this kind of a quality measure is not enough for example, in describing the performance of a video capturing device. By applying Interpretation Based Quality (IBQ) method as a qualitative/quantitative approach we have collected attributes familiar to the end user and that are extracted directly from the material offered by the observers' comments. Based on these findings we formed contextually valid assessment scales from the typically used quality attributes. A large set of data was collected from 138 observers to generate the video quality vocabulary. Video material was shot by three types of video cameras: Digital video cameras(4), digital still cameras(9) and mobile phone cameras(9). From the quality vocabulary, we formed 8 unipolar 11-point scales to get better insight of video quality. Viewing conditions were adjusted to meet the ITU-T Rec. P.910 requirements. It is suggested that the applied qualitative/quantitative approach is especially efficient for finding image quality differences in video material where the quality variations are multidimensional in nature and especially when image quality is rather high.

6808-20, Session 4

Measuring multivariate subjective image quality for still and video cameras and image processing system components

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A methodology and three cases in the study of subjective image quality analysis is described. The data has been collected in a series of image quality studies concerning still, video and printed image material. The approach introduced is a non-HVS (Human Visual System) based approach in which relevant subjective quality attributes are analyzed for each image genre and device context. Several devices and image contets were studied in standard conditions. Over 500 subjects have participated in the studies reported. The role and practical value of non-HVS image quality analysis is discussed.

6808-21, Session 5

Zen and the art of image science: musings on the measurement and meaning of image quality

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Image scientists often use the term "image quality" to refer to an objective assessment of measured characteristics within an image, such as signal-to-noise ratio, resolving power, dynamic range or color accuracy. However, these criteria cannot completely capture the impact or influence of an image on its viewer. These objective metrics (as well as subjective evaluations performed without a specific use-context) measure the "static" quality of an image. However, during the immediate use and/or application of the image to its task, "dynamic" quality factors can have a significant influence on the observer's assessment of overall quality.* A thorough characterization of imaging system performance should not overlook either aspect as we pursue our quest for the "holy grail" to define a complete image quality specification.

As a foundation, some of the common static-quality metrics used in various imaging fields (reconnaissance, radiology, photography, digital imaging and video display) will be presented and described. As these concepts are reviewed, we will also explore the influence that dynamic quality has on the ultimate perception of performance by the user, consumer, or imagery analyst. Task and perception-based metrics such as NIIRS, ROC analysis, Subjective Quality Factor (SQF) and Mean Opinion Score (MOS) are also discussed in the context of static measurements, and personal insights on the infusion of dynamic quality perceptions into these structured measurements of performance complete the assessment of context-based image quality. We will conclude with an exploration into the general meaning of quality as it relates to imaging systems and their ever-evolving applications as tools for documentation, entertainment, and scientific research.

* Note that the use of the terms static and dynamic when referring to different aspects of quality was developed in the book Zen and the Art of Motorcycle Maintenance by Robert Prisig in 1974.

6808-22, Session 5

Process perspective on image quality evaluation

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The psychological complexity of multivariate image quality evaluation makes it difficult to develop general image quality metrics. Quality evaluation includes several mental processes and ignoring these processes and the use of a few test images can lead to biased results. By using a qualitative/quantitative (Interpretation Based Quality, IBQ) methodology, we examined the process of pair-wise comparison in a setting, where the quality of the images printed by laser printer on different paper grades was evaluated. Test image consisted of a picture of a table covered with several objects. Three other images were also used, photographs of a woman, cityscape and countryside. In addition to the pair-wise comparisons, observers (N=10) were interviewed about the subjective quality attributes they used in making their quality decisions. An examination of the individual pair-wise comparisons revealed serious inconsistencies in observers' evaluations on the test image content, but not on other contexts. The qualitative analysis showed that this inconsistency was due to the observers' focus of attention. The lack of easily recognizable context in the test image may have contributed to this inconsistency. To obtain reliable knowledge of the effect of image context or attention on subjective image quality, a qualitative methodology is needed.

6808-23, Session 6

Image quality evaluation using generalized natural image

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Most image quality metrics are derived from feature values of specified test charts. However, such test charts can explain only a small portion of the comprehensive performances on image quality of imaging systems. Thus, designers of imaging systems need to check every possible type of natural image to verify the performance even if they check every image quality factor by test charts. But it is not clear how many and what types of images should be used to verify the performances. Meanwhile a number of studies have shown that the amplitude spectrum of natural images falls inversely with spatial frequency. This paper proposes a new image quality evaluation methodology using a quasi-random noise image that has 1/f spectrum property as a generalized natural image. After being processed by image processing operations, the power spectra of the image show reasonable responses to the operations and their parameters. In addition, a metric derived from this image can predict the subjective judgments on the spatial reproducibility of imaging systems with a high correlation coefficient. The results suggest that this image can be used for the purpose of evaluation of the comprehensive performance on image quality of imaging systems.

6808-24, Session 6

Toward an efficient objective metric based on perceptual criteria

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Quality assessment is a very challenging problem and will still as is since it is difficult to define universal tools. So, subjective assessment is one adapted way but it is tedious, time consuming and needs normalized room. Objective metrics can be with reference, with reduced reference and with no-reference. This paper presents a study carried out for the development of a no-reference objective metric dedicated to the quality evaluation of display devices. Initially, a subjective study has been devoted to this problem by asking a representative panel (15 male and 15 female; 10 young adults, 10 adults and 10 seniors) to answer questions regarding their perception of several criteria for quality assessment. These quality factors were hue, saturation, contrast and texture. This aims to define the importance of perceptual criteria in the human judgment of quality.