

FADGI Still Image Working Group

September 13, 2012

9 AM to 11 AM

Library of Congress

Agenda

1.Introductions

2.Sub-Group Activities

- a) File Format Update

3.Activities

- a) Gap Analysis – Steve Puglia and Lei He
- b) Production and Quality Management Metadata – Short-term vs. Long-term – Steve Puglia
- c) DICE Software Updates – Steve Puglia and Don Williams
- d) SFR Analysis Updates – Lei He and Don Williams

4.Documents and Wiki

- a) Discuss Revision Priorities and Timeline

5.Priorities and New Work

File Format Assessment

Revisit of FADGI Gap Analysis

- The Gap Analysis provides a brief description and justification of a set of topics that are insufficiently or not addressed by the current guidelines
- We revisited the topics relating to image processing and imaging quality analysis by conducting a more comprehensive review, including both objective and subjective assessments of the topics and related resources as references

New Format of Topics

- Objective
- Background
- Problems and possible solutions
- References

Revisited topics with new additions

- Image Sharpening
 - SFR/MTF and more comprehensive histogram/distribution-based measurements
- Image Specifications - Metric Aims and Limits
 - Application-specific measurements perform better and more accurate assessments than general metrics, e.g., coder-specific metrics
- Color Encoding Accuracy
 - Incorporate ICC profile into calculation for existing measurements such as ΔE

Revisited topics with new adds (cont.)

- Color Space Encoding
 - Incorporate ICC color profile
- Selection Criteria for Master Image File Format
 - Application-specific measurements (can be a combination of both objective and subjective measurements) will provide more accurate criteria
- Objective Image Performance Analysis – Data and Workflow
 - With the contributions from domain experts, training data can be collected to build learning systems for objective and consistent analysis, which will provide more accurate results than single measurements, e.g., PSNR, MSE, SSIM, MTF

Revisited topics with new adds (cont.)

- Subjective Image Performance Analysis
 - To overcome inter- and intra-observer variations, domain experts/users are needed to construct standard and authorized atlas of visual image defects as a guide for general users, which may be further quantized by combination with objective measurements ([Stanford webpage](#))
- Tiling and Stitching for Oversize Objects
 - Standard error measurements, features, and techniques are needed for objectively optimal tiling and stitching
- Human Visual System (HVS) Considerations in Reporting and Analyzing Noise
 - Image noise produced at different imaging pipeline should be characterized separately, based on which HVS-based metrics may be constructed as in other applications, e.g., coder-specific metrics to measure the compression artifacts

Revisited topics with new adds (cont.)

- “Visually Lossless” Image Definition and Conditions
 - To overcome inter- and intra-observer variations, domain experts/users need to construct standard and application-specific atlas of “visually lossless” images, which should also be combined with objective measurements for a quantitative reference
- Slant Edge Measure of Resolution – Repeatability of Measure/Precision
 - A statistics-based learning method may be developed to model the effects of these factors on the resolution computation, as well as the repeatability and precision on a variety of images of different modalities and contents
- Modulation Transfer Function
 - To more completely use the information provided by the whole SFR curves, we may construct the SFR model by fitting the curves (e.g., by a polynomial), which thus can be characterized by the distribution of the curve parameters. A set of application-specific rules can then be either established by domain experts or learned from training data, based on which we can construct the imaging quality analysis system

Revisited topics with new adds (cont.)

- Noise Cleaning Artifacts
 - We may conduct a comprehensive study to compare denoising algorithm effects on different noise levels. First we collect a set of representative image samples, and add different levels of noise to the images. A set of selected denoising algorithms can be applied to the noisy images. Objective metrics such as PSNR and SSIM may be used for the optimal results, based on which MTF can be employed as an objective performance measurement to evaluate the denoising effects. [[Dead leaves model](#)]

Production and Quality Management Metadata – Short-term vs. Long-term

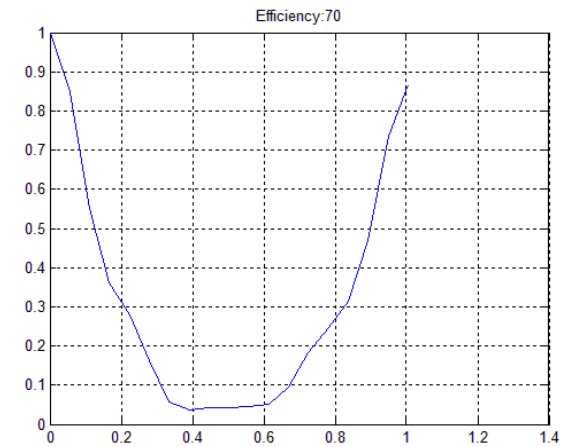
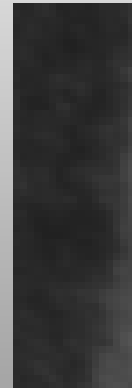
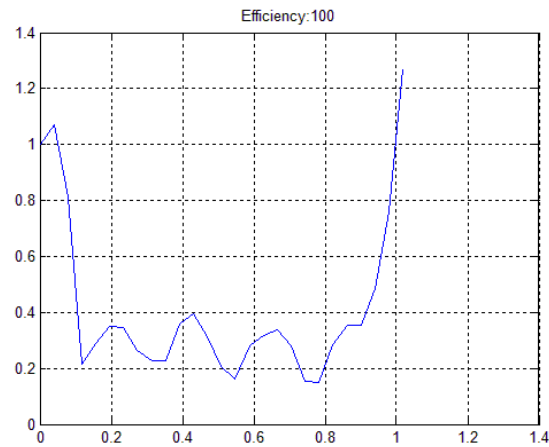
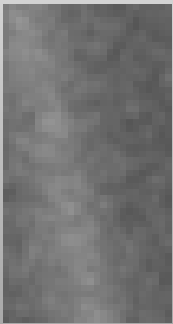
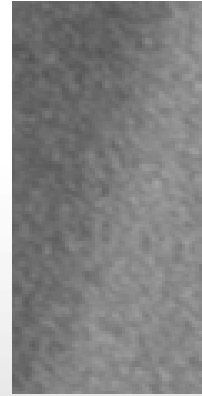
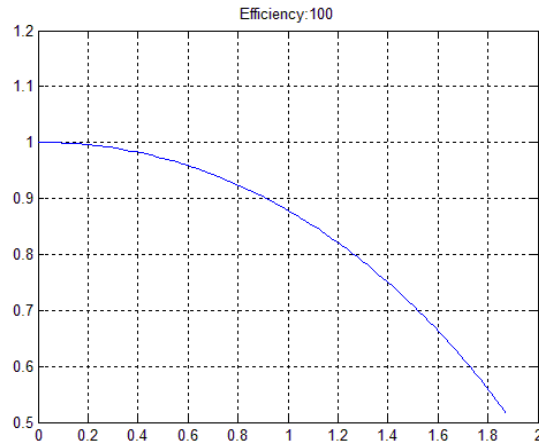
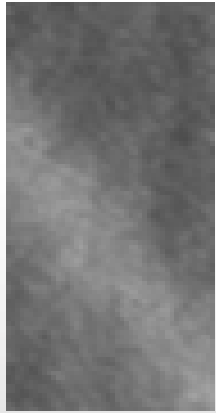
DICE Software Updates

- Color channel misregistration and white balance comparisons updated
- ICC color profile enablement
- Compare feature updates
- Internal database for compare functionality replaces the auto-export to Excel and Access

Updates for Automated SFR Computation

- Previous algorithm automatically detects straight edge segments in the image, based on which the regions of interest (ROI) are identified for SFR computation
- Rough constraints are applied for edge detection, ROI identification, and SFR computation, which produce invalid SFR results

Examples of invalid edge and ROI



New constraints to eliminate invalid edges/ROIs

- The increase of SFR values at high frequencies are caused by insufficient samples in the regions, based on which we can either enlarge the ROIs or simply remove such ROIs
- For images with heavy noise, denoising the ROIs before edge detection produces more accurate detection of edge angles
- Add more strict constraint on ROI homogeneity, i.e., both sides of the edge segment in the ROI should have similar homogeneity
- Add more strict constraints on edge orientations, i.e., vertical edges should touch the top and bottom borders of the ROIs; horizontal edges should touch the left and right borders of the ROIs

Revising the Guidelines

- Wiki is done
- Revisit limits
- Volunteers

New Work?