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New Distortion/Content Dependent Quality Metric

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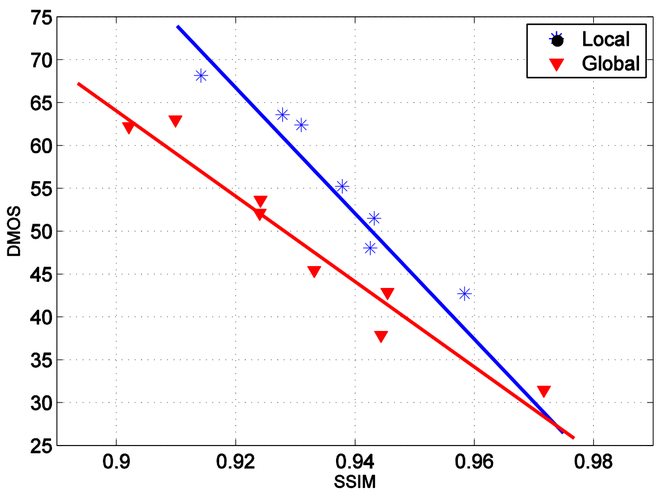
Motivation & Introduction



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.

Fig. 1 The plot of SSIM as a function of DMOS for different distortions.

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

Performance

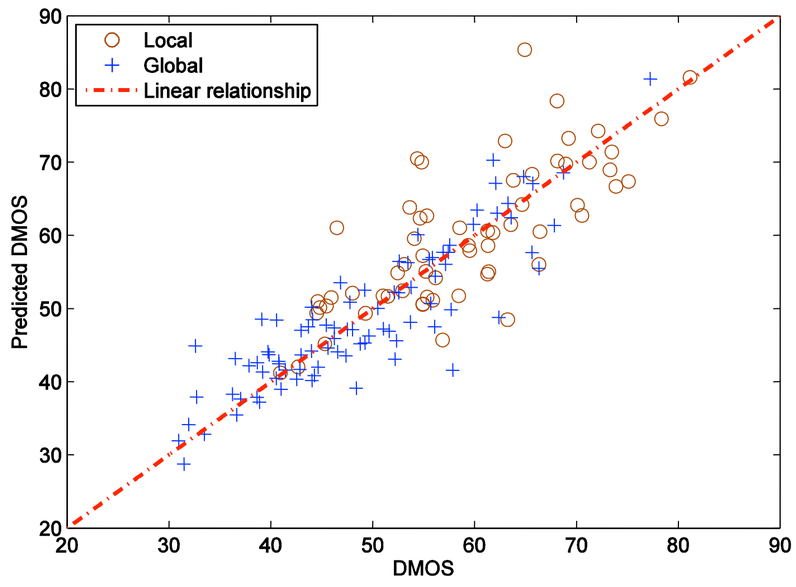


Fig. 2 Prediction V.S. DMOS on LIVE database

	PSNR	SSIM	STMAD	VIF	VQM	VSNR	MOVIE	DCVQI
PLCC	0.542	0.500	0.823	0.525	0.741	0.429	0.812	**0.869**
SROCC	0.523	0.525	0.825	0.527	0.725	0.422	0.789	**0.865**
RSME	9.175	10.977	6.118	10.977	7.349	9.914	6.413	**5.497**

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

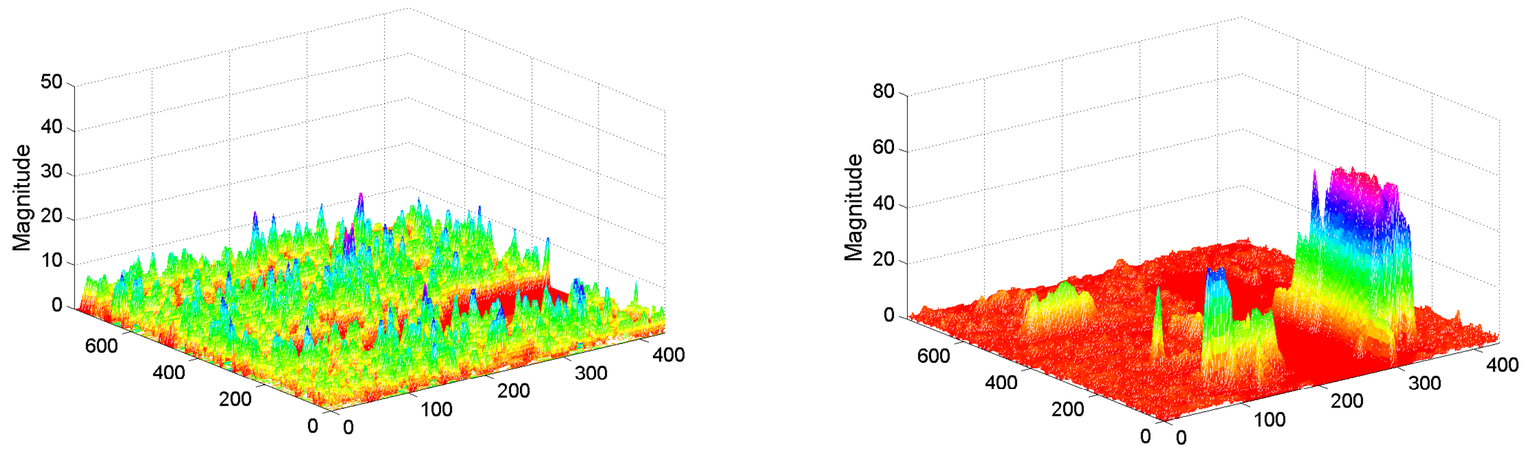


Fig. 3 Error map of the different distortion types

$$V = var\left(\{p \mid p > \eta M, p \in \Delta F\}\right)$$

Parameter Estimation

Feature Extraction

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

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

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

$$ML = \frac{1}{N}\sum_{i=1}^{N} mean(F(i))$$

Machine Learning

$$y = \mathbf{w}^T\mathbf{x}$$

Radial basis kernel function

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

Parameters Estimation

- α^G, β^G — Global distortion
- α^L, β^L — Local distortion

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