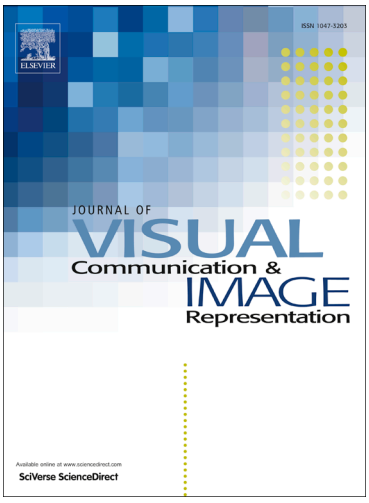

Anisotropic blind image quality assessment: survey and analysis with current methods

Salvador Gabarda, Gabriel Cristóbal, Navdeep Goel

PII: S1047-3203(18)30040-3
DOI: https://doi.org/10.1016/j.jvcir.2018.02.008
Reference: YJVCI 2139

To appear in: *J. Vis. Commun. Image R.*

Received Date: 10 March 2017
Accepted Date: 13 February 2018

Please cite this article as: S. Gabarda, G. Cristóbal, N. Goel, Anisotropic blind image quality assessment: survey and analysis with current methods, *J. Vis. Commun. Image R.* (2018), doi: https://doi.org/10.1016/j.jvcir.2018.02.008

Anisotropic blind image quality assessment: survey and analysis with current methods

Salvador Gabarda[a], Gabriel Cristóbal[a], Navdeep Goel[b]

[a]*Instituto de Óptica Daza de Valdés (CSIC), Serrano 121, 28006 Madrid, Spain*
[b]*ECE Section, Yadavindra College of Engineering, Talwandi Sabo-151302, Punjab, India*

Abstract

The *Anisotropic Quality Index* (AQI) was previously introduced by the authors as a non-distortion-specific, no-reference image quality measure. AQI is based on measuring the variance of the expected entropy of a given image over a predefined set of orientations. In this paper, a statistical evaluation of AQI is provided using standard benchmarking parameters showing good match with observer's response. Some AQI extensions are proposed for tackling ill-posed noise types that provide fair or poor performance. A comparison with other no-reference methods has been included showing good competitiveness with many of them.

Keywords: Image Quality Assessment, Pseudo-Wigner Distribution, Rényi entropy, anisotropy, correlation, Mean Opinion Scores

1. Introduction

No-reference image quality assessment (NR-IQA) methods provide quality estimates without any prior knowledge about the reference image and the quality evaluation is only based on the test images. Most of the conventional NR-IQA algorithms can be classified into three different categories: i) Distortion-specific (Single/Multiple distortion), ii) Natural scene statistics (NSS), and iii) Training/learning methods. For recent surveys of no-reference image quality assessment algorithms, the readers may refer to [1]. This paper is focused on assessing the performance of the distortion-specific (multiple distortion mode), no-reference index called *Anisotropic Quality Index* (AQI) introduced by he authors in [2]. The major contributions of this paper are twofold. First, the AQI index has been evaluated using standard benchmarking parameters not previously considered in [2]. Secondly, AQI modifications are proposed to extend the suitability of the index to more noise types.

Interestingly, the AQI measure has been used in different real-world scenarios. Sidiropoulos and Muller [3] used AQI for the quality assessment of planetary degraded images and Bos and Roggermann [4] for speckle image reconstruction. In [5], AQI was applied in different biometric applications (face, fingerprints and hand veins). AQI was used in different surveillance scenarios under the presence of atmospheric distortions [6] and for biomedical image classification [7].

In a recent work, Maddheshiya [8] pointed out the need to develop no-reference quality metrics such as AQI that can overcome the limitation of other measures that are distortion specific. In addition to that, the AQI performance was validated using the LIVE database. LIVE is a standard image database that is frequently used as a benchmark because the distorted images have been evaluated by human observers. In such work, they concluded that AQI is highly correlated with Structural Similarity Index Measure (SSIM) [9] and therefore it will be suitable for no reference quality assessment and among the five distortion types included in LIVE it provides a more accurate and stable performance for white noise and Gaussian blur distortions. This known AQI limitations led us to introduce few extensions for improving the index performance.

This paper is structured as follows. Section 2 describes the AQI comparison against *Differential Mean Opinion Scores* (DMOS) for different distortion types of the LIVE (Laboratory for Image & Video Engineering - University of Texas at Austin) database. Section 3 presents a statistical evaluation of the AQI performance vs *Mean Opinion Scores* (MOS), for the set of noise types in the *Tampere Image Database 2013* (TID2013) introducing some AQI modifications to fit the measure with ill-posed types. A comparison of scoring tests with