图像全参考客观评价算法比较

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Lin Zhang等人在论文《A COMPREHENSIVEEVALUATION OF FULL REFERENCE IMAGE QUALITY ASSESSMENT ALGORITHMS》中，比较了几种全参考图像质量评价算法，在此记录一下他们的结果。

下表所示是他们所用的图像库，包含了：TID2008database， CSIQ database， LIVEdatabase， IVCdatabase， Toyama-MICTdatabase， Cornell A57 database，以及 WirelessImaging Quality database (WIQ)。从上到下数据库的规模依次下降。

Table 1: Benchmark image datasets for IQA

Dataset	Ref. Images No.	Distorted Images No.	Distortion Types No.	Image Format	Subjects No.
TID2008	25	1700	17	color	838
CSIQ	30	866	6	color	35
LIVE	29	779	5	color	161
IVC	10	185	4	color	15
MICT	14	168	2	color	16
WIQ	7	80	5	gray	60
A57	3	54	6	gray	7

一共比较了如下所列的全参考图像客观质量评价算法：

PeakSignal to Noise Ratio(PSNR)

峰值信噪比。

noise quality measure (NQM) index

参考文献：N. Damera-Venkata, T.D. Kite, W.S. Geisler, B.L. Evans, and A.C.Bovik, “Image quality assessment based on a degradation model,” IEEE Trans. IP,vol. 9, pp. 636-650, 2000.

universal quality index (UQI)

参考文献：Z. Wang and A.C. Bovik, “A universal image quality index,” IEEE SignalProcess. Lett., vol. 9, pp. 81-84, 2002.

structural similarity (SSIM) index

参考文献：Z. Wang, A.C. Bovik, H.R. Sheikh, and E.P. Simoncelli,”Image qualityassessment: from error visibility to structural similarity,” IEEE Trans. IP,vol. 13, pp. 600-612, 2004.

multi-scaleSSIM (MS-SSIM) index

参考文献：Z. Wang, E.P. Simoncelli, and A.C. Bovik, “Multi-scale structuralsimilarity for image quality assessment,” ACSSC’03, pp. 1398-1402, 2003.

information fidelity criterion (IFC) index

参考文献：H.R. Sheikh, A.C. Bovik, and G. de Veciana, “An information fidelitycriterion for image quality assessment using natural scene statistics,” IEEETrans. IP, vol. 14, pp. 2117-2128, 2005.

visual information fidelity (VIF) index

参考文献：H.R. Sheikh and A.C. Bovik, “Image information and visual quality,”IEEE Trans. IP, vol. 15, pp. 430-444, 2006.

visual signal to noise ratio (VSNR) index

参考文献：D.M. Chandler and S.S. Hemami, “VSNR: a wavelet-based visualsignal-to-noise ratio for natural images,” IEEE Trans. IP, vol. 16, pp. 2284-2298, 2007.

information content weighted SSIM (IW-SSIM) index

参考文献：Z. Wang and Q. Li, “Information content weighting for perceptualimage quality assessment,” IEEE Trans. IP, vol. 20,

pp. 1185-1198, 2011.

Riesz transforms based feature similarity (RFSIM) index

参考文献：L. Zhang, L. Zhang, and X. Mou, “RFSIM: a feature based imagequality assessment metric using Riesz transforms,” ICIP’10, pp. 321-324, 2010.

feature similarity (FSIM) index

参考文献：L. Zhang, L. Zhang, X. Mou, and D. Zhang, “FSIM: a feature similarityindex for image quality assessment,” IEEE Trans. IP, vol. 20, pp. 2378-2386,2011.

统计了每种全参考图像质量评价算法的客观值和主观值之间的相关系数：

斯皮尔曼秩相关系数(Spearman rankorder correlation coefficient，SROCC)，肯德尔秩次相关系数(Kendallrank-order correlation coefficient，KROCC)，皮尔森线性相关系数(Pearsonlinear correlation coefficient，PLCC)。客观算法的结果和主观评价的结果相关性越高，则以上三个系数的值越接近于1，说明算法越准确。由表可见，FSIM算法的准确度相对来说是最高的，三个系数的取值分分别达到了0.9094，0.7409，0.9050。

Table 3: Overall performance of IQA indices over 7 datasets

IQA Index	SROCC	KROCC	PLCC
PSNR	0.6874	0.5161	0.7020
NQM	0.7355	0.5649	0.7349
UQI	0.7137	0.5398	0.7602
SSIM	0.8430	0.6593	0.8407
MS-SSIM	0.8885	0.7087	0.8831
IFC	0.7128	0.5524	0.8084
VIF	0.8423	0.6827	0.8728
VSNR	0.7875	0.6132	0.7776
IW-SSIM	**0.8955**	**0.7215**	**0.8960**
RFSIM	0.8866	0.7092	0.8845
FSIM	**0.9094**	**0.7409**	**0.9050**

下表将上表的数值进行了一下排名。排在前面的有FSIM，IW-SSIM，RFSIM，MS-SSIM。猛然发现：PSNR真的是好不准啊~~

Table 4: Overall performance ranking of IQA indices

IQA Index	SROCC	KROCC	PLCC
PSNR	11	11	11
NQM	8	8	10
UQI	9	10	9
SSIM	5	6	6
MS-SSIM	3	4	4
IFC	10	9	7
VIF	6	5	5
VSNR	7	7	8
IW-SSIM	2	2	2
RFSIM	4	3	3
FSIM	1	1	1

下表反映了每种全参考质量评价算法的耗时，耗时越短，说明算法速度越快。

Table 5: Time cost of each IQA index

IQA Index	Time (milliseconds)
PSNR	14.3
NQM	545.2
UQI	105.8
SSIM	45.2
MS-SSIM	141.7
IFC	3352.9
VIF	3399.9
VSNR	382.8
IW-SSIM	870.6
RFSIM	219.4
FSIM	705.3

总体说来FSIM，IW-SSIM，RFSIM这三种比较新的图像质量评价算法准确性比较高。

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个人分类： 视频质量评价