Title: MCL-3D Database

1. Overview

This database was built upon the 2D-image-plus-depth source for stereoscopic image quality assessment.

Stereoscopic image/video contents become more popular nowadays. Since the multi-view image format is complex for visual communication, the 2D-image-plus-depth format is proposed as an alternative, where a texture image and its associated depth image are recorded at a view point simultaneously. For stereoscopic display, the depth image-based rendering (DIBR) technique is applied to the texture and depth images to generate the proper left- and right-views.

Here, we attempt to address the visual quality assessment problem using the 2D-image-plus-depth source. With the DIBR technology, the stereoscopic images rendered and displayed on the 3D display rely on the quality of texture images, depth maps and the rendering technology. Since discomfort caused by watching stereoscopic images may go beyond annoying and lead to psychological dizziness, we cannot over-emphasize the importance of the stereoscopic image/video assessment problem.

We show the processing flow of a stereoscopic visual communication system with the DIBR technology in Fig.1. At the encoder end, the texture and depth images captured at one viewpoint (or multiple viewpoints) are compressed and transmitted separately. At the decoder end, texture and depth maps are decoded and a pair of stereoscopic images can be rendered. In this work, we follow a similar process to build a stereoscopic image quality assessment database and consider a wide range of distortion types occurring in video capturing, compression, transmission and rendering. The resulting database is called MCL-3D.

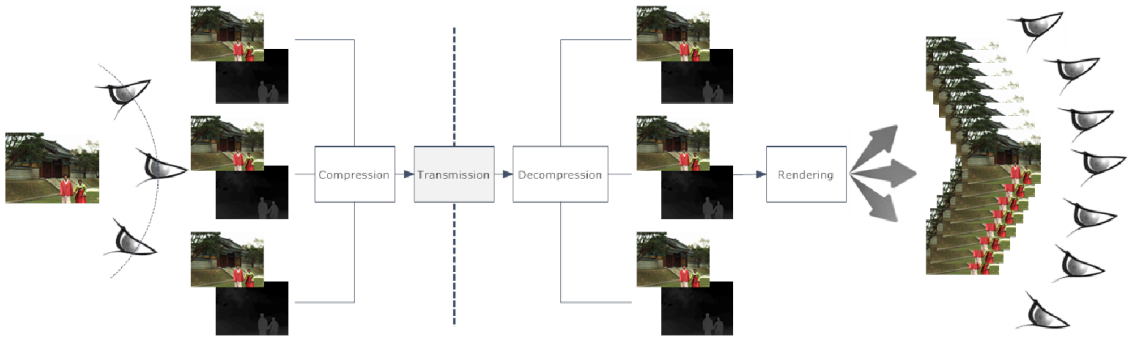

Figure. 1. The processing flow of a stereoscopic visual communication system with the DIBR technology

2. Description

9 image-plus-depth sources are first selected in MCL-3D Database, as shown in Figure.2. The distortion types applied to either the texture image or the depth image before stereoscopic image rendering include: Gaussian blur, additive white noise, down-sampling blur, JPEG and JPEG-2000 (JP2K) compression and transmission error. Furthermore, we consider the artifact caused by imperfect rendering. The MCL-3D database contains 693 stereoscopic image pairs, where 1/3 of them are of resolution 1024x728 and 2/3 are of resolution 1920x1080. To be user friendly, the pair-wise comparison was adopted in the subjective test and the Mean Opinion Score (MOS) was computed accordingly. Study on user experience in this perceptual quality assessment process was conducted. Finally, we evaluate the performance of several 2D and 3D image quality metrics applied to MCL-3D.

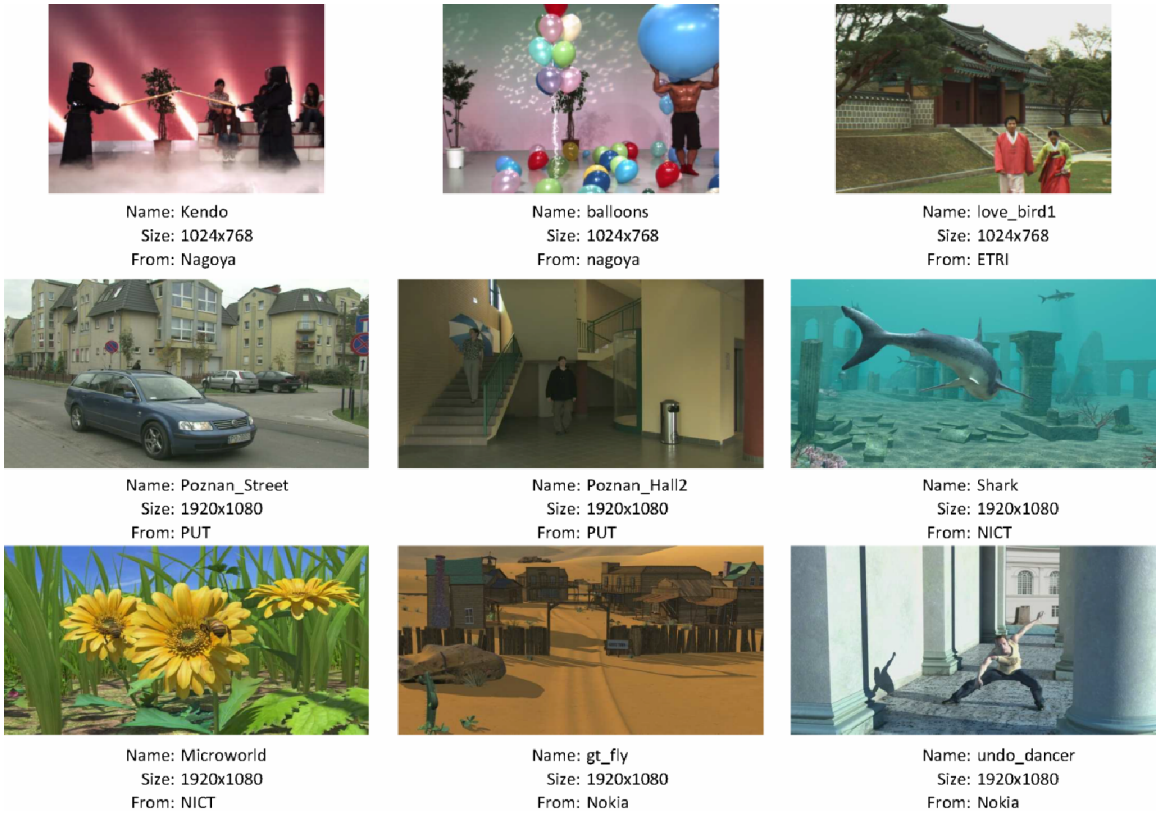

Figure. 2. Reference images in MCL-3D database

The summary of MCL-3D database could be found in Figure.3, the detailed distortion types and corresponding levels could be found in Figure.4.

Main Characters	MCL-3D database
Scenes	9
Image Resolution	6 with 1920x1080
	3 with 1024x768
Distortion Types	Gaussian Blur,
	Downsampling Blur,
	Additive White Noise
	JPEG Compression,
	JP2K Compression,
	Transmission Error,
	Rendering algotirhm
Distortion Levels	4
Total Num of Image Pairs	693
Subjective test method	Pair-wise comparison
No. of Assessors	270
Scale of MOS	0..18

Figure. 3. Summary of MCL-3D database

DIBR Algorithm	Texture	Depth	Levels
VSRS3.5/ VSRS3.0	Gaussian Blur	No Distortion	4
	Sampling Blur		4
	JPEG		4
	JPEG 2000		4
	Additive White Noise		4
	Transmission Loss		4
	No Distortion	Gaussian Blur	4
		Sampling Blur	4
		JPEG	4
		JPEG 2000	4
		Additive White Noise	4
		Transmission Loss	4
	Gaussian Blur	Gaussian Blur	4
	Sampling Blur	Sampling Blur	4
	JPEG	JPEG	4
	JPEG 2000	JPEG 2000	4
	Additive White Noise	Additive White Noise	4
	Transmission Loss	Transmission Loss	4
DIBR without Hole-Filling	No Distortion	No distortion	1
DIBR with horizontal inpainting			1
DIBR with depth map smoothing			1
DIBR with Hierarchical Hole-Filling[5]			1
Total			**76**

Figure. 4. Detailed distortion types and corresponding levels

3. Download

All the reference texture images with depth map, the distorted texture image with depth map, and the finally rendered image pairs could be downloaded with this link:

http://viola.usc.edu/coming_soon.htlm

If you are using this database, please kindly reference to this paper.

> Rui Song, Hyunsuk Ko, C. C. Jay Kuo. MCL-3D: a database for stereoscopic image quality assessment using 2D-image-plus-depth source. Journal of Visual Communication and Image Representation, xxx, xx(xx).

Before you use the database, please make sure that you have read this paper, and know the structure for image generation in this database.

If you are comparing your results with C4 algorithm, please reference to this paper:

> Carnec M, Le Callet P, Barba D. An image quality assessment method based on perception of structural information. In: IEEE International Conference on Image Processing; vol. 3. Barcelona, Spain: Institute of Electrical and Electronics Engineers Computer Society; 2003, p. 185–8.

If you are working on rendering algorithms, and comparing the results with the algorithms used in this database, please reference to:

> Solh M, AlRegib G. Hierarchical Hole-Filling(HHF): Depth image based rendering without depth map filtering for 3D-TV. In: 2010 IEEE Inter- national Workshop on Multimedia Signal Processing, MMSP2010. Saint Malo, France: IEEE Computer Society, 445 Hoes Lane - P.O.Box 1331, Piscataway, NJ 08855-1331, United States; 2010, p. 87–92.

4. Copyright Notice