New Distortion/Content Dependent Quality Metric
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Motivation & Introduction

The distortion in a small region has a different impact on the perceptual quality from that going through the entire sequence. Fig 1 shows the relationship of SSIM and the DMOS under two distortion types for the same input sequence.

\[
DMOS = \begin{cases} 
\alpha^G(S_i) \cdot SSIM + \beta^G(S_i), & \text{if } S_i \in \text{Global} \\
\alpha^L(S_i) \cdot SSIM + \beta^L(S_i), & \text{if } S_i \in \text{Local}
\end{cases}
\]

The plots show the performance for different distortions.

Distortion Classification

Step 1: Search for the frame with largest PSNR change to find the possible location of local distortion.

Step 2: Calculate the variance of selected frame. Only part of pixels are used.

Step 3: The variance is used to determine the distortion types.

\[
V = \text{var} \left\{ \{ p \ | \ p > \eta M, p \in \Delta F \} \right\}
\]

Parameter Estimation

Feature Extraction

\[
SI = \frac{1}{N} \sum_{i=1}^{N} sbl_{space}[\text{Sobel}(F(i))]
\]

\[
TI = \frac{1}{N-1} \sum_{i=1}^{N-1} sbl_{space}[F(i) - F(i+1)]
\]

\[
CI = \frac{1}{NM} \sum_{i=1}^{N} \sum_{j=1}^{M} \frac{\text{Max}(B(i,j)) - \text{Min}(B(i,j))}{\text{Max}(B(i,j)) + \text{Min}(B(i,j))}
\]

\[
ML = \frac{1}{N} \sum_{i=1}^{N} \text{mean}(F(i))
\]

Machine Learning

\[
y = W^T X
\]

Radial basis kernel function

\[
K(x_i, x_j) = \exp(-\gamma \|x_i - x_j\|^2)
\]

Parameters Estimation

\[
\begin{align*}
\alpha^G & : \text{Global distortion} \\
\beta^G & : \text{Local distortion} \\
\alpha^L & : \text{Local distortion} \\
\beta^L & : \text{Local distortion}
\end{align*}
\]