Abstract

With this thesis, we developed saliency enabled compression, and feature based quality assessment method for screen and camera content images. Under low bit rate requirements, JPEG Baseline causes degradation in the perceptual quality at regions with high frequency and thus leads to compression artifacts in the image. The aim of the proposed compression method is to develop a region of interest dependent quantization method in JPEG framework with small computational overhead. Thus, in this thesis we present a framework for camera-content images (CCIs) and another for screen-content images (SCIs).

For CCIs, we have devised a multi-level saliency enabled framework. The developed method judiciously quantizes DCT coefficients belonging to salient and non-salient regions of the image. The image is first divided into non-overlapping blocks of size 8×8. 2D-DCT coefficients of each of the blocks are obtained and the same are quantized adaptively based on their ranks. A block may belong to more than one regions and hence, the same are ranked based on their membership to the various regions. The overhead for the rank information of the blocks is minimized by applying delta-encoding. The results of the proposed method are analyzed in terms of objective quality parameters and visual perception and it was observed that the blocking artifacts in our method are significantly lower as compared to JPEG. In case of SCIs, it was found that the textual regions were legible even after high compression ratio which was a big improvement over the traditional compression algorithms. Moreover, the efficiency of the developed method is demonstrated using results of recently published similar methods. Interestingly, it was observed that the our method performed superior in terms of quality of the reconstructed image.

For SCIs, a separate framework is presented with two-level saliency. The aim of this method is to identify and preserve the textual regions in the SCIs as salient regions. The salient regions in the image are identified using the DCT coefficients of the image as the energy distribution of the text blocks among some DCT coefficients are significantly higher compared to non-text blocks. The developed a method that judiciously quantizes the DCT coefficients which belongs to salient and non-salient regions of the image. The results of our compression method are analyzed in terms of objective quality parameters and visual perception. It was observed that the visual quality of the reconstructed image using our method are significantly better compared to other state-of-the-art methods.

In order to accurately identify the performance of the proposed compression methods, two reduced-reference Image-Quality-Assessment (RR-IQA) methods for camera and screen content images are also designed in the thesis. These methods are based on the fact that Human Visual System (HVS) is more sensitive towards change in features than intensity or structure. An affine transform invariant feature extraction process is developed with low descriptor size. Features and their descriptors from the reference and distorted images are then extracted from the reference and distorted images. In order to find the preserved features in the distorted image, a feature matching process with a reduced number of distance calculations is presented, namely reduced-distance method. To reflect the importance of the matched features and their distance, the inner product between normalized scale and distance vector is obtained. Extensive comparisons are performed on available benchmark databases namely LIVE, TID-2013, SIQAD and QACS, with state-of-the-art reduced-reference, full-reference IQA techniques to demonstrate the consistency, accuracy, and robustness of our method. The subjective evaluation of mean opinion score shows that the proposed method outperforms the current state-of-the-art IQA techniques.

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