



TAMPEREEN TEKNILLINEN YLIOPISTO

JANNE EETU KORHONEN
VIDEO TESTING IN MOBILE DEVICES

Diplomityö

Tarkastaja: Ireneusz Defee Tarkastaja 1
Tarkastaja ja aihe hyväksytty
xxxxxxx tiedekuntaneuvoston
kokouksessa xx.xx.xxxx

TIIVISTELMÄ

TAMPEREEN TEKNILLINEN YLIOPISTO

xxxxxxxxxxxxx koulutusohjelma

TEKIJÄN NIMI: Otsikko

Diplomityö, xx sivua, x liitesivua

Xxxxxxkuu 201x

Pääaine:

Tarkastajat:

Avainsanat:

Ensimmäinen kappale

Toinen kappale

ABSTRACT

TAMPERE UNIVERSITY OF TECHNOLOGY

Master's Degree Programme in xxxxxxx Technology

AUTHOR : Title

Master of Science Thesis, xx pages, x Appendix pages

xxxxxx 201x

Major:

Examiner:

Keywords:

First paragraph

Second paragraph

ALKUSANAT

Tämä (*d-tyo.tex*) on L^AT_EX-pohja Tampereen teknillisen yliopiston opinnäytetöitä varten. Samaan pakettiin kuuluu myös tiedosto *tutthesis.cls*, joka sisältää taittoteknisiä lisäyksiä L^AT_EX:n alkuperäiseen *report.cls*-luokkatiedostoon.

Lisäksi otsikkosivua varten tarvitaan tiedosto *tty-logo.xxx*, jonka tulee sisältää TTY:n logo. Tiedoston tulee olla joko *.eps*- tai *.pdf*-muodossa riippuen L^AT_EX-versiosta.

SISÄLLYS

1. Introduction	1
2. Mobile Device	2
2.1 What is mobile device	2
2.1.1 Restrictions of mobile device	2
2.2 Mobile device testing	2
2.2.1 Driver level	2
2.2.2 Middleware	2
2.2.3 User Interface	2
2.2.4	2
3. Theory of Video testing	3
3.1 Algorithmic errors	3
3.1.1 Blockiness	3
3.1.2 Blurr	3
3.1.3 Blink	3
3.1.4 Motion smoothness	3
3.1.5 Jaggy edge	3
3.1.6 Frame drop	4
3.1.7 Sound Sync	4
3.1.8 Moiré-effect	4
3.1.9 Aliasing	4
3.2 Hardware erros	4
3.2.1 Noise	4
3.2.2 Frame drop	4
3.2.3 Jellyness	4
3.2.4 CMOS and CCD sensor	4
4. Different testing methods	5
4.1 State of art in Video testing	5
4.1.1 Reference testing	5
4.1.2 Non-Reference testing	5
4.1.3 Objective testing	5
4.1.4 Subjective testing	5
5. Practical example or comparision of methods	6
5.1 Foo Bar	6
6. Conclusions and future work	7
A. LiitteitÄ	11

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.

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 [8] [22] [9] [1] [11] [21] [18] [20]
[12] [15] [17] [6] [10] [2] [19] [13] [3] [7] [4] [14]

4. DIFFERENT TESTING METHODS

4.1 State of art in Video testing

4.1.1 Reference testing

4.1.2 Non-Reference testing

4.1.3 Objective testing

4.1.4 Subjective testing

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

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

- [1] S. Chikkerur, V. Sundaram, M. Reisslein, and L.J. Karam. Objective video quality assessment methods: A classification, review, and performance comparison. *Broadcasting, IEEE Transactions on*, 57(2):165–182, June 2011.
- [2] M.C.Q. Farias, S.K. Mitra, and M. Carli. Video quality objective metric using data hiding. In *Multimedia Signal Processing, 2002 IEEE Workshop on*, pages 464–467, Dec 2002.
- [3] Yuan Fei and Cheng En. Temporal information detection for video quality evaluation. In *Wireless Networks and Information Systems, 2009. WNIS '09. International Conference on*, pages 38–41, Dec 2009.
- [4] Yuan Fei, Huang LianFen, and Yao Yan. An improved psnr algorithm for objective video quality evaluation. In *Control Conference, 2007. CCC 2007. Chinese*, pages 376–380, July 2007.
- [5] R. Ferzli and L.J. Karam. A no-reference objective image sharpness metric based on the notion of just noticeable blur (jnb). *Image Processing, IEEE Transactions on*, 18(4):717–728, April 2009.
- [6] F.F.E. Guraya, A.S. Imran, Yubing Tong, and F.A. Cheikh. A non-reference perceptual quality metric based on visual attention model for videos. In *Information Sciences Signal Processing and their Applications (ISSPA), 2010 10th International Conference on*, pages 361–364, May 2010.
- [7] C. Keimel, J. Habigt, C. Horsch, and K. Diepold. Video quality evaluation in the cloud. In *Packet Video Workshop (PV), 2012 19th International*, pages 155–160, May 2012.
- [8] Tao Liu, G. Cash, Wen Chen, Chunhua Chen, and J. Bloom. Real-time video quality monitoring for mobile devices. In *Information Sciences and Systems (CISS), 2010 44th Annual Conference on*, pages 1–6, March 2010.
- [9] Tsung-Jung Liu, Kuan-Hsien Liu, and Hsin-Hua Liu. Temporal information assisted video quality metric for multimedia. In *Multimedia and Expo (ICME), 2010 IEEE International Conference on*, pages 697–701, July 2010.
- [10] N. Lukic, D. Kukolj, M. Pokric, Z. Marceta, M. Temerinac, and V. Zlokolica. Content based video quality assessment platform. In *Engineering of Computer Based Systems, 2009. ECBS-EERC '09. First IEEE Eastern European Conference on the*, pages 93–99, Sept 2009.

- [11] N.D. Narvekar and L.J. Karam. A no-reference image blur metric based on the cumulative probability of blur detection (cpbd). *Image Processing, IEEE Transactions on*, 20(9):2678–2683, Sept 2011.
- [12] K.S. Ni, Z.Z. Sun, and N.T. Bliss. Real-time global motion blur detection. In *Image Processing (ICIP), 2012 19th IEEE International Conference on*, pages 3101–3104, Sept 2012.
- [13] T. Oelbaum, C. Keimel, and K. Diepold. Rule-based no-reference video quality evaluation using additionally coded videos. *Selected Topics in Signal Processing, IEEE Journal of*, 3(2):294–303, April 2009.
- [14] V. Ojansivu, O. Silven, and R. Huotari. A technique for digital video quality evaluation. In *Image Processing, 2003. ICIP 2003. Proceedings. 2003 International Conference on*, volume 3, pages III–181–4 vol.2, Sept 2003.
- [15] S. Paulikas. Estimation of video quality of h.264/avc video streaming. In *EUROCON, 2013 IEEE*, pages 694–700, July 2013.
- [16] M.H. Pinson, N. Staelens, and A. Webster. The history of video quality model validation. In *Multimedia Signal Processing (MMSP), 2013 IEEE 15th International Workshop on*, pages 458–463, Sept 2013.
- [17] M. Saad, A. Bovik, and C. Charrier. Blind prediction of natural video quality, 2014.
- [18] M.A. Saad, A.C. Bovik, and C. Charrier. Dct statistics model-based blind image quality assessment. In *Image Processing (ICIP), 2011 18th IEEE International Conference on*, pages 3093–3096, Sept 2011.
- [19] N. Vercammen, N. Staelens, A. Rombaut, B. Vermeulen, and P. Demeester. Extensive video quality evaluation: A scalable video testing platform. In *Computer and Information Technology, 2008. ICCIT 2008. 11th International Conference on*, pages 91–97, Dec 2008.
- [20] Long Xu, King Ngi Ngan, Song Nan Li, and Lin Ma. Video quality metric for consistent visual quality control in video coding. In *Signal Information Processing Association Annual Summit and Conference (APSIPA ASC), 2012 Asia-Pacific*, pages 1–7, Dec 2012.
- [21] Yan Yang, Xiangming Wen, Wei Zheng, LeLin Yan, and Ajing Zhang. A no-reference video quality metric by using inter-frame encoding characters. In *Wireless Personal Multimedia Communications (WPMC), 2011 14th International Symposium on*, pages 1–5, Oct 2011.

- [22] Junyong You, J. Korhonen, and A. Perkis. Attention modeling for video quality assessment: Balancing global quality and local quality. In *Multimedia and Expo (ICME), 2010 IEEE International Conference on*, pages 914–919, July 2010.
- [23] YouTube. Statistics. <http://www.youtube.com/yt/press/statistics.html>, January 2014. Accessed 31.1.2014.

A. LIITTEITÄ