White Paper: Video Testing for Encoder Manufacturers

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This paper explores the challenges Video Encoder (MPEG, JPEG, WAVLET Compression) Equipment Manufacturers face when assessing video quality. Assessing video quality ultimately depends on the customer's reaction on their new display (PC, POD, TV, etc.).

For visual and audio data, some loss of quality can be tolerated without losing the essential nature of the data. By taking advantage of the limitations of the human sensory system, a great deal of space can be saved while producing an output which is nearly indistinguishable from the original. These lossy data compression methods typically offer a three-way tradeoff between compression speed, compressed data size and quality loss.

The question must be asked. How much data can be removed before the customer has a violent reaction. So testing is increasing important. The test setup simply stated is
- Start with a known video sequence.
- Compress the video sequence.
- Decode the processed video sequence.
- Capture the processed video sequence.
- Display the original and processed video sequences.
- Bring in experts to subjectively vote.

Complexity arises as
- New Video Processing systems may need new equipment to playback the video sequences.
- The original and processed video sequences need to be captured, aligned, and displayed in multiple viewing modes for analysis
- Expert viewers are expensive and do not produce repeatable results.

So a need arises to perform quantitative, repeatable objective scoring of the video.

Previous Options

Each vendor builds unique test equipment to verify their new algorithms. So the first job is to debug the test equipment before it can be used to verify a new design. Debugging the test equipment can take as long if not longer than debugging the display equipment.

Easier Solution

To streamline the process, equipment for video quality testing needs to be defined, which can capture, play, and analyze any two video sequences. Further, as new input/output modules are continuously under development, the test equipment should use an open-architecture approach to ease upgradeability.

The following are the key attributes of a robust video quality testing tools.
- Allow a way to import video sequences regardless of their file type – i.e. AVI, QuickTime, Raw, Video Editor, MPEG, etc.
- Serve video sequences to the encoder and/or video processing unit using SDI, Component, DVB-ASI or DVI.
- Capture the output of the encoder or the encoder/decoder pair.
- Convert all video sequences to user-selectable resolution, bit depth, and color format so that they can be displayed multiple viewing modes on the same display.
- Support 8 and 10-bit data paths with upgradeability to future 16-bit modes.
- Store the video sequences as frames (fields) so that they can be played at any rate.
- Allow multiple playing modes such as play, shuttle, jog, pause, zoom and pan.
- Apply objective metrics to the video sequences to score the video frame-by-frame, and log/graph the results for easy analysis.
- Export pieces of video sequences to further analyze off-line.

Case Examples

In all of the following examples, the tests can be performed using software mockups of the actual hardware.
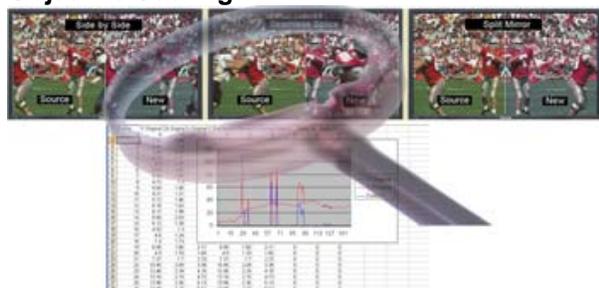
An Encoder manufacturer needs to
- Source for their video processing or encoders in SDI, Component, or DVI.
- Capture the output of their unit.
- Capture the output of their unit after it has been decoded.
- Visually inspect the new algorithm compared to the original and/or previous algorithms.
- Generate a Score for repeatability.

Figure 1: Video Testing for Encoder Manufacturers

Figure 2: Multiple Display Modes with Objective Scoring

Using this setup, the encoder manufacturer, can test their video quality with respect to the original, one of their competitors algorithms, or a previous generation algorithm. The objective metrics are logged for archiving, and the entire process can be fully automated.

Another benefit is that the video sequences can be stored and taken out to the customer sites. This aids in sales presentations and customer retention. Can you imagine showing your new algorithm against your competitors, objectively measuring the video quality, and showing the customer the results to close the deal?

- This adds the requirement for a portable unit.

The Author

Bill Reckwerdt has been involved in digital video since the early 90's from digital compression, video on demand, to streaming servers. He received his MS specializing in Behavioral Modeling and Design Automation from the University of Illinois Urbana-Champaign.

He is currently the VP of Marketing and the CTO for Video Clarity, which makes quantitative, repeatable video quality testing tools. For more information about Video Clarity, please visit their website at http://www.videoclarity.com.