

DESIGNING A COCKPIT FOR IMAGE QUALITY EVALUATION

Alessandro Rizzi, Michela Lecca, Alice Plutino and Simone Liberini

ABSTRACT

Image Quality (IQ) as assessed by humans is a concept hard to be defined, since it relies on many different features, including both low level and high level visual characteristics. Image luminance, contrast, color distribution, smoothness, presence of noise or of geometric distortions are some examples of low level cues usually contributing to image quality. Aesthetic canons and trends, displacement of the objects in the scene, significance and message of the imaged visual content are instances of the high level (i.e. semantic) concepts that may be involved in image quality assessment. Despite subjective evaluation of IQ being very popular in many applications (e.g. image restoration, colorization and noise removal), it may be scarcely reliable due to subjectivity issues and biases. Therefore, an objective evaluation, i.e. an image quality assessment based on visual features extracted from the image and mathematically modelled, is highly desirable, since it guarantees the repeatability of the results and it enables the automation of image quality measurements. Here the crucial point lies in the detection of visual elements salient for IQ.

Many objective, numerical measures have been proposed in the literature. They differ from one another in the features considered to be relevant to IQ, and in the presence of a reference image, an image of “perfect” quality with which to compare the image to be evaluated. Objective measures are thus broadly classified as full-reference, reduced-reference or no-reference, according to the availability of reference information.

Due to the complexity of the IQ assessment process, a single measure may be not robust and accurate enough to capture and numerically summarize all the aspects concurring to IQ. Therefore, we propose to employ multiple objective IQ measures assembled in a *cockpit* of objective IQ measures. This cockpit should be designed to offer not only an extensive analysis and overview of features relevant to IQ, but also as a tool to automate the selection of machine vision algorithms devoted to image enhancement.

In this work we describe a preliminary version of a cockpit, and we employ it to assess a set of images of the same scene acquired under different conditions, with different devices or even processed by computer algorithms.

Biographies

Alessandro Rizzi

Alessandro Rizzi is full professor, Department of Computer Science, University of Milano. He has been one of the founders of the Italian Color Group, secretary of CIE Division 8, an IS&T Fellow and a past Vice-President. He is topical editor for Applied Color Science of Journal of Optical Society of America A and associate editor of Journal of Electronic Imaging. In 2015, he received the Davies medal from the Royal Photographic Society.

Michela Lecca

Michela Lecca is a researcher at the Research Unit Technologies of Vision of Fondazione Bruno Kessler of Trento (IT), where she works after her graduation in Mathematics from the Università degli Studi di Trento (IT). Her research interests include automatic object recognition, image retrieval, semantic image labelling, color constancy, color correction, low-level and hardware-oriented image processing. She is a member of the International Association for Pattern Recognition - Associazione Italiana per la ricerca in Computer Vision, Pattern recognition e machine Learning IAPR - CVPL (ex GIRPR) and of the Gruppo Italiano del Colore - Associazione Italiana Colore (GdC-AIC).

Link: <http://tev.fbk.eu/people/profile/lecca>

Alice Plutino

Alice Plutino is a PhD student in Computer Science at the University of Milan. She received her Bachelor and her Master degree in Conservation and Diagnostic of Cultural Heritage. Her current field of research is colorimetry for cultural heritage and digital movie restoration. She's also interested in image quality metrics, digital color and algorithms for image enhancement.

Simone Liberini

Simone Liberini received his Bachelor and Master degrees in Biomedical Engineering in Politecnico di Milano. He briefly worked as a research fellow at Istituto di Bioimmagini e Fisiologia Molecolare, Milano, where he contributed to developing a quantitative image-based frame of assessment of parotid glands shrinkage in head-and-neck cancer patients. He is currently fellow frequenter at Università degli Studi di Milano, and is investigating the effects of glare on luminance and chromaticity measurements.