

Recent Developments in Visual Quality Monitoring by Key Performance Indicators

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Presentation Structure

- Introduction to Monitoring of Audio Visual Quality by Key Indicators (MOAVI)
- Origin of artifacts
- Video artifacts and related Key Performance Indicators (KPI) for automated quality checking
- Experimental setups for concept verification
- Results on KPI
- Deployment
 - NET-MOZAIC probe
 - NET-MOZAIC in the NET-xTVMS system
- Future work

Introduction to MOAVI

Introduction to MOAVI

- Mission

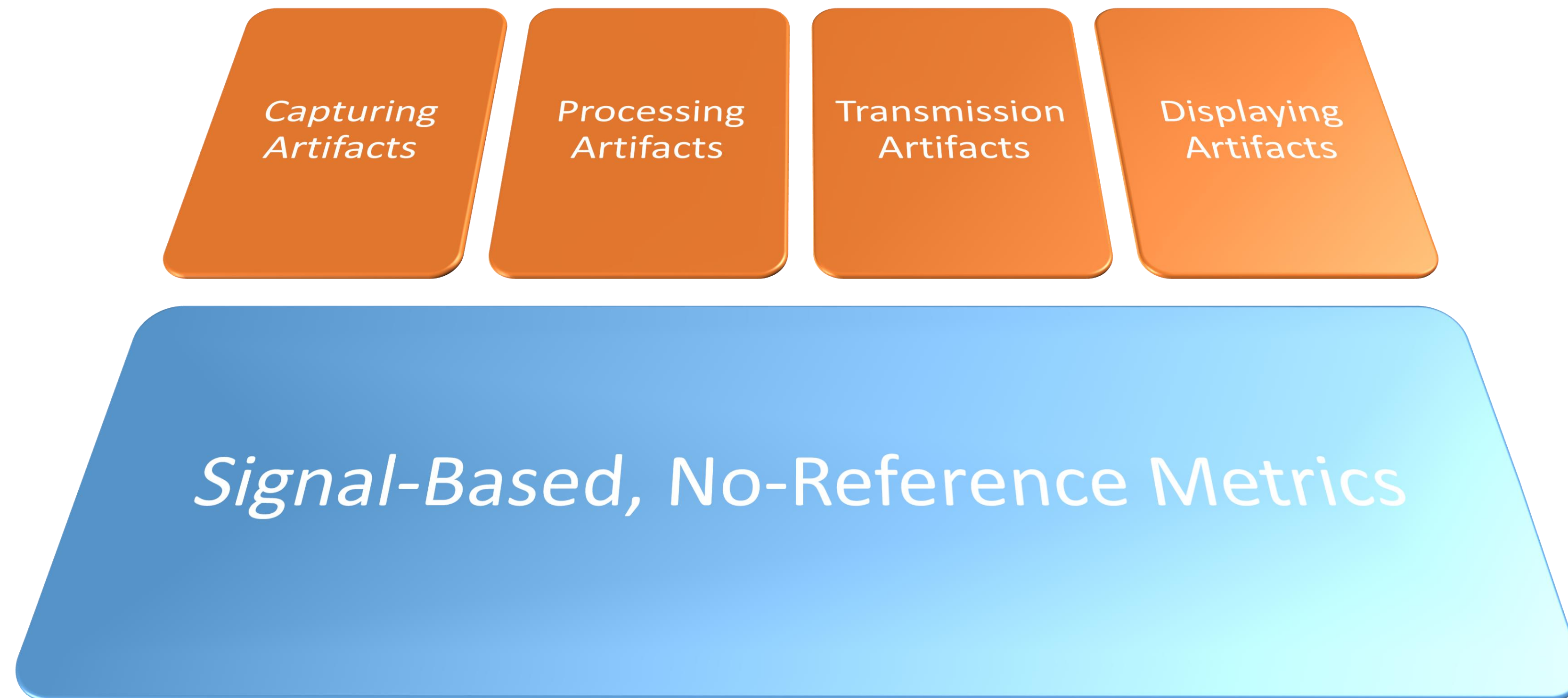
- *“To collaboratively develop No-Reference models for monitoring individual audio-visual service quality artifacts”*

- 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

Origin of Artifacts

Origin of Artifacts



Video Artifacts and Related KPI for Automated Quality Checking

Video Artifacts and Related KPI for Automated Quality Checking



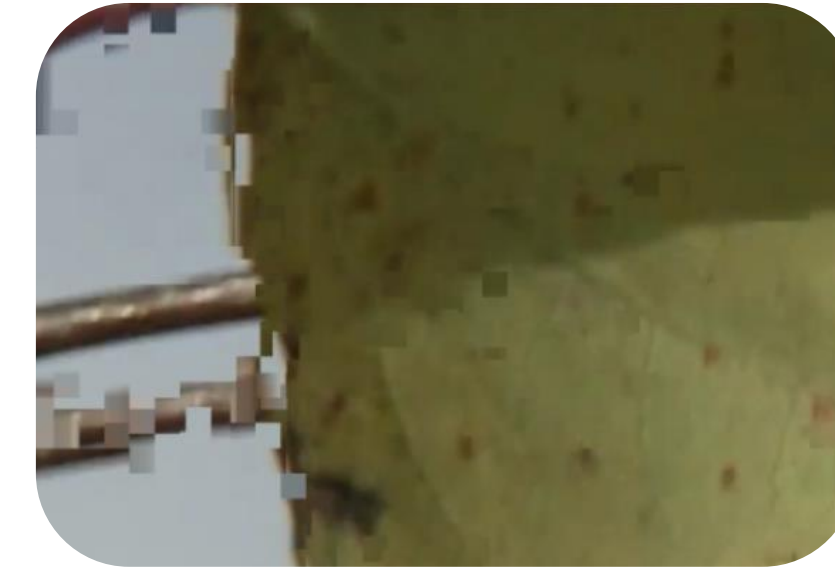
Blur



Exposure Time
Distortions



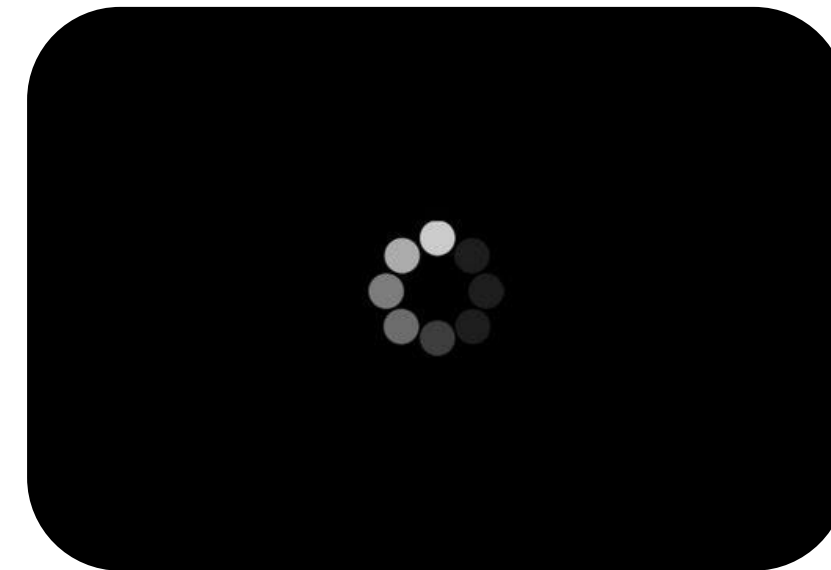
Noise



Block Loss



Blockiness



Freezing



Slicing

Experimental Setups for Concept Verification

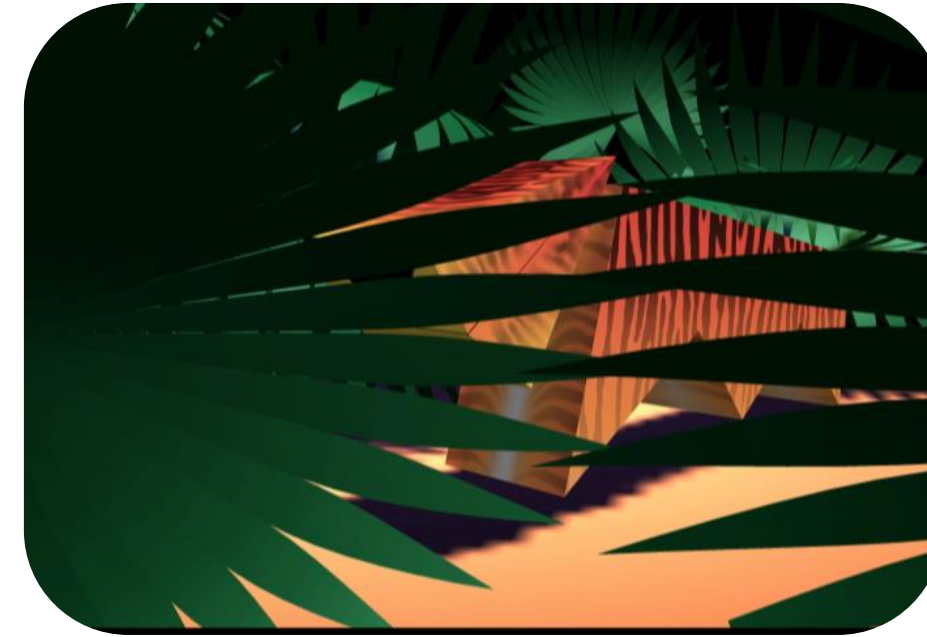
Mapping between KPI and Experimental Setups

KPI	Experimental Setup
Blur	VARIUM 2013
Exposure Time Distortions	INDECT 2011
Noise	CONTENT 2009
Block Loss	VQEG HDTV 2010
Blockiness	VARIUM 2013
Freezing	VQEG HDTV 2010
Slicing	VQEG HDTV 2010

- Scores:
 - VARIUM 2013 – binary
 - Others – Absolute Category Rating (ACR) Mean Opinion Scores (MOS)
- Degradation Category Rating (DCR):
 1. **Degradation is very annoying**
 2. **Degradation is annoying**
 3. **Degradation is slightly annoying**
 4. **Degradation is perceptible but not annoying**
 5. **Degradation is imperceptible**
- ACR \approx DCR?

Experimental Setups for Concept Verification

- CONTENT 2009:
 - 720×486@30
 - 100 subjects
- INDECT 2011:
 - 720×486@30
 - 24 subjects



Betes



Autumn



Football



Susie

Experimental Setups for Concept Verification

- VQEG HDTV 2010:
 - 1920×1080@25
 - 24 subjects



VQEG HD 4,
SRC 1



VQEG HD 4,
SRC 2



VQEG HD 4,
SRC 3



VQEG HD 4,
SRC 4



VQEG HD 4,
SRC 5



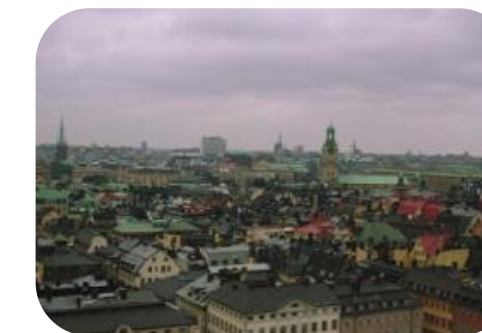
VQEG HD 4,
SRC 6



VQEG HD 4,
SRC 7



VQEG HD 4,
SRC 8



VQEG HD 4,
SRC 9



Common Set
SRC 11



Common Set
SRC 12



Common Set
SRC 13



Common Set
SRC 14

Experimental Setups for Concept Verification

- VARIUM 2013
 - 1280×720@50
 - 15 subjects



Joy Park



Into Trees



Crowd Run



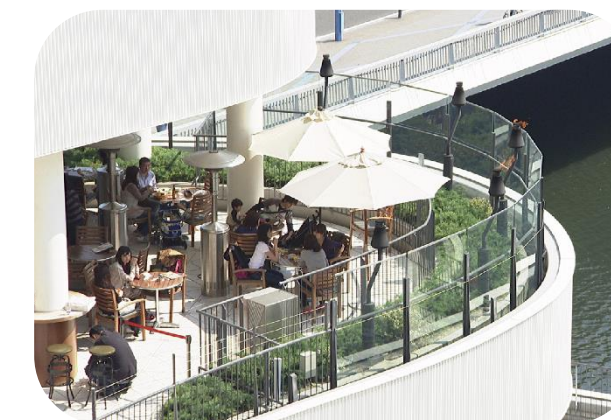
Romeo & Juliet



Cactus



Basketball



Barbecue

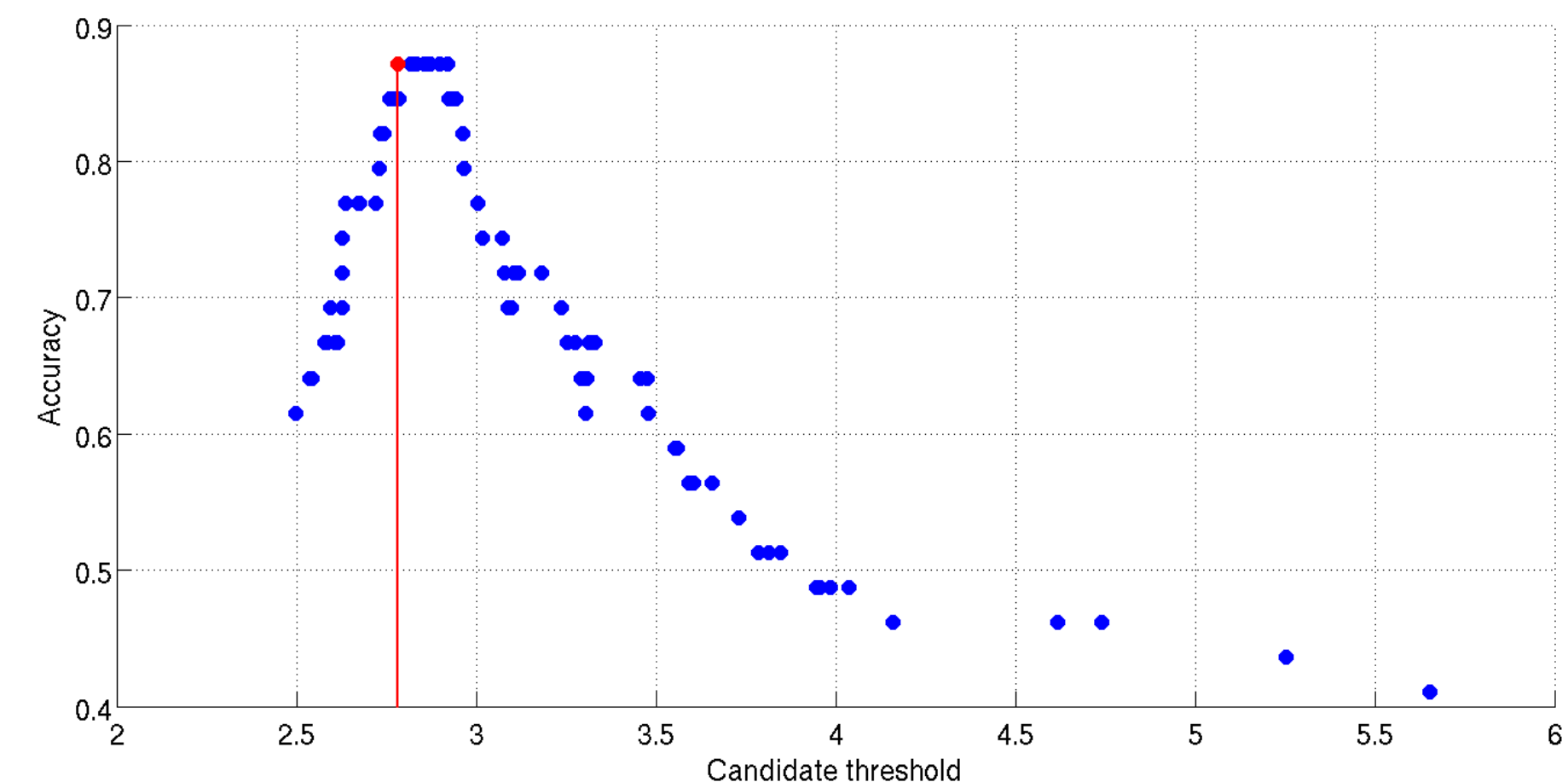
Results on KPI

Setting Metrics Threshold Value (Training Set)

1. For all video sequences from the appropriate subjective experiment the values of the metric is calculated.
2. We assume each successive value of metric as candidate thresholds th_{TEMP} . For values less then th_{TEMP} we set the *KPI* to 0 and to 1 for same or above.
3. For each th_{TEMP} we calculate the accuracy rate of resulting assignments. It is the fraction of *KPI*, which match with indications given by humans from the training set.

$$accuracy(th_{TEMP}) = \frac{\# \text{ matching results}}{\# \text{ results}}$$

4. We set the threshold of metric to the candidate th_{TEMP} with the best (maximum) accuracy. In the case of several th_{TEMP} values with the same accuracy we select the least value.



KPI Verification (Verification Set)

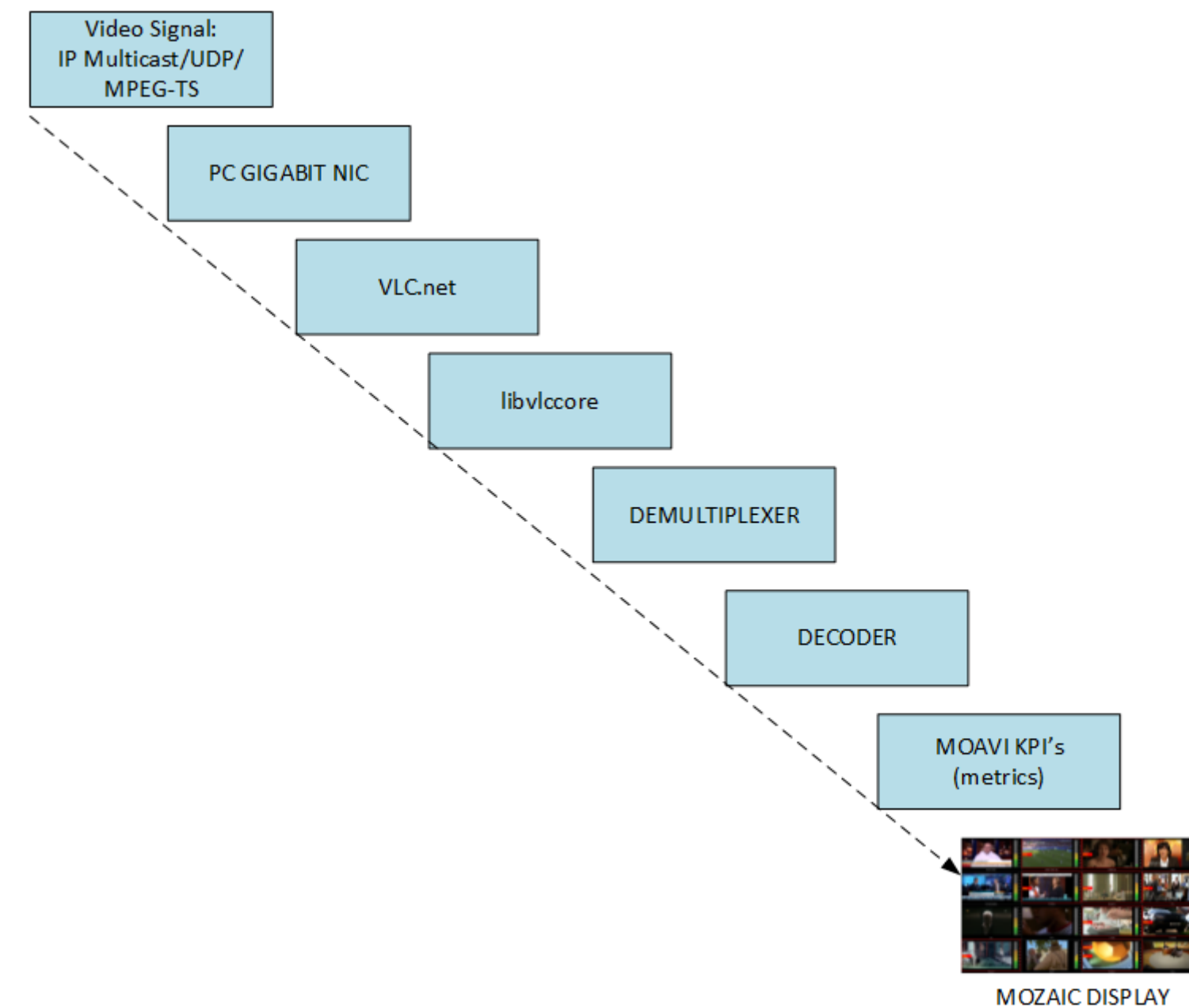
Metric	Probability of distortion detection	Value of threshold
Blur	0.86	2.78
Exposure Time Distortions	0.81	78 and 178
Noise	0.85	3.70
Block loss	0.84	5.3
Blockiness	0.94	0.85
Freezing	0.80	0
Slicing	0.85	7

Deployment

NET-MOZAIC Probe

Functional Diagram

- Satellite Video Encoders
- DVB-C cable TV
- DVB-CS Satellite TV
- DVB-T Off-The-Air TV broadcast
- VOD Servers



Key Features

- Simultaneous full motion preview and image analysis of up to 16 SD and/or HD channels
- Round-robin for up to hundreds of IPTV channels
- Integrated with Net-xTVMS system for centralized control/access or stand alone operation
- Supports MPEG-2 and H.264/AVC
- Supports audio codecs AC-3, MPEG-1 Level 2, MPEG-2 AAC, MPEG-4 AAC
- Supports UDP or UDP/RTP encapsulation
- All metrics have user defined alarm thresholds
- Long term storage of metrics
- Optional HDMI/IP encoding of a 16 channel group for advertising

MOAVI KPI (Metrics) Implemented in the NET-MOZAIC

MOAVI Metrics

- Blur
- Exposure Time Distortions (brightness problem)
- Noise (within video picture)
- Block loss
- Blockiness
- Freezing (frozen picture)

Non-MOAVI Metrics

- Black screen
- Contrast problem
- Flickering
- Audio silence detection
- Audio clipping detection
- No Audio
- No Video

Set Up Menu

The screenshot shows the 'NET-MQZC - Settings' application window. The 'Metrics' tab is active, displaying a list of video quality metrics. Each metric has a checkbox and two numerical input fields for 'Passed' and 'Warned' thresholds. A color scale legend at the top right indicates the status: green for 'Passed', yellow for 'Warned', and red for 'Failed'. The 'ON' button is visible in the top right corner of the window.

Metric	Passed	Warned
<input checked="" type="checkbox"/> No video	1	5
<input checked="" type="checkbox"/> No audio	1	5
<input checked="" type="checkbox"/> Blockiness	1	5
<input checked="" type="checkbox"/> Blackout	1	5
<input checked="" type="checkbox"/> Blur	1	5
<input checked="" type="checkbox"/> Noise	1	5
<input checked="" type="checkbox"/> Flickering	1	5
<input checked="" type="checkbox"/> Freezing	1	5
<input checked="" type="checkbox"/> Silence	1	5
<input checked="" type="checkbox"/> Clipping	1	5

Buttons at the bottom: Restore Default Thresholds, Apply

NET-MOZAIC Picture



NET-MOZAIC Layout Settings

The screenshot displays the NET-MOZAIC Settings application interface. It features a left sidebar with a channel list and a main workspace for configuring a matrix layout.

Channels List:

Nr	Name	Multicast address
1	Channel 1	225.1.1.1
2	Channel 2	225.1.1.2
3	Channel 3	225.1.1.3
4	Channel 4	225.1.1.4
5	Channel 5	225.1.1.5
6	Channel 6	225.1.1.6
7	Channel 7	225.1.1.7
8	Channel 8	225.1.1.8
9	Channel 9	225.1.1.9
10	Channel 10	225.1.1.10
11	Channel 11	225.1.1.11
12	Channel 12	225.1.1.12
13	Channel 13	225.1.1.13
14	Channel 14	225.1.1.14
15	Channel 15	225.1.1.15
16	Channel 16	225.1.1.16
17	Channel 17	225.1.1.17
18	Channel 18	225.1.1.18
19	Channel 19	225.1.1.19
20	Channel 20	225.1.1.20
21	Channel 21	225.1.1.21
22	Channel 22	225.1.1.22
23	Channel 23	225.1.1.23

Matrix Configuration:

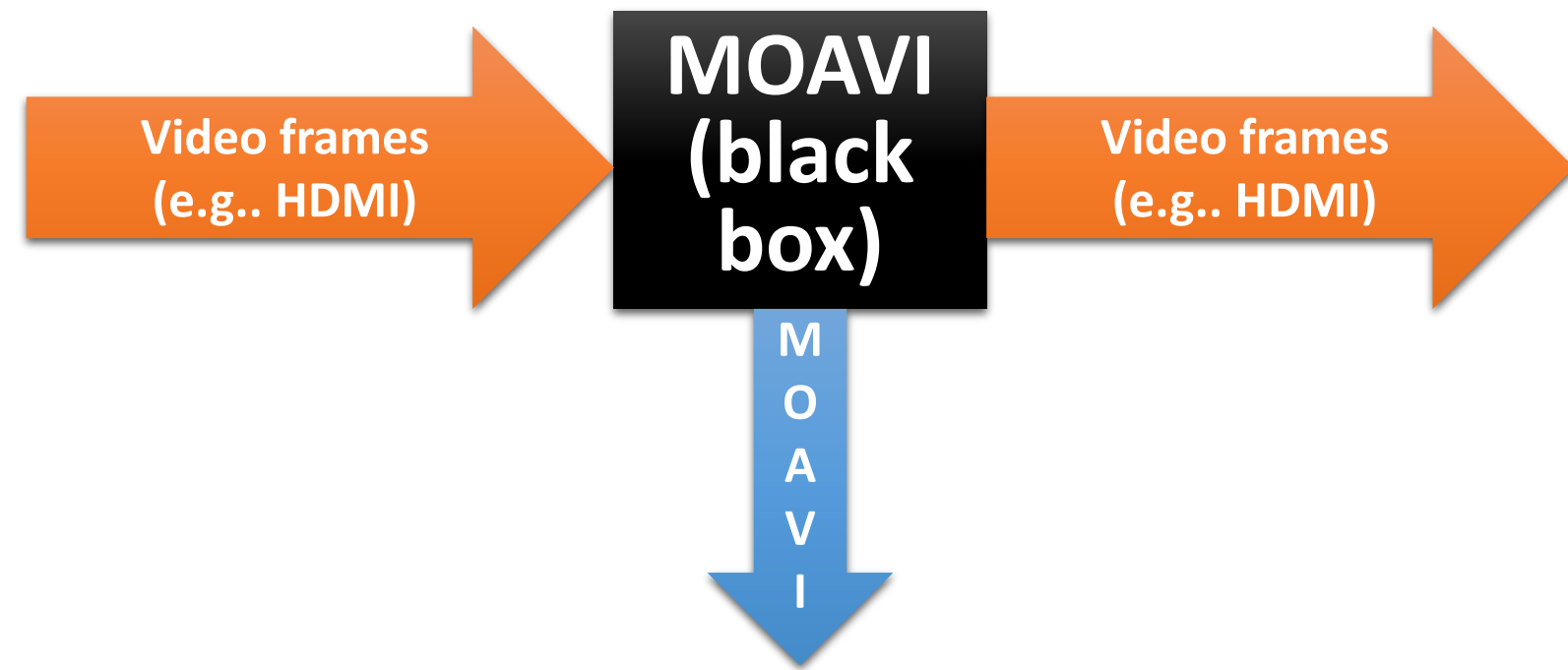
- Application switching mode: Multi matrixes mode, Single layout mode
- Matrix switch interval [min]: 1
- Matrix 1 and Matrix 2 tabs are visible.
- The matrix layout is a 4x4 grid of cells. Each cell contains a channel name (e.g., "Channel 1 - 225.1.1.1") and a "Delete" button. Arrows indicate movement options between cells.

Deployment

NET-MOZAIC in the NET-xTVMS System

Future Work

Future Work



- To provide more tools and evaluation methods
- To deploy distributed probes for measuring quality in real-time
- To eventually target proposals for ITU Recommendations (P.930?)