Real-time quality assessment of videos from body-worn cameras
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Project webpage: http://cis.eecs.qmul.ac.uk/projects/MBRISQUE

Introduction
• Body-worn camera videos
• Aim: to provide a frame-by-frame quality score of a video → Video quality assessment (VQA)

• Challenges
  • scene conditions change abruptly
  • continuous changing of quality
  • score to be calculated quickly
  • uncontrolled scenarios with multiple simultaneous distortions

• Related work
  • full [1], reduced [2] and mutual [3] reference
  • no reference: distortion (e.g. blur) specific [4] and non-distortion specific [5]

Proposed approach: M-BRISQUE
• No-reference and non-distortion specific VQA method with a real-time implementation
  • Michelson Contrast (MC) to account for distortions of the whole frame - global cue
  \[
  C_m = \frac{I_{\text{max}} - I_{\text{min}}}{I_{\text{max}} + I_{\text{min}}}
  \]
  • Blind/Referenceless Image Spatial QUality Evaluator (BRISQUE [5]) to account for patch-based distortions - local cues
  \[
  f(i,j) = \frac{\sum_{(i,j)} |\hat{I}(i,j) - \hat{I}(i,j)|}{\sigma(I) + 1}
  \]
  • descriptors of luminance for image patches
  • vary coherently in the presence of a distortion
  • distortion estimation [9] by fitting the histogram of \( f(i,j) \) with
  • Generalised Gaussian Distribution (GGD) defined by mean (\( \mu \)) and variance (\( \sigma^2 \))
  • Asymmetric Generalised Gaussian Distribution (AGGD) defined by mean (\( \mu \)), shape (\( \nu \)) and variances (\( \sigma_1^2, \sigma_2^2 \))

• Feature vector to describe the frames:
  \[
  \{C_m, (\alpha, \sigma_0^2), (\eta, v, \sigma_1^2, \sigma_2^2)\}_H, (\eta, v, \sigma_1^2, \sigma_2^2)\}_V, (\eta, v, \sigma_1^2, \sigma_2^2)\}_D
  \]
  • Operates in the spatial domain (no Gabor filters, Wavelets or DCT) → computationally efficient

Experimental results
• Spearman’s Rank Ordered Correlation Coefficient (SROCC) to correlate human judgement ↔ image score

Training
• M-BRISQUE score
  • Support Vector Regression (SVR)
  • Radial Basis Function (RBF) kernel
  • Computational and Subjective Image Quality (CSIQ) database [7]
  • 30 original images
  • distortions for each image:
    • JPEG and JPEG2000 compressions
    • global contrast decrements
    • additive pink Gaussian noise
    • additive white Gaussian noise
    • Gaussian blurring

  • Mean Subtracted Contrast Normalised (MSCN) coefficients \( \hat{I}(i,j) \)

  • Location
  • Standard deviation
  • Mean
  • RMS noise: \( \frac{\sum_{(i,j)} (I(i,j) - \mu)^2}{\sigma(I) + 1} \)
  • MC noise: \( \frac{\sum_{(i,j)} |I(i,j) - \mu|}{\sigma(I) + 1} \)
  • BRISQUE noise: \( \frac{\sum_{(i,j)} (I(i,j) - \mu)^2}{\sigma(I) + 1} \)

  • Features
  • Mean subtracted contrast normalized for image patches
  • luminance for image patches
  • vary coherently in the presence of a distortion

Testing
• LIVE Mobile In-Capture Video Quality Database [8]
  • 208 videos captured with 8 hand-held devices

M-BRISQUE scores w.r.t. BRISQUE

References

Watch the live demo