Monitoring of Audio-Visual Quality by Key Indicators (MOAVI)

Mikołaj Leszczuk, Jakub Nawała and Kais Rouis

Presentation Plan

- Reminder on MOAVI
- Report for 2015H1
- Plans for 2015H2

Reminder on MOAVI

VQEG's Subproject: MOAVI

- **Mission**:
  "To collaboratively develop No-Reference (NR) models for monitoring individual audio-visual service quality artefacts"
- **Goals**:
  - To develop set of key indicators describing service quality in general and by removing implementation constraint
  - To select subsets for each potential application
  - To concentrate on models based on key indicators contrary to models predicting overall visual quality

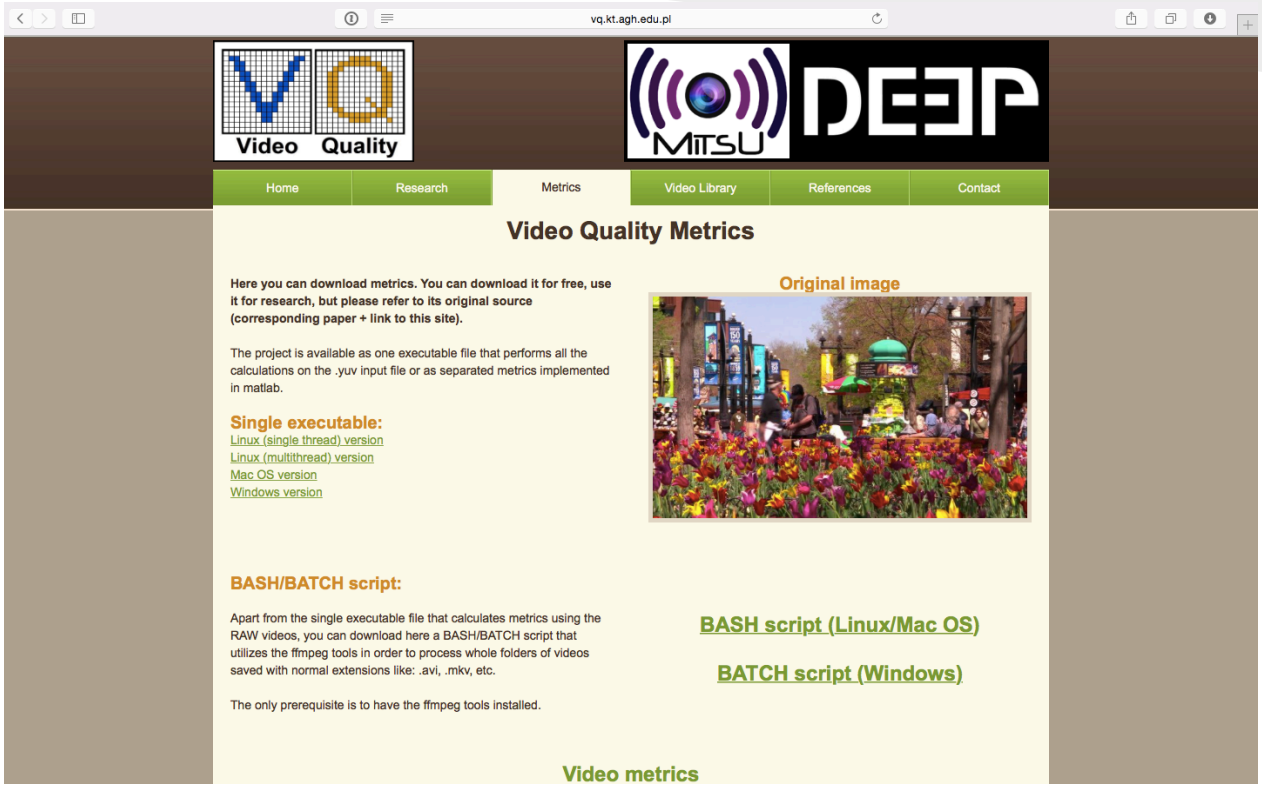
MOAVI Co-Chairs

- **Silvio Borer**
  - SwissQual, Zuchwil, Switzerland
  - **Silvio.Borer@rohde-schwarz.com**
- **Mikołaj Leszczuk**
  - AGH University of Science and Technology, Krakow, Poland
  - **leszczuk@agh.edu.pl**

Signal-Based, NR Indicators for Artefacts of Various Origin

- **Capturing Artefacts**: blurriness, exposure, interlace, etc.
- **Processing Artefacts**: blockiness, blurriness, flickering, reduced spatial & temporal resolution, etc.
- **Transmission Artefacts**: blackout, block loss, freezing, slicing, etc.
- **Displaying Artefacts**: blackout, slicing, etc.

Free Audio-Video Quality Indicators Online at http://vq.kt.agh.edu.pl/



Report for 2015H1

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Major Changes for Selected Indicators

- Normalization of results returned by **Interlace** indicator
- New **Flickering** indicator algorithm
  - Based on: *"Perceptual Quality Assessment for H.264/AVC Compression"* (P. Romaniak et al., http://dx.doi.org/10.1109/CCNC.2012.6181021)
  - Indicator counts on following *N* frames, where *N* is parameter defined in code allowing to change scope of implementation
- New **Contrast** indicator algorithm
  - Based on: *"Contrast in Complex Images"* (E. Peli, http://doi.org/10.1167/13.13.3)
  - New indicator proved to be more independent from content present in picture
  - Indicator normalized so as to be independent of resolution

Optimizing Performance of All Metrics by Improving Algorithms

- Blackout
- Block loss
- Blockiness
- Blurriness
- Contrast
- Brightness (now merged with Blackout to achieve even better execution times)
- Exposure
- Freezing
- Interlace
- Letter-box
- Noise
- Pillar-box
- Slicing
- Spatial Activity
- Temporal Activity

Multiplatform, Multithread Implementation in C

- Optimization by transferring implementation from **C++** to **C**
- Porting to most popular platforms:
  - **Linux**
  - **Windows**
  - **Mac OS**
- Using **C** macros – enough to change compiler and put flag to compile for target platform
- Development of multithreaded version of project
  - Creation of multi-threaded version significantly reducing execution time, using **POSIX Threads** library
  - This version, for compatibility reasons with abovementioned standard, available only on **UNIX** platforms:
    - **Linux**
    - **Mac OS**

Creating User-Friendly Bash and Batch Shell Scripts for Counting Indicators

- Using **FFmpeg** package to enable user of calculating indicators on files in format other than **YUV**
- Using **FFmpeg** package to automate indicators counting process for remote reading out video features:
  - **Width**
  - **Height**
  - **Frames Per Second (FPS)**
- Output results in **Comma Separated Values (CSV)** in order to allow their analysis in e.g. spreadsheets
- Enabling counting indicators on all video files present in specified folder

Maintenance of Webpage: http://vq.kt.agh.edu.pl/

- Merging **“Science”** tab with **“Video Library”** tab
- Upgrading existing references to scientific papers
- Removing references to non-existent indicators
- Adapting **“Metrics”** tab by:
  - Broadening its content with user-friendly scripts to facilitate use of indicators, and
  - Attaching executable files counting indicators for video sequences in **YUV** format
- Refreshing Webpage multimedia content (mostly attachments – video sequences from official account on **YouTube**)
- Updating content contained on Webpage (descriptions of bookmarks/sub-tabs)

Inclusion of **MOAVI** Source Codes and Scripts to **JEG-Hybrid** Virtual Machine

- Creating documentary short description for each indicator
- Description given as comment at beginning of each source file

Experimenting with **High Efficiency Video Coding (HEVC)** Compression

- Experimenting with existing **H.264/MPEG-4 AVC** quality assessment indictors for **H.265/HEVC**
- Objectively estimated perceptual quality of set of processed video sequences
- Typical distortions introduced by **HEVC** block-based coding approaches:
  - **Blockiness**
  - **Blurriness**
- Correlation between **NR** quality indicators and **Video Quality Model (VQM)**, performed to validate accuracy
- Quick, basic experiment – **1** month only

Source Reference Circuits (SRC) for HEVC Experiment

- **10 SRC** video sequences
- Based on: *"Subjective Experiment Dataset for Joint Development of Hybrid Video Quality Measurement Algorithms"* (M. Barkowsky et al., https://hal.archives-ouvertes.fr/hal-00717861)

src01

src02

src03

src04

src05

src06

src07

src08

src09

src10

Hypothetical Reference Circuits (HRC) for HEVC Experiment

- **9 HRC** video compression scenarios
- Based on: *"Full-HD HEVC-Encoded Video Quality Assessment Database"* (G. Van Wallendael et al., https://tel.archives-ouvertes.fr/EC-NANTES/hal-01149347v1)

Param	*Value*
WIDTH	1280
GOPTYPESIZE	GOP8
RATECONTROL_QP	26,32,38,46
RATECONTROL_FRAME_mbit/s	1,2,4,8,16
REFRESH	1
INTRAPERIOD	16
SLICEARGUMENT	0

Pearson Correlation Coefficients with VQM for HEVC Experiment

Source	*Blockiness*	*Blur*
*src*01	-0.6717388541	0.9954709528
*src*02	-0.9749964525	0.9090649423
*src*03	-0.9708443139	0.9607804685
*src*04	-0.7670559256	0.9919857045
*src*05	-0.8735519257	0.9864433862
*src*06	-0.5702805793	0.9134877699
*src*07	-0.9559820691	0.9576177467
*src*08	-0.953632615	0.923630412
*src*09	-0.3575432364	0.9528495059
*src*10	0.6914738003	0.9902707301

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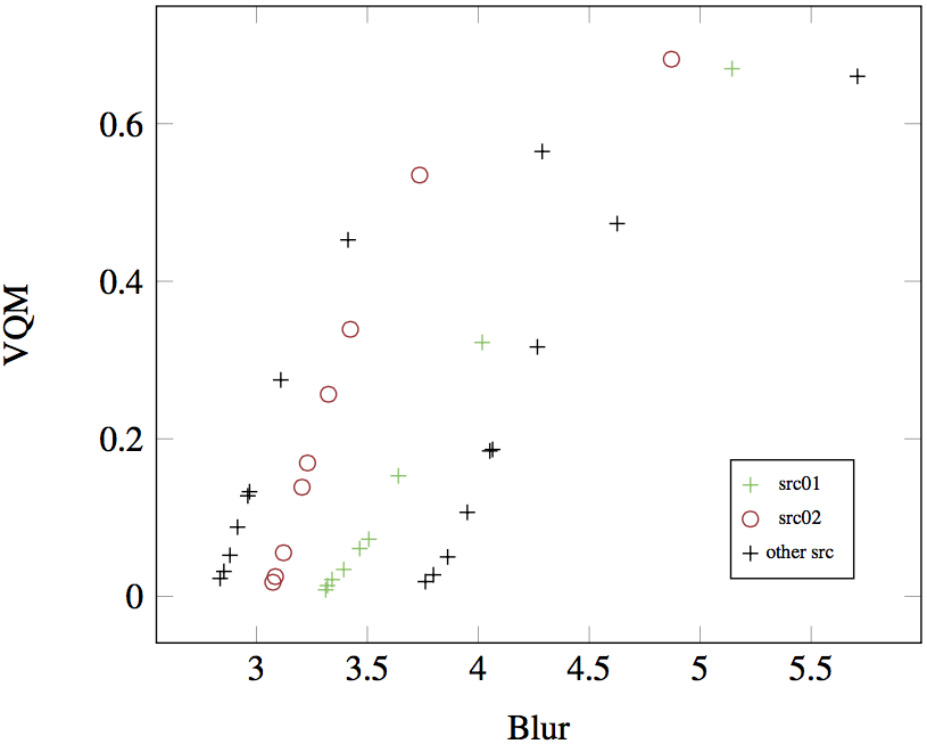
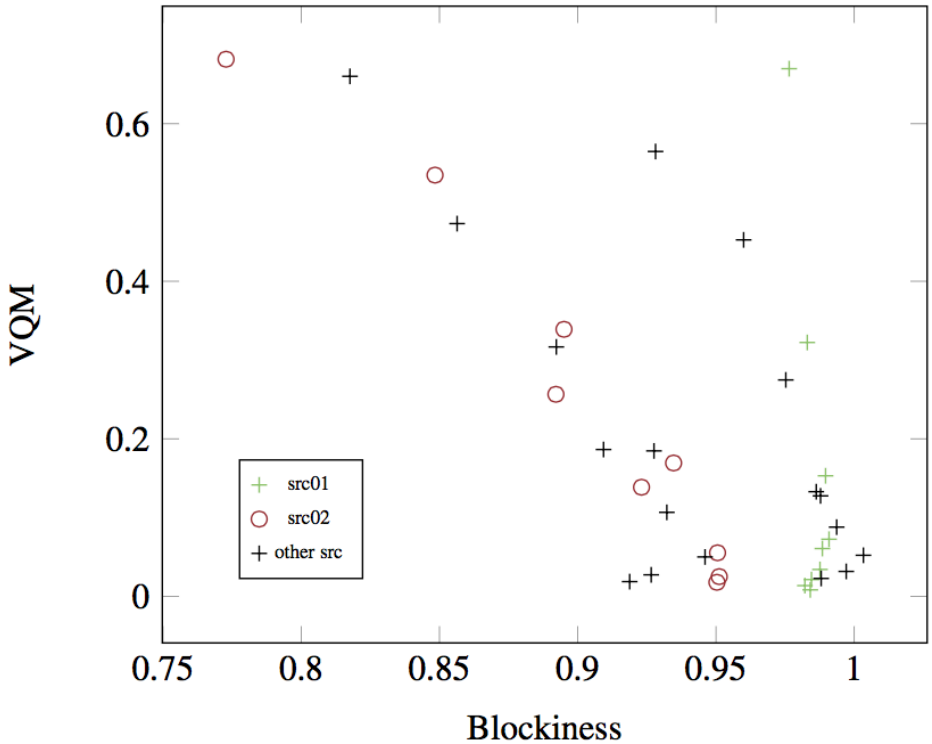
Correlation with VQM for Selected vs. Other SRC for HEVC Experiment





Cooperation with External Students, PhD Students and Other Academics

- **Hamed Ahmadi**, University of Tehran, Iran
- **David Cassany Viladomat**, i2Cat, Spain
- **Steve Sciandra**, freelancer, USA
- **Helard A. Becerra Martinez**, Universidade de Brasilia, Brasil
- **Kais Rouis**, Université de Tunis El Manar, Tunisia
- **Jacob Søgaard**, Technical University of Denmark, Denmark

Plans for 2015H2

Plans for **H.264/MPEG-4 AVC**

- New **Noise** indicator algorithm, based on: *"Block-Based Noise Estimation Using Adaptive Gaussian Filtering"* (D.-H. Shin et al., http://dx.doi.org/10.1109/TCE.2005.1405723)
- New **Frame Drop** indicator algorithm
- New audio indicator algorithms:
  - **Clipping**
  - **Muting**
- Inclusion of **Brightness** indicator in **Exposure** indicator
- Testing indicators for frames larger than **1080p** (**4K** and beyond)

Plans for **H.265/HEVC**

- Consider specificities of **HEVC** distortions relative to:
  - New prediction tools, and
  - Tree-based structure
- Implicate temporal impairments
- Pooling model for performed measures
- Further experimenting with **HEVC**

Thank You!

http://mitsu-project.eu/