

Blind Depth Quality Assessment of Stereoscopic 3D Image using Histogram Shape Analysis

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ABSTRACT: Multiview videos plus depth(MVD) is a popular 3D representation. The 2D quality metric are not suitable for MVD. In this paper we are work on depth quality assessment of stereoscopic 3D image which is some modification of 2D image and present the novel algorithm to determine the distortion present in depth videos induced by compression. Stereoscopic 3D is an attempt to reproduce the process by which we see with our eyes in order to produce a feeling of depth. The experimental result is the blind depth quality metric which used to predict quality of depth image.

KEYWORDS: Depth image quality metric, Depth image based rendering, Quality assessment.

I. INTRODUCTION

A study on the video plus depth representation for multi-view video sequences is presented. Such a 3D representation enables functionalities like 3D television and free viewpoint video. Compression is based on algorithms for multi-view video coding, which exploit statistical dependencies from both temporal and inter-view reference pictures for prediction of both color and depth data. The main benefit from using a multi-view video plus depth representation is that intermediate views can be easily rendered.

The quality assessment of 3D images have more new challenges, like asymmetric stereo compression, depth perception, and virtual view synthesis, than its 2D counterparts. In addition, the widely used 2D image quality metrics (e.g., PSNR and SSIM) cannot be directly applied to deal with these newly introduced challenges. This statement can be justified by the low correlation between the computed objective measures and the subjectively measured mean opinion scores (MOSSs), when 3D images are the tested targets. In order to meet these newly introduced challenges, in this paper, besides traditional 2D image metrics, the binocular integration behaviors—the binocular combination and the binocular frequency integration, are used for measuring the quality of stereoscopic 3D images. the binocular integration behaviors are important factors in the development of objective quality assessment for 3D images.

Image quality assessment (IQA) has been increasingly popular due to the prevalence of new types of image processing and communication systems the current IQA metrics can be classified into full-reference (FR), reduced-reference (RR) and no-reference (NR) For FR metrics, high-quality pristine images are needed, which are usually not available in practice. Therefore, NR metrics are more useful for practical applications. Image restoration is the technique to estimate a latent clean image from its corrupted version. Since images are very easily subject to distortions in all stages of the processing chain, image restoration has been a classical problem in image processing, such as denoising, deblocking, deblurring, etc. A no-reference quality metric for defocus deblurred images based on Natural Scene Statistics (NSS). Two categories of NSS features are extracted in both the spatial and frequency domains to account for both the global and local aspects of distortions in deblurred images. Specifically, the spatial domain NSS

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features are used to characterize the global naturalness, and the frequency domain NSS features are used to portray the local structural distortions.

3D image and video quality assessment is more difficult and complex problem than its 2D counterpart. 2D image quality used to quantify the quality of stereoscopic images.

An efficient general-purpose blind/no-reference image quality assessment (IQA) algorithm using a natural scene statistics (NSS) model of discrete cosine transform (DCT) coefficients. The approach depend on a simple Bayesian inference model to predict image quality scores given certain extracted features. The features are depend on an NSS model of the image DCT coefficients.

Presently, NR-IQA algorithms generally follow one of three trends: 1) distortion-specific approaches. These employ a specific distortion model to drive an objective algorithm to predict a subjective quality score. These algorithms check one or more distortions such as blockiness, blur, or ringing and score the image accordingly; 2) training based approaches: these train a model to predict the image quality score based on a number of features extracted from the image ; and 3) natural scene statistics (NSS) approaches.

II. LITERATURE SURVEY

Zhu, et al. [3] proposed a 3D QA model based on a 2D QA algorithm. Similarly, Yang, et al. [4] proposed a FR 3D QA algorithm based on the average PSNR of the two images in the stereopair and the absolute difference between the left and right view. Their algorithm therefore did not deploy a stereo matching stage to compute depth or disparity. However, none of these studies benefited by a large scale study of algorithm QA performance against human opinion. The study in [16], which employed thirty-two subjects who viewed two hundred distorted stereopairs affected by five different distortions, found the remarkable result that none of the 3D QA algorithms developed at the time of the study delivered QA prediction performance better than or in most cases, even as good as, 2D QA algorithms applied to the individual stereo image pairs.

Maalouf, et al. [6] proposed to perform the task of 3D QA on a Cyclopean image, which they define as the average of the left image and the disparity-compensated right image. Of course, the Cyclopean image is not an average of the left and right views but instead, is a 3D percept consisting of luminance and color patterns superimposed on a 3D images.

Kong et al. proposed NR quality metric for image autodenosing by maximizing the structure similarities between the input noisy image and the estimated noise as well as the denoised image. Zeng et al. [5] also proposed a quality model for denoised images by measuring structural fidelity and statistical naturalness. Structural distortion was evaluated in the wavelet domain following the SSIM approach [10].

For naturalness, natural scene statistics (NSS) features were extracted based on the marginal distributions of wavelet coefficients and frequency energy fall-off characteristics. In [6], Ma et al. conducted a subjective user study on image dehazing. Then the performances of the existing quality metrics were tested on the dehazed images.

Li et al. [7] proposed a quality metric for image deblocking. A sharpness module in texture areas and a blockiness module in smooth areas were combined to produce the overall quality score for deblocked images. This metric was further used for optimizing image deblocking algorithms. More recently, Liang et al. [8] proposed a general comparison-based framework for quality evaluation of restored images.

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III. PROPOSED METHOD

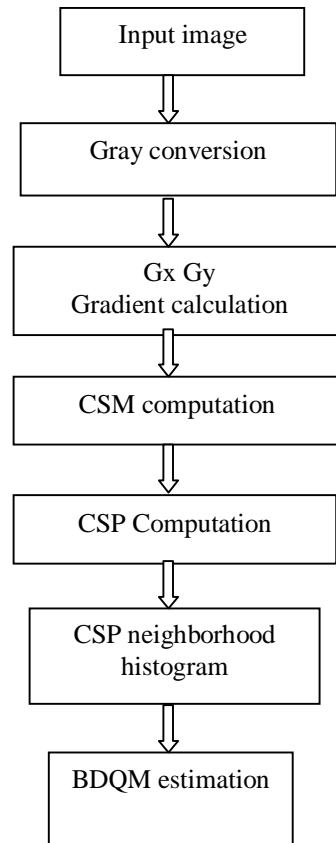


Fig.1. Block diagram of proposed method.

- At first we are taking any input image.
- Convert that image from colour to gray. In colour image there are three colours like red , green , blue.
- Apply sobel filter on this image. Sobel filter is used for edge detection for vertical and horizontal edges. Gx and Gy are vertical and horizontal gradient.

| | | |
|----|---|----|
| -1 | 0 | +1 |
| -2 | 0 | +2 |
| -1 | 0 | +1 |

Gx

| | | |
|----|----|----|
| +1 | +2 | +1 |
| 0 | 0 | 0 |
| -1 | -2 | -1 |

Gy

- CSM is compression sensitivity map. There will be maximum changes of distortion in edges of image so CSM is used. CSM can be used to dark the edges of images.

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- CSP is compression sensitivity pixel. To quantify the effect of compression the neighborhood pixel of csp is examined to determine the smoothness.
- Then histogram of neighborhood is constructed and analyzed to determine quality index.
- BDQM is build on the key observation of histogram. It is used to predict the quality of depth images.

III. COMPUTING COMPRESSION SENSITIVITY MAP

The compression sensitivity map is given by,

$$CSM = \sqrt{G_x^2 + G_y^2}$$

where G_x and G_y are gradients along horizontal and vertical directions and can be computed with Sobel filters.

For eg. Suppose we are taking one input image then consider G_x matrix and applied mask of G_x on image then at the result we are getting dark horizontal lines of the image. If we are applying G_y matrix as mask on image then vertical line of the image are darker.

There will be more chances of distortion in the edges of image so CSM is used to dark the edges of images. After that we are thresholding csm by taking $T=100$ to remove noise in image.

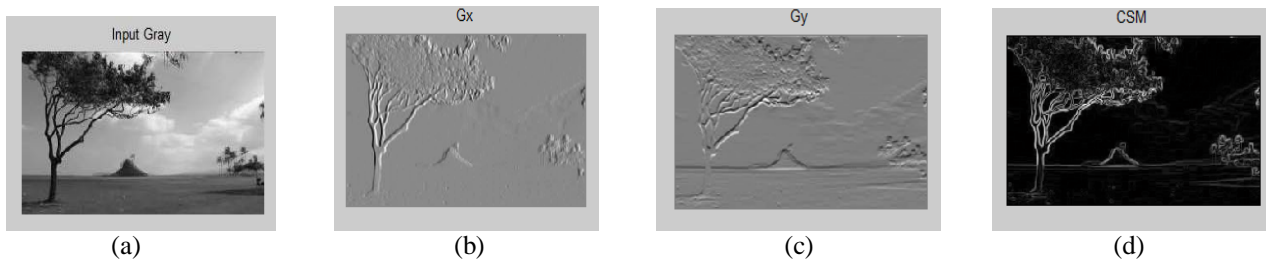


Fig.2. (a) Input gray image (b) G_x (c) G_y (d) Csm

IV. COMPRESSION SENSITIVITY PIXEL

The CSPs defined above belong to the sharp discontinuities representing the boundaries between two usually very flat or linearly changing regions at different depth levels. To quantify the effect of compression the neighborhood of the CSPs is examined to determine the smoothness induced by quantization. A local histogram is constructed and analyzed to infer the presence of compression effects. As the CSPs lie on or in the proximity of the boundary between two different depth levels, the histogram appears to be very peaked around two bins. Bin is the area of values that is divide the entire range of values into a series of intervals and then count how many values fall into each interval. As the bins increases the histogram height also increases by one.



Fig.3. (a) Dilated csm neighbourhood (b) Csp

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V. BDQM (BLIND DEPTH QUALITY METRIC)

The blind depth quality metric is given by,

$$BDQM = 1/|S| \sum_{t=1}^{|S|} Qi \quad (2)$$

Where Qi is quality index is given by,

$$Qi = \sum_{t=1}^k [\max(Hi^k) - Hi^k(t)] \quad (3)$$

Let H_i^k denote the histogram distribution of patch P_i with k equally sized bins. BDQM is computed for each frame of depth video and values are averaged to predict quality of whole image. BDQM builds on the key observation that the histogram around a CSP gets flattened when increasing the amount of compression. BDQM is a quality measure means larger the value of BDQM is better the quality of depth map.

VI. EXPERIMENTAL EVALUATION

We are measuring three parameters to improve the quality of image.

- Average gradient
- Edge intensity
- Shannon entropy

An image gradient is a directional change in the intensity or Color in an image. Image gradients can be used to remove information from images. Gradient images are created from the original image (generally by convolving with a filter, one of the simplest being the Sobel filter) for this purpose. Each pixel of a gradient image calculate the change in intensity of that same point in the original image, in a given direction. As the average gradient value is large then blurring is low.

As Edge intensity large then blurring in image is low. When we are calculating edge intensity as the value is large then image will more smooth and blurriness of image is removed.

Shannon entropy used to measure information quantity Entropy is a statistical measure of randomness that can be used to characterize the texture of the input image.

| Sr.no. | Images | Parameters | | |
|--------|-------------|------------------|----------------|-----------------|
| | | Average gradient | Edge intensity | Shannon entropy |
| 1. | Nature.jpg | 6.2929 | 61.4792 | 7.5968 |
| 2. | Desert.jpg | 4.9648 | 47.2071 | 0.0481 |
| 3. | Nature1.jpg | 14.2604 | 138.56 | 7.5803 |

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VII. EXPERIMENTAL RESULT

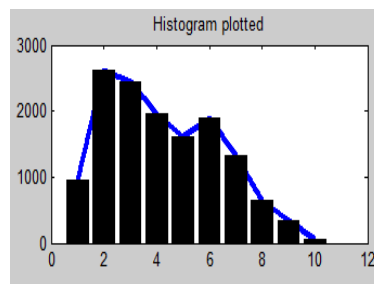


Fig.4. Result

BDQM is a quality measure means larger the value of BDQM then better the quality of depth map. As the compression ratio increases then histogram around depth transition becomes flattens.

VIII. CONCLUSION AND FUTURE WORK

The proposed algorithm estimates depth quality by measuring the blurriness of the compression sensitive regions of the depth image using a histogram based approach. Higher compression makes the histogram flatter. BDQM is used to predict quality of depth image. The experimental results show that BDQM exhibits high prediction accuracy when compared to full reference PSNR metric.

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