



TAMPEREEN TEKNILLINEN YLIOPISTO

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VIDEO TESTING IN MOBILE DEVICES

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TERMIT JA NIIDEN MÄÄRITELMÄT

MSE	Mean Square Error
SNR	Signal to Noise Ratio
HSV	Human Visual System
VQEG	Video Quality Experts Group
DVq	Digital Video Quality
NR	No Reference

1. INTRODUCTION

Every minute there are 100 hours of video uploaded just to Youtube.com. [23]

Analysis, subjective or objective, for video is just starting. In year xx there were xx articles related to video in IEEE explorer but after two years the amount of articles has skyrocketed and there is no end.

The goal for this thesis is to make state of art analysis of current methods of video testing. I will not study transmission errors over networks. I focus on errors coming from coding, device, optics, ois(optical image stabilization), etc. I try to focus more on non-reference methods but reference video methods are also studied and introduced.

Videos in this thesis are considered as being part of multimedia experience meant for human usage so any medical, traffic and et cetera related usage has been ruled out of scope. Medical videos have more strict rules for example in compression to be lossless and in traffic the ROI, region of interest, can be the only license plate to verify the owner of the vehicle. In human usage it is more about the whole experience and seamless image stream without any glitches, sound-sync error is the most important part of viewing videos. Is

Video quality can be determined with psychophysical experiments, but they are expensive and time consuming to arrange. There are no physical measures like meter for distance to predict the quality of video.

On first chapter I will define what is mobile device. What restrictions it causes in testing and typical ways of mobile testing.

Second chapter will introduce different error types divided into algorithmic and hardware related errors. This will help us to understand how to recognize those errors and also how to detect those in testing and how to correct them.

Third chapter digs in to the state of the art of testing methods: subjective, objective, reference, non-reference, black box and etc.

Fourth chapter shows comparison of different methods or practical example done with matlab.

Fifth chapter is for conclusions and future work.

2. MOBILE DEVICE

In this chapter I will go through basic features in video and imaging sense of mobile devices. I will also try to define what is mobile device to give some kind of limitations what kind of errors are to be handled and what is the boundary line for example sensor size and stuff

2.1 What is mobile device

2.1.1 Restrictions of mobile device

2.2 Mobile device testing

2.2.1 Driver level

2.2.2 Middleware

2.2.3 User Interface

2.2.4

3. THEORY OF VIDEO TESTING

In this chapter error sources are introduced because before we can start testing errors in video we must understand where and why are the errors generated. That will also help developing test methods but also understanding results and actions followed by them.

I have divided errors in the algorithmic and hardware based errors. Main focus will be on the algorithmic errors, but essential hardware errors like noise are also introduced. Some errors have overlapping reasons like in example jitter might be caused by poor processor performance or error in algorithm design. Those are handled by the most dominant reason base. So ie. *noise* is categorized as hardware error, but *jitter* is handled in algorithmic side.

Errors produced in transmission like in videocalls, over network streaming, watching videos from www.youtube.com are not dealt with in this thesis.

3.1 Algorithmic errors

Algorithms include: -Exposure -White Balance -Focus -Coding/Encoding —Many things in here

3.1.1 Blockiness

-Fixed framerate vs. non fixed framerate -Too low bitstream -how it is seen

3.1.2 Blurr

-shutter speed -Fixed framerate vs. non fixed framerate

3.1.3 Blink

-Exposure jumping

3.1.4 Motion smoothness

3.1.5 Jaggy edge

-bitstream, codec -how it is seen/detected

3.1.6 Frame drop

-Jitter -Jerkiness

3.1.7 Sound Sync

-

3.1.8 Moiré-effect

3.1.9 Aliasing

3.2 Hardware erros

3.2.1 Noise

Noise

Temporal noise sources

-Reset noise -Thermal noise -1/f noise -dark current shot noise -quantization noise
-phase noise

Spatial noise sources

-dark fixed-pattern noise -PRNU -leakers -defect pixels -cosmetic defects

3.2.2 Frame drop

-also SW error

3.2.3 Jellyness

-Ois and corners

3.2.4 CMOS and CCD sensor

-Noise from sensors -Temporal noise -Rolling shutter -Wobble -Skew -Smear -
Partial exposure

Testing citing [5]

addign cites to get them visible in the end [9] [22] [10] [1] [12] [21] [18] [20]
[13] [15] [17] [6] [11] [2] [19] [14] [3] [8] [4]

4. DIFFERENT TESTING METHODS

4.1 State of art in Video testing

Most widely used methods are PSNR and MSE [4] Benefits *Easy to calculate, easy to compare Minuses *Correlation with visible errors low sometimes

4.1.1 Reference testing

4.1.2 Non-Reference testing

TODO: find more watermark based studies and compare them ie: “A no-reference video quality assesment method based on digital watermarking” Model where watermark is added to video and the idea is that after the video os gone trough the modification pipeline(algorithms, compressions etc) that once the watermark is extracted from result video the degeneration is about the same that it would be for the actual video. [2]

4.1.3 Objective testing

[4]

4.1.4 Subjective testing

<http://www.its.bldrdoc.gov/resources/video-quality-research/standards/objective-models.aspx>

This is the main thingy also other can be used for ie. [7]

Human visual system *Spatial response *Temporal response *Masking [4]

The history of video quality model validation [16]

5. PRACTICAL EXAMPLE OR COMPARISON OF METHODS

Here we might have some kind of practical example or comparison of state of the art methods

5.1 Foo Bar

6. CONCLUSIONS AND FUTURE WORK

And here we have the grand conclusions. What ever they might be.

KIRJALLISUUTTA

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A. LIITTEITÄ