

Batch Video Quality Metric (BVQM) Software Release Version 2.1
Release Notes
February, 2013

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1) Release Contents

The BVQM software was developed by the Institute for Telecommunication Sciences (ITS). BVQM performs objective automated quality assessments of processed video clip batches (i.e., as output by a video system under test). BVQM reports video calibration and quality metric results such as: temporal registration, spatial registration, spatial scaling, valid region, again/level offset, and objective video quality estimates. BVQM operates on original and processed video files only, and has no video capture capability. This program runs under the Windows operating system on a PC.

2) Package Contents

The BVQM software Version 2.1 package contains the following:

Installation related files:

MCRInstaller.exe

Software related files:

bvqm.exe
nn_8par.mat

Video Sequences:

test_original.avi
test_processed.avi

Documentation:

bvqm_pc_readme.pdf
ntia_hb-11_441d.pdf
ntia_tm_10_463.pdf
ntia_tm-11-475.pdf
ntia_tm-11-482.pdf
ntia_tr_02_392.pdf
ntia_tr_06_433a.pdf
ntia_tr_08_433b.pdf
ieee_04.pdf

vpqm_05.pdf
ITUT_COM9_C5.pdf
ITUT_COM9_C6.pdf

If any of these files are missing, you have not received an official distribution of the BVQM software.

3) System Requirements

BVQM software version 2.1 requires the following software and hardware:

Minimum Configuration:

Processor 3.0 GHz Pentium (Quad Core Recommended)
RAM 2 GB (for SD Video), 16.0 GB (for HD Video). The RAM requirements are highly dependent on the clip duration, clip resolution, and the user selected calibration and model options. An 8 second HD clip may require up to 32 GB for some calibration and model options.
Software Microsoft XP (for 32-bit executable), Windows 7 (for 64-bit executable). The software may run under Vista but this has not been tested. Windows 7 64-bit is highly recommended as XP 32-bit does not support usable RAM configurations larger than 2 GB.
Disk > 4 GB free disk space
Display 1600 x 1200 pixel resolution monitor

4) Technical Support Information

Please send any problems or requests for future improvements to
vqm@its.blrdoc.gov

For information on other video quality NTIA/ITS publications, visit
<www.its.blrdoc.gov/pub/n3/video/index.php>. For information on other NTIA/ITS publications, visit the NTIA/ITS web site at <www.its.blrdoc.gov>. Other video quality measurement software tools may be obtained from
<<http://www.its.blrdoc.gov/n3/video/vqmssoftware.htm>>.

5) Install/Uninstall Instructions

*****Install Instructions

The BVQM software was developed using MATLAB and its associated toolboxes. It is therefore necessary to install the MATLAB Component Runtime (MCR) library before running BVQM. If a prior version of BVQM was installed, you must first uninstall the old version of the MATLAB Component Runtime Library before proceeding (see Uninstall Instructions below). Follow this installation procedure for BVQM:

1. Copy the files on the installation CD to a directory on your computer. This directory will be denoted as c:\BVQM for the rest of the installation instructions given below.

2. Double click MCRInstaller.exe in c:\BVQM and follow the instructions to install the MCR library on your computer.

3. After completing installation, check to make sure that the MATLAB Component Runtime library installed properly. From the "Start" menu, select "Control Panel", and in the window that appears, double-click "Add or Remove Programs" and see if the MATLAB Component Runtime library appears in the list of installed programs. If not, repeat step 2.

If the VQM_VFD model is selected, then file nn_8par.mat must be in the directory with BVQM.

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*****  
*****Uninstall Instructions  
*****
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1. Select "Start", "Control Panel", "Add/Remove Programs". From the list of programs, select "MATLAB Component Runtime", and press "Remove".

2. Delete your installation directory and all files in it.

6) Operating Instructions

Open a command prompt window by selecting "Start", "Program", "Accessories", "Command Prompt". Change to the c:\BVQM installation directory by typing "cd c:\BVQM" at the command prompt.

To start the BVQM software, type "BVQM" at the command prompt.

7) Product Release Notes

The following changes were made to version 1.1 (from version 1.0):

1. BVQM no longer creates logical links for each clip selected; hence, write permission is not required for the clip directory.
2. The term "Video Standard" has been replaced with "Scanning Standard" throughout the documentation and interface.
3. Users can click on the "Test Data" button to reenter the test data (i.e. rows, cols, and frame rate).
4. Two new calibration algorithms have been added; "Temporal Registration and Valid Region Only - Full Reference", and "Temporal Registration and Valid Region Only - Reduced Reference".
5. Users have the option to save intermediate results before exiting BVQM.
6. Replace the following quantizers with more efficient, lower bandwidth quantizers: Low Bandwidth model's ATI feature quantizer, Fast Low Bandwidth model's ATI feature quantizer, Temporal Registration feature quantizer, and the Luminance Gain & Offset feature quantizer. These improvements significantly reduce the side channel bandwidth requirements while imposing only a negligible drop in accuracy.

The following changes were made to version 1.2 (from version 1.1):

1. Fix defect that caused sequences with reframing to receive very low quality scores (i.e., the reframing was not being performed properly in previous versions - see ntia_tr_02_392.pdf, section 3.1.2 for a definition of reframing).
2. Insert missing VQM zero clipping function (activated when $VQM < 0.0$) and high value crushing function (activated when $VQM > 1.0$) on the output of General VQM and Developer VQM (see ntia_tr_02_392.pdf, section 6.3 and 6.4). Defect in previous versions would have caused clips with extremely bad quality (greater than 1.0) to be exaggerated; and may have allowed for negative scores (i.e., quality improvement) for the General Model, only.
3. Implement parsing for video sequences longer than 15 seconds. MS-Excel required.
4. Change manual calibration option. Data now entered using Excel.
5. Summary and detailed reports changed. Additional warning and error messages included. Unfiltered calibration results included on the detailed report for spatial scaling, spatial shift, and gain/offset.
6. New calibration options added: reduced reference low bandwidth version 2 (ITU-T Recommendation J.244) including color calibration estimation; and manual calibration with automated temporal registration (full reference or reduced reference).
7. "Export to Excel" option produces a third file, containing the calibration values used. This file is intended to be used with "manual calibration" on a subsequent run.

The following changes were made to version 1.3 (from version 1.2):

1. Fix defect that caused "Excel Export" on machines without export to fail when many video clips had been processed.
2. Fix unfiltered spatial registration printout.
3. Lowbw and FastLowbw model parameter printouts of Horizontal and Vertical shift identified correctly (these had been swapped).
4. Added PSNR to available models. PSNR values are clipped at 48 db (8-bit sampling accuracy is assumed).

The following changes were made to version 1.4 (from version 1.3):

1. Replace export to MS-Excel (.xls) files with export to Comma Separated Value (.csv) files, since the MS-Excel export fails on some platforms and versions of MATLAB.
2. Improve quality of image rescaling, when interlaced images are rescaled.

The following changes were made to version 1.5 (from version 1.4)

1. Cleaned up spatial registration, temporal registration, and gain/offset code. Changes impact failure cases (i.e., when algorithms cannot accurately estimate calibration values) and these functions' command line arguments. These changes may improve calibration accuracy for some interlaced video sequences.
2. Updated read_avi function to read files larger than 2 GB and expanded the number of uncompressed AVI formats the function can read.

The following changes were made to version 2.0 (from version 1.5)

1. Improvements and bug fixes have been made to the read_avi function, including support for the 'YV12' and 'V210' formats (the read times are very slow for the 'V210' 10-bit uncompressed format).
2. Added 3 new calibration options: (1) Peak Signal to Noise Ratio (PSNR) Search (ITU-T J.340, see ITUT_COM9_C6.pdf), (2) ITU-T J.244, then ITU-T J.340, and (3) ITU-T J.144, then ITU-T J.340. To compute the ITU-T J.340 PSNR values, one of these new PSNR search calibration options must be selected, followed by the PSNR model (NOT the PSNR_VFD model, which also includes advanced variable frame delay estimation).
3. Added 2 new model options: (1) PSNR_VFD, which is a PSNR metric computed after variable frame delay (VFD) is estimated and removed (see ntia_tm-11-475.pdf), and (2) VQM_VFD, which is a neural network (NN) based video quality metric (VQM) that incorporates VFD processing and VFD quality parameters. The new VQM_VFD model also incorporates viewing distance (in picture heights), which may be set in the VQM_VFD model options pop-up window.

The following changes were made to version 2.1 (from version 2.0)

1. Fixed defects that caused BVQM to crash.

8) Usage, Copyright, and Patent Information

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other disposition by the Collaborator, or others acting on its behalf, of products made by the use of NTIA/ITS' Software.

The algorithms contained within the IVQM Software are covered by two U.S. Patents.

U.S. Patent Number 5,446,492, entitled "A Perception-based Video Quality Measurement System," issued on August 29, 1995.

U.S. Patent Number 6,496,2221, entitled "In-Service Video Quality Measurement System Utilizing an Arbitrary Bandwidth Ancillary Data Channel," issued December 17, 2002.

9) Use of VQM Numbers in Outside Reporting

U.S. Department of Commerce policy prohibits NTIA/ITS from endorsing products. However, the NTIA General Model was standardized by ANSI in July of 2003 (ANSI T1.801.03-2003), by ITU-T in March of 2004 (ITU-T J.144), and by ITU-R in June of 2004 (ITU-R BT.1683). The NTIA General Model has been approved for use in performance testing and comparison of digital video systems.

In 2009, the NTIA/ITS Fastlowbw model was a member of the top-performing group in the Reduced-Reference TV (RRTV) tests conducted by the Video Quality Expert Group (VQEG). This model has been included in ITU-T Recommendation J.249 (see ITUT_COM9_C5.pdf).

In 2010, the NTIA/ITS PSNR search algorithm with compensation for constant spatial shifts, constant temporal shift, and constant luminance gain and offset was standardized by ITU-T (ITU-T J.340). This model can be computed by selected one of the PSNR search calibration options, followed by the PSNR model (NOT the PSNR_VFD model, which also includes advanced variable frame delay estimation).

Therefore, you can reference the VQM numbers in outside reporting of performance as long as you:

1. Use the General Fastlowbw, or PSNR Models, and
2. Reference the ANSI, ITU-T, or ITU-R standards referenced above, and
3. Do not mention NTIA/ITS.

10) Frequently Asked Questions (FAQ)

Question: "Which calibration option should I choose?"

Answer: If you do not know anything about your codec's calibration, here are our suggestions. Run BVQM twice: once with 'Reduced Reference Calibration Version 2' and once with 'Full Reference Calibration'. Both of these calibration options check everything. 'Full Reference Calibration' is more accurate but does not check for spatial scaling. 'Reduced Reference Calibration Version 2' will check whether or not your codec is spatially scaling the video.

Question: "Where can I find source video sequences?"

Answer: See the Consumer Digital Video Library (www.cdvl.org). Registered CDVL users have access to high quality uncompressed video scenes that may be used freely for research and development purposes. Users may also contribute their videos to the CDVL database.

Question: "Which model should I choose?"

Answer: Depending on the user's needs, there are several possible recommendations.

The NTIA General Model, the Fast Low Bandwidth Model, and the PSNR Model were validated by the Video Quality Experts Group (VQEG) and then standardized by the ITU. See #9 above for information on how to run those models in compliance with those Recommendations. This gives legitimacy and credence to your results.

Model VQM with Variable Frame Delay (VQM_VFD) was completed in 2011. Based on ITS training and testing data, VQM_VFD is the most accurate model provided by BVQM. VQM_VFD includes a neural network that achieves 0.9 correlation to subjective quality for subjective datasets at image resolutions from QCIF to HDTV. VQM_VFD was trained on transmission errors. However, this model has not yet been independently validated.

PSNR is a model with wide industry acceptance. PSNR is very sensitivity to calibration errors. If you want to use PSNR on video that may contain a reduced frame rate or variable frame delay and you want this effect removed before PSNR is calculated, we recommend 'PSNR with Variable Frame Delay'. PSNR is less accurate than the NTIA General Model and the Fast Low Bandwidth Model for most applications.

Question: "How do I run the BVQM source code from the MATLAB command line?"

Answer: There are no differences when running BVQM from the MATLAB command line.