With the increase use of internet, a high volume of visual media is being transmitted. Diversity of display devices, such as mobile phones and tablets, requires display of an image with different sizes on different devices. Image retargeting performs this resizing task and is becoming an important tool. When an image is retargeted at a receiver device, with a display size different than the transmitter, quality preservation is of cardinal importance. Although subjective quality assessment is the most accurate method to determine the quality of images, it is time-consuming, laborious, very costly, and in most cases it is unpractical. Thus a lot of efforts have been made to design computational models for objective quality assessment of such images and videos [1].

Size and aspect ratio of images are changed to display them on different devices. Traditional retargeting methods, such as uniform scaling and cropping, often lead to degradation of salient areas or loss of background content [2, 3]. To solve these problems, many content aware retargeting algorithms have been proposed [4-9]. These methods aim to protect salient content of images during the retargeting process.

The well-known method of seam carving (SC) is proposed by Avidan and Shamir [4]. The SC algorithm reduces the width or height of the image by removing pixels that belong to a path with least fluctuations. Such a pixel path is supposed to belong to a less important area. Warping (WARP), which is presented by Wolf [5], finds important areas using local saliency, object and motion detection algorithms and tries to keep them away from shrinkage. Rubinstein in [6] offered a multi operator (MULTIOP) retargeting algorithm, which combines cropping, scaling and seam carving operators. It provides better results than single operator methods. In [7] a scale-and-stretch warping (SNS) method is proposed. It iteratively computes an optimal local scaling factor for each local region. It tries to update a warped image that best matches such scaling factor. In [8] a non-uniform warping is also introduced for streaming video (SV) which tries to retain cinematographic scene composition after retargeting operation. Another method, named shift-map editing (SM), converts the image retargeting problem to a graph labeling problem and then solving it graph cut [9].

Using retargeting methods causes information loss and geometric distortions in images. To determine the efficiency of a retargeting approach, its results are usually perceptually evaluated for a small set of images. But in real-time applications, and for large sets of images, using subjective quality assessment is not possible. Therefore, designing retargeted image quality assessment (RIQA) criteria has become a new challenge in this area. Using these criteria, not only facilitates online quality monitoring of retargeted images, but also retargeting methods can be optimized through it.

Although distorted image quality assessment methods for natural images have made good progress [10-13], the field of quality assessment for retargeted images is still in its infancy. For natural images that have gone through noisy channels, or been compressed, or have been filtered, there are powerful objective image quality assessment (IQA) methods which produce quality scores that are very close to subjective scores. It is not easy to align non-uniformly retargeted images with

Maryam Karimi is with the Department of Electrical and Computer Engineering, Isfahan University of Technology, 84156-83111, Iran.
Shadrokh Samavi is with the Department of Electrical and Computer Engineering, Isfahan University of Technology, 84156-83111, Iran, and the University of Michigan Center for Integrative Research in Critical Care, Ann Arbor, 48109 U.S.A.
Nader Karimi is with the Department of Electrical and Computer Engineering, Isfahan University of Technology, 84156-83111, Iran.
S.M.Reza Soroushmehr is with the Dept. of Computational Medicine and Bioinformatics, University of Michigan, Ann Arbor, 48109 U.S.A.
Weisi Lin is with the School of Computer Engineering, Nanyang Technological University, 639798 Singapore.
Kayvan Najarian is with the Michigan Center for Integrative Research in Critical Care, and also with the Dept. of Computational Medicine and Bioinformatics, University of Michigan, Ann Arbor, 48109 U.S.A.