Special Issue on Advances in Statistical Methods-based Visual Quality Assessment

Visual information, represented by various types of images and videos, is omnipresent, substantial, indispensable, diverse and complicated in our daily life. Regardless of being raw or processed, visual information is ultimately received and interpreted by our human beings. To assess the quality of images and videos, some traditional measures like the peak signal to noise ratio (PSNR) have been widely used. However, the inconsistency between these traditional measures and the human vision system (HVS) has hindered the development of visual information processing. Being aware of this problem, a large number of practitioners from the computer vision and image processing communities have focused on developing new metrics of visual quality assessment (VQA), which are designed perceptually more consistent to the HVS. In early research, they focused on imitating the HVS with the help of psychophysics. Then the trend in research became to treat the HVS as a black box and just imitate its functions. More recently, the researchers start to exploit the links between statistics of the visual information and the perception of HVS, which were shaped and developed throughout the evolution of the HVS. In fact, the use of statistics, including the local and global summary statistics, statistical models and statistical machine learning techniques, becomes more and more popular in each constituent module of VQA. This special issue collected eight papers reporting the state-of-the-art researches in the theory, algorithm, modeling, system and database of statistical methods-based VQA and demonstrating the latest efforts of relevant researchers.

- **Cao *et al.***

Content-oriented image quality assessment with multi-label SVM classifier

In the first paper, the authors study the influence of image content type on image quality assessment (IQA). To this end, an IQA database based on the classification of image content is built. It contains four content types, including landscape, human face, handcrafted scene and hybrid scene. In total, 80 reference images with 20 images for each type of content are involved, and 1600 distorted

images with mean opinion scores are generated by using five types and four levels of distortion. Furthermore, to classify these images, especially for the hybrid case, a support vector machine (SVM) based multi-label classification is presented.

- **Aldahdooh *et al.***

Improving relevant subjective testing for validation: Comparing machine learning algorithms for finding similarities in VQA datasets using objective measures

The second paper presents an attempt to reduce the number of subjective tests by selecting a sub-set with minimum size which yields the same conclusions of the larger set. The authors combine information coming from different types of objective quality metrics with machine learning algorithms to perform the actual selection, therefore reducing the required subjective assessment effort while preserving the variety of content and conditions needed to ensure the validity of the conclusions.

- **Wang *et al.***

An effective general-purpose NR-IQA model using natural scene statistics (NSS) of the luminance relative order

In the third paper, a general-purpose NR-IQA model is proposed by using natural scene statistics (NSS) of the luminance relative order, based on the observation that the variation of the marginal distribution of the relative order coefficients effectively reflects the degree of warping caused by different types of image distortions. The model firstly extracts 32 NSS features of the luminance relative order, which are obtained from the log histograms of horizontal, vertical, main-diagonal and secondary-diagonal derivatives, along with kurtosis, variance, differential entropy and entropy at two scales. Then a mapping is learned to predict the quality score using a support vector regression.

- **Zhang *et al.***

Linking visual saliency deviation to image quality degradation: A saliency deviation-based image quality index

The fourth paper focuses on the issues regarding optimal use of visual saliency in image quality metrics. The authors explore an approach to directly assessing image quality by measuring the visual saliency deviation triggered by visual

artifacts. They first analyse the relationship between visual saliency deviation and image quality degradation on the basis of a large-scale eye-tracking dataset. Then, a saliency deviation-based image quality index is devised.

- **Heydari *et al.***

A low complexity wavelet-based blind image quality evaluator

In the fifth paper, the authors propose a low complexity wavelet based image quality evaluator. The interaction of fine and coarse details of the image, which is extracted by the Haar wavelet, is analyzed. Moreover, the joint statistics of two normalized high frequency subbands which indicate coarse and fine structures is utilized for extracting features. After feature extraction, support vector regression is adopted to provide a quality score.

- **Mansouri *et al.***

SSVD: Structural SVD-based image quality assessment

In the sixth paper, the authors analyze the efficiency of singular value decomposition (SVD) in extracting the structural information of the viewing scene. Furthermore, an SVD based IQA method is presented in which the structural information of the distorted image is evaluated based on its reflection on the original singular vector matrices.

- **Akamine *et al.***

A framework for computationally efficient video quality assessment

The seventh paper, by Akamine *et al.*, focuses on the computational cost in video quality assessment. Specifically, the authors analyze the effects of resolution reduction on the performance of VQA methods. Based on this analysis, they propose a framework that decreases the overall processing time of VQA methods, without decreasing significantly the accuracy.

- **Lu *et al.***

Gated CNN for visual quality assessment based on color perception

In the eighth paper, Lu *et al.* propose to take advantage of the intrinsic structural properties from conditional random field (CRF) to model the color harmony of images. In the CRF framework, the authors present a novel method that uses gated convolutional neural networks (CNNs) to calculate the probabilities of being of high aesthetic quality for small patches and compute the harmonious compatibilities between them, which can be considered as the associated and

interactive potentials of CRF. Semantic tag of each image is also employed in this work to improve the proposed harmony model's capability.

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