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Advanced Visual Quality Indicators

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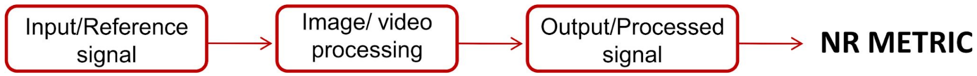
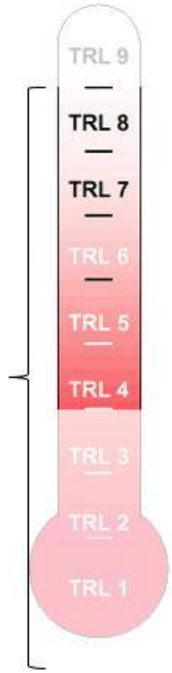
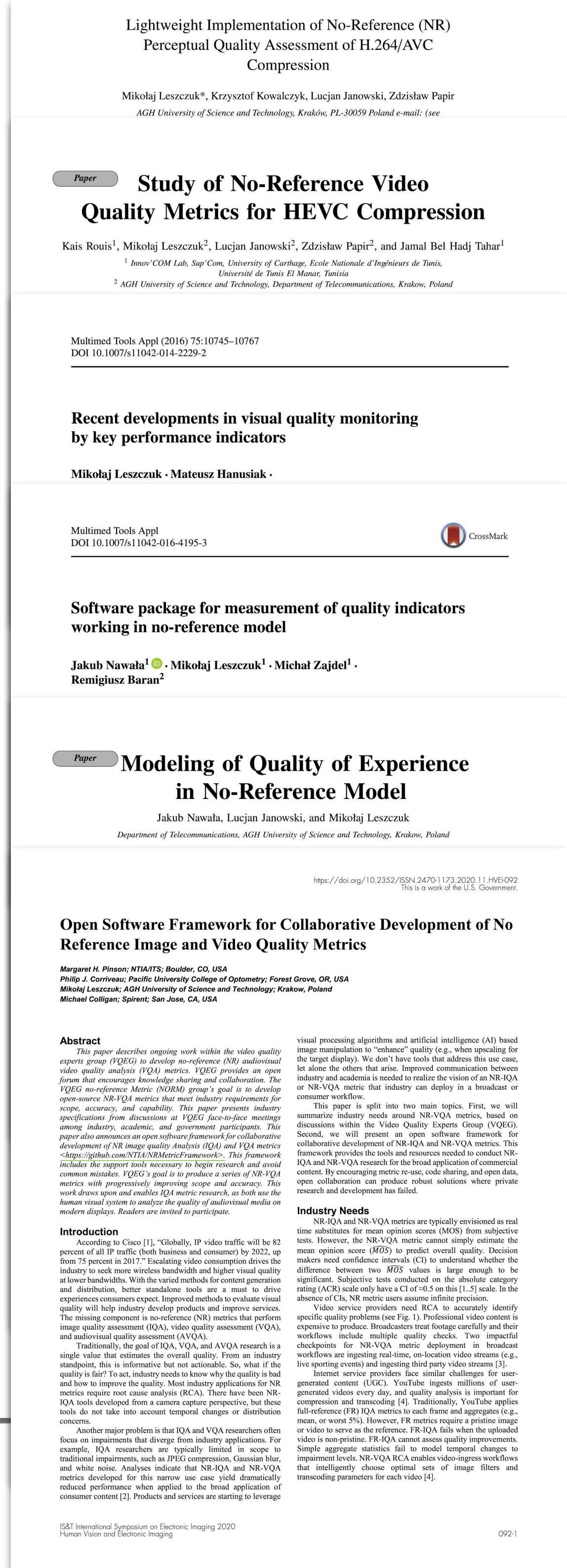
Potential (Need)



- *Increasing number of resolutions*
- *Difficulty reaching user*





Lightweight Implementation of No-Reference (NR) Perceptual Quality Assessment of H.264/AVC Compression

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Paper

Study of No-Reference Video Quality Metrics for HEVC Compression

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Recent developments in visual quality monitoring by key performance indicators

Mikołaj Leszczuk · Mateusz Hanusiak ·

Multimed Tools Appl
DOI 10.1007/s11042-016-4195-3

CrossMark

Software package for measurement of quality indicators working in no-reference model

Jakub Nawała[1] · Mikołaj Leszczuk[1] · Michał Zajdel[1] · Remigiusz Baran[2]

Paper

Modeling of Quality of Experience in No-Reference Model

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Open Software Framework for Collaborative Development of No Reference Image and Video Quality Metrics

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Abstract

This paper describes ongoing work within the video quality experts group (VQEG) to develop no-reference (NR) audiovisual video quality analysis (VQA) metrics. VQEG provides an open forum that encourages knowledge sharing and collaboration. The VQEG no-reference Metric (NORM) group's goal is to develop open-source NR-VQA metrics that meet industry requirements for scope, accuracy, and capability. This paper presents industry specifications from discussions at VQEG face-to-face meetings among industry, academic, and government participants. This paper also announces an open software framework for collaborative development of NR image quality Analysis (IQA) and VQA metrics <https://github.com/NTIA/NRMetricFramework>. This framework includes the support tools necessary to begin research and avoid common mistakes. VQEG's goal is to produce a series of NR-VQA metrics with progressively improving scope and accuracy. This work draws upon and enables IQA metric research, as both use the human visual system to analyze the quality of audiovisual media on modern displays. Readers are invited to participate.

Introduction

According to Cisco [1], "Globally, IP video traffic will be 82 percent of all IP traffic (both business and consumer) by 2022, up from 75 percent in 2017." Escalating video consumption drives the industry to seek more wireless bandwidth and higher visual quality at lower bandwidths. With the varied methods for content generation and distribution, better standalone tools are a must to drive experiences consumers expect. Improved methods to evaluate visual quality will help industry develop products and improve services. The missing component is no-reference (NR) metrics that perform image quality assessment (IQA), video quality assessment (VQA), and audiovisual quality assessment (AVQA).

Traditionally, the goal of IQA, VQA, and AVQA research is a single value that estimates the overall quality. From an industry standpoint, this is informative but not actionable. So, what if the quality is fair? To act, industry needs to know why the quality is bad and how to improve the quality. Most industry applications for NR metrics require root cause analysis (RCA). There have been NR-IQA tools developed from a camera capture perspective, but these tools do not take into account temporal changes or distribution concerns.

Another major problem is that IQA and VQA researchers often focus on impairments that diverge from industry applications. For example, IQA researchers are typically limited in scope to traditional impairments, such as JPEG compression, Gaussian blur, and white noise. Analyses indicate that NR-IQA and NR-VQA metrics developed for this narrow use case yield dramatically reduced performance when applied to the broad application of consumer content [2]. Products and services are starting to leverage visual processing algorithms and artificial intelligence (AI) based image manipulation to "enhance" quality (e.g., when upscaling for the target display). We don't have tools that address this use case, let alone the others that arise. Improved communication between industry and academia is needed to realize the vision of an NR-IQA or NR-VQA metric that industry can deploy in a broadcast or consumer workflow.

This paper is split into two main topics. First, we will summarize industry needs around NR-VQA metrics, based on discussions within the Video Quality Experts Group (VQEG). Second, we will present an open software framework for collaborative development of NR-IQA and NR-VQA metrics. This framework provides the tools and resources needed to conduct NR-IQA and NR-VQA research for the broad application of commercial content. By encouraging metric re-use, code sharing, and open data, open collaboration can produce robust solutions where private research and development has failed.

Industry Needs

NR-IQA and NR-VQA metrics are typically envisioned as real time substitutes for mean opinion scores (MOS) from subjective tests. However, the NR-VQA metric cannot simply estimate the mean opinion score ($\widehat{MOS}$) to predict overall quality. Decision makers need confidence intervals (CI) to understand whether the difference between two $\widehat{MOS}$ values is large enough to be significant. Subjective tests conducted on the absolute category rating (ACR) scale only have a CI of ≈0.5 on this [1..5] scale. In the absence of CIs, NR metric users assume infinite precision.

Video service providers need RCA to accurately identify specific quality problems (see Fig. 1). Professional video content is expensive to produce. Broadcasters treat footage carefully and their workflows include multiple quality checks. Two impactful checkpoints for NR-VQA metric deployment in broadcast workflows are ingesting real-time, on-location video streams (e.g., live sporting events) and ingesting third party video streams [3].

Internet service providers face similar challenges for user-generated content (UGC). YouTube ingests millions of user-generated videos every day, and quality analysis is important for compression and transcoding [4]. Traditionally, YouTube applies full-reference (FR) IQA metrics to each frame and aggregates (e.g., mean, or worst 5%). However, FR metrics require a pristine image or video to serve as the reference. FR-IQA fails when the uploaded video is non-pristine. FR-IQA cannot assess quality improvements. Simple aggregate statistics fail to model temporal changes to impairment levels. NR-VQA RCA enables video-ingress workflows that intelligently choose optimal sets of image filters and transcoding parameters for each video [4].

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Essence of Solutions to Be Created as Result of Works