QoE向上のための映像コンテンツ提示方法に関する研究

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1. Proposed method and Its quality measure

In this research, we use stereoscopic techonology for 3D content presentation. Although the technologies required for 3D image are emerging rapidly, the effect of these technologies as well as image compression on the perceptual quality of 3D viewing has not been thoroughly studied. However perceptual 3D image quality is an important evaluation criteria to assess the performance of 3D imaging systems. Consequently, perceived quality is a great important issue to assess the performance of all 3D imaging applications. Perceived distortion and depth of any stereoscopic images are strongly dependent on the local features, such as edge, flat and texture. Therefore, we propose an no-reference (NR) perceptual quality assessment model for JPEG coded stereoscopic images based on segmented local features of artifacts and disparity. The local features information of stereoscopic pair images such as edge, flat and texture areas and also the blockiness and zero crossing rate within the block of the images are evaluated for artifacts and disparity in this method. Block diagram of the proposed model is shown in Figure 1(a).

2. Results

In order to verify the performance of our proposed model, we conduct subjective experiments on our stereo images database (Mean Opinion Score (MOS) scale, 1-5, see Subjective test conditions and parameters in Table1) and divide the database into two parts for training and testing. The training data set consists of five randomly selected stereo images (from the total ten) and all of their different combinations of symmetric/asymmetric coded stereo images. The testing data set consists of the other five stereo images and their all symmetric/asymmetric coded versions, and also there is no overlapping between training and testing. The model' s parameters and weighting factors are obtained by the Particle Swarm Optimization (PSO) algorithm with all of our training images. In order to provide quantitative measures on the performance of our proposed NR model, we follow the standard performance evaluation procedures employed in the video quality experts group (VQEG) FR-TV Phase II test, where mainly Pearson linear correlation coefficient (CC), Average absolute prediction error (AAE), Outlier Ratio (OR), and Root mean square prediction error (RMSE) between objective (MOSp) and subjective (MOS) scores were used for evaluation. The evaluation results are summarized in Table 2. It has been observed from Table 2 that the proposed model performances for every one of the evaluation metrics are sufficient. It has also been observed from Table 2 and that our proposed model provides sufficient prediction accuracy (higher CC), and sufficient prediction consistency (lower OR). The MOS versus MOS prediction (MOSp) of our proposed model for training and testing data sets is shown in Figure 1(b). The symbols * and + respectively indicate MOSp points for data sets of training and testing.

3. Conclusions

We have proposed an NR quality assessment model for JPEG coded stereoscopic images based on segmentation based artifacts and disparity measures. The assessment was performed on different

combinations of symmetric/ asymmetric coded stereo images of different content. This model can be used for stereoscopic video quality assessment with the incorporation of the temporal dependency between adjacent images of the video. The results show that the model performs quite well over wide range of stereo image content and distortion levels. In order to improve the proposed model, future research need to consider more efficient disparity estimation with incorporation of all three color components.

Table 1: Subjective test conditions and parameters

Method	SS (Adjectival categorical judgment)
Evaluation scales	5 Grades (Adjective scales)
Reference stereo images	10, 24-bits/pixel RGB color (640×480)
Coder	JPEG
Coding parameters	7 (QS: 10, 15, 27, 37, 55, 75 and reference)
Subjects	24 (Non expert, students)
Display	10-inch, 3D Autostereoscopic (640×480)
Viewing distance	70 cm
Room illumination	Dark

∗ Single Stimulus (SS), Quality scale (QS)

Table 2: Performance evaluation on our stereoscopic images database (MOS scale, 1-5)

Stereo pairs	*Training*			
	CC	AAE	OR	RMSE
245	0.966	0.292	0.069	0.367
	Testing			
245	0.935	0.350	0.065	0.4211

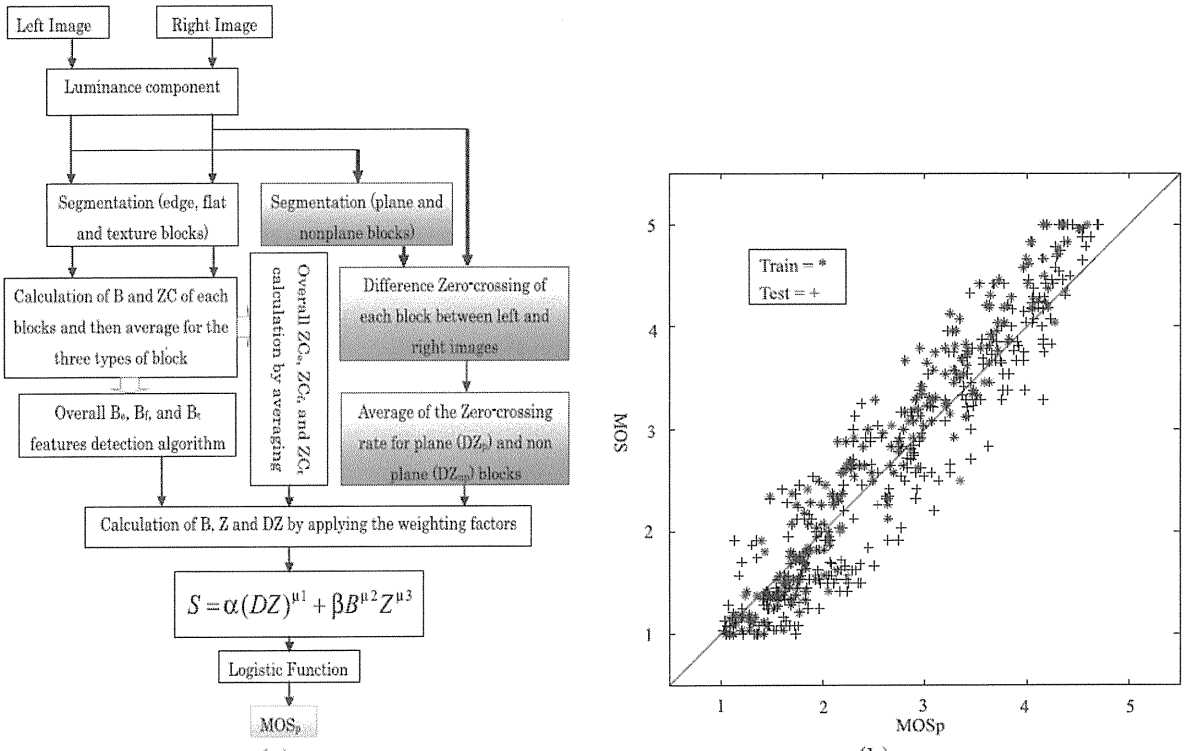

Figure 1: (a) Proposed model (b) Model's performance