NISTIR 8187

Evaluation Infrastructure for the Measurement of Content-based Video Quality and Video Analytics Performance

Haiying Guan
Daniel Zhou
Jonathon Fiscus
John Garofolo
James Horan
Information Access Division
Information Technology Laboratory

This publication is available free of charge from:
https://doi.org/10.6028/NIST.IR.8187

July 2017

U.S. Department of Commerce
Wilbur L. Ross, Jr, Secretary

National Institute of Standards and Technology
Kent Rochford, Acting NIST Director and Acting Under Secretary of Commerce for Standards and Technology

in these measurements would also be useful to drive and inform public safety best practices and standards for quality measurement.

2 LITERATURE OVERVIEW

2.1 OVERVIEW OF VIDEO QUALITY METRICS RESEARCH

The following section describes a survey of existing video quality metrics (VQM).
National Geospatial-Intelligence Agency (NGA) developed the National Imagery Interpretability Rating Scale (NIIRS) for image quality measurement and the Video-National Imagery Interpretability Rating Scale (VNIIRS) for video quality measurement. The metrics that are created are based on human assessment and human-based evaluation. These metrics are focused on interpretation, but are constrained to human perception specifically for the domain of photo reconnaissance and thus require domain-specific metadata.

National Telecommunications and Information Administration (NTIA) and International Telecommunication Union (ITU) developed Video Quality Metric (VQM) Software[1] for signal transformation and communication applications [1].

NIST researchers have performed extensive research and evaluation in the image biometric technology area (fingerprint comparison, face recognition, iris recognition) quality and video quality [2] for decades.

In academic research, video quality metrics can generally be classified as one of three categories: full-reference, reduced-reference and no-reference metrics. Full-reference metrics are used to assess comparative degradations in video that has been put through an encoding, compression, or transmission process and generally impose a precise spatial and temporal alignment of the two videos so that every pixel in every frame can be assigned its counterpart in the reference clip. Aside from the issue of spatiotemporal alignment, full-reference metrics usually do not respond well to global changes in luminance, chrominance or contrast and require a corresponding calibration. For reduced-reference metrics, the restrictions are less severe, as only the extracted features need to be aligned, but they are similar in their comparative use to full reference metrics. No-reference quality metrics are used to determine an absolute measure of quality of a single video source. As such, the focus of this effort was exclusively on no-reference metrics to determine which metrics correlated with semantic features as expressed in video analytics applications relevant to public safety needs.

2.2 NO-REFERENCE VIDEO QUALITY METRIC SURVEY

We performed an informal survey of existing no-reference video quality metrics to determine candidate algorithms for our experiments. In performing this survey, we scanned literature that we could identify on the Web and we reached out to NTIA who has a longstanding program in measuring video quality

[1] https://www.its.bldrdoc.gov/resources/video-quality-research/guides-and-tutorials/description-of-vqm-tools.aspx

This publication is available free of charge from: https://doi.org/10.6028/NIST.IR.8187