

Peer Review of Tradeoff within Image Compression and Quality Estimation

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Abstract— Image quality assessment (IQA) evaluates the quality of an image by computing the difference between the reference and reconstructed image in case of lossy or distorted image in case of lossless compression. Generally, IQA methods are classified into full-reference, reduced-reference, and no reference but our interest lies within case study of image compression towards quality assessment and to evaluate the trade-off of compression and image quality assessment, and it has been concluded that rate-distortion analysis should only be utilized for compression, not for quality estimation.

Keywords— IQM, NR-IQA, HVS, SSIM, MSE.

I. INTRODUCTION

In a communication field, data compression plays a vital role towards designing algorithms in order to reduce size of data, overall compression is performed based on smaller strings of bits i.e., 0s & 1s towards eliminating redundant characters, Data compression is performed whenever there is a need to reduce the size of data.

II. DATA COMPRESSION

In order to understand this technique, basically we need to understand the difference between information and data. In general, raw data holds disorganized cluster of values, mean numbers, text, symbols, etc. On the other hand, data required to save the information will not only reduce size but perhaps the quality too, but the information will remain intact. Only after considerable loss in information, we can lose the data. This type of compression eliminates redundant of data instead of reducing size of any data through encoding or using any kind of formula and is not feasible even though it is Essential, and data can be restored to its original state without loss of any Information, but it is less effective for larger data.

III. IMAGE COMPRESSION AND QUALITY ESTIMATION

A. Losses and Lossy Compression

It may be Lossless or Lossy compression which can be preferred for medical imaging, clip art or etc. Lossy compression methods are compressed at low bit rates towards introducing artifacts this kind of methods are suitable for natural images where imperceptible loss of fidelity is acceptable to achieve a considerable reduction in bit rate.

Lossy compression (Reconstructed Image) that creates negligible changes and it's called visually lossless. Even in Transform coding, Discrete Cosine Transform (DCT) is most widely used for lossy compression.

B. Image quality assessment

Image quality assessment (IQA) evaluates the quality of an image by computing the difference between the reference and reconstructed images. In our research, we did survey on Image quality assessment based on Human Visual Perception (HVS).

C. Human Visual Perception

In general terms, the trade-off between complexity and dimensionality, the computational visualization become insufficient and inefficient.

But through the visual system, i.e., human perception has a key role in the visualization domain as it supports the cognitive associated process. Thus, in the development of computational tools for complex and high dimensional data visualization becomes fundamental to consider the behaviour of the visual human perception.

An efficient, general-purpose, no-reference image quality assessment (NR-IQA) algorithm based on a natural scene statistics model of discrete cosine transform (DCT) coefficients was introduced in below mentioned paper. This algorithm is computationally appealing, given the availability of platforms optimized for DCT computation. They propose a generalized parametric model of the extracted DCT coefficients. The parameters of the model utilized to predict image quality scores. The resulting algorithm requires minimal training and adopts a simple proposed model for score prediction [1].

D. Rate distortion algorithm for image compression

[2] Proposed SSIM quality metric for evaluating Rate distortion of reconstructed image as shown in below mentioned in below reference image.

Fig 1 illustrates plotting within rate distortion function(R(D)) and distortion.

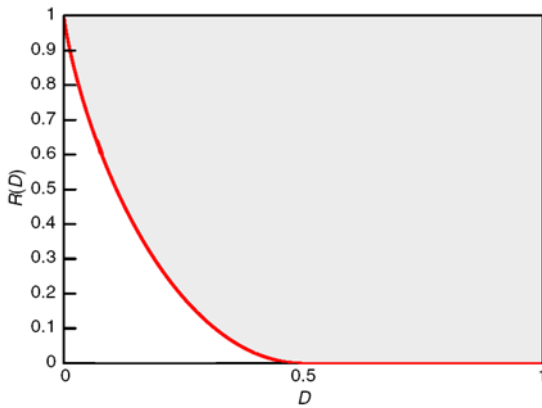


Fig. 1 illustration of Rate of distortion and distortion itself

Table 1: Properties vs Charecterstics of Inbuilt Metrics

Quality Metric	Informa
MSE / Data Transmission	Binary
SNR PSNR/ Signal Processing	Decimal
SSIM / Image Processing	Pixel based
MSSSIM / Image processing	Frame size
PEVQ/ Video processing	Frame rate
MOS / Natural Processing	HVS

IV. HYPOTHETICAL ANALYSIS

My research lies within Evolution of Image compression technique with minimal loss of data within reconstructed image towards evaluating rate distortion of reconstructed image while considering Human Visualization Characteristics in real time situations.

Subjective quality assessment plays vital role in evaluating Lossy data within data compression by comparing reference image with compressed or reconstructed image within natural assessment. Even though it is costlier and time-consuming method, subjective scores considered as true values and are obtained by evaluation of quality with involvement of human observers by grading them according to his/her perception. Subject will grade the visual quality of reconstructed image based on reference by in the form of Mean Opinion Score. This experiment should be conducted under specified requirement.

V. PROPOSED INBUILT MODEL

Objective quality Metric plays vital role in evaluating IQM model by training the model with data extracted out of reconstructed images and [1] et al proposed a No

Reference Image Quality Assessment, which is based on inbuilt DCT coefficient-based quality metric.

[1] et al Proposed that his metric produced better performance than the conventional Image Quality Assessment, where the Pearson CC is used for performance comparison. Experimental results with two different distortion types show that the proposed model gives better performance than the conventional quality metrics. Also mentioned that his method requires a small amount of data (84 bytes), thus it can be used as an effective video quality

Table 2: Referenced Statistical Analysis

Quality Metric	SSIM	MSE
Pearson cc	0.9171	0.8873

VI. CONCLUSION

It has been concluded that rate-distortion analysis should only be utilized for compression, not for quality estimation. Since as in results in Table 2 shows that correlation coefficient of mean square error is very high than expected in the research paper [1], Moreover mean square error should not be validated in terms of Correlation coefficient.

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Amitesh Kumar Singam received the M.Sc. degrees from Blekinge institute of Technology, Karlskrona, Sweden in the year 2012. From the year 2013-2022, he worked in govt based food corporation Pvt Ltd company and his expertise skills are accounting and Billing. His current research interests lie within investigating and analysing the issue based on decisions making without losing data integrity within any information and he is a member of IEEE since 2022.