



**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY**

Evaluation of Quality Retaining Diagnostic Credibility for Surgery Video Recordings

Mikołaj Leszczuk
(with Mariusz Duplaga,
Zdzisław Papier, Artur Przelaskowski)

**Faculty of Electrical Engineering, Automatics, Computer Science and
Electronics
Department of Telecommunications**

Salerno, 2008-09-12

Plan of Presentation

- Introduction
- Subjective and Objective Evaluation of Lossy Codecs
 - Subjective Evaluation of a Reference Codec
 - Objective Evaluation of a Reference Codec
 - Objective Evaluation of Other Codecs
- Results of Codec Evaluation
- Summary and General Conclusions

Introduction

- Significant potential behind platforms allowing to access digital video
- Lossy codecs – serious danger of impermissible influence on diagnosis
- *"It is possible to use lossy compressed images and video sequences for diagnostic purposes provided the compression has not introduced any quality impairment visible to a panel of physicians"*
- Targeting video-bronchoscopy



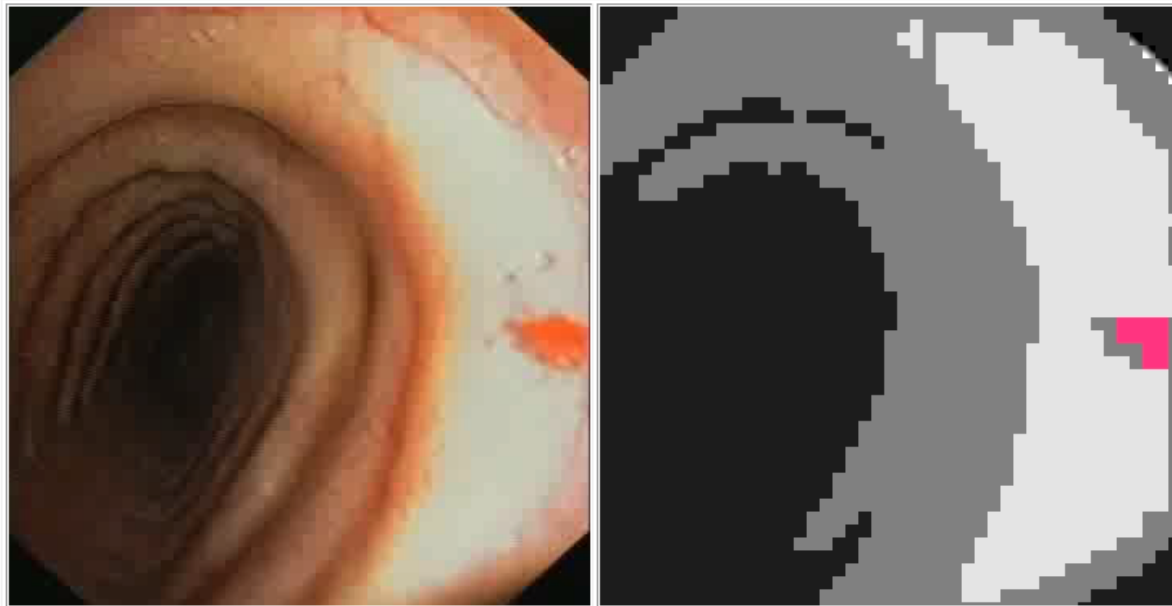
Subjective and Objective Evaluation of Lossy Codecs

1. To specify maximum Compression Ratio (CR_{max}) still yielding in visually lossless compression for some selected, reference video codec using subjective evaluations supported by physician panel
2. To specify numerically corresponding objective distortion metrics for same video sequence compressed with reference codec at CR_{max}
3. To estimate CR_{max} values for other codecs under consideration at same objective distortion values as for reference codec

Subjective Evaluation of a Reference Codec

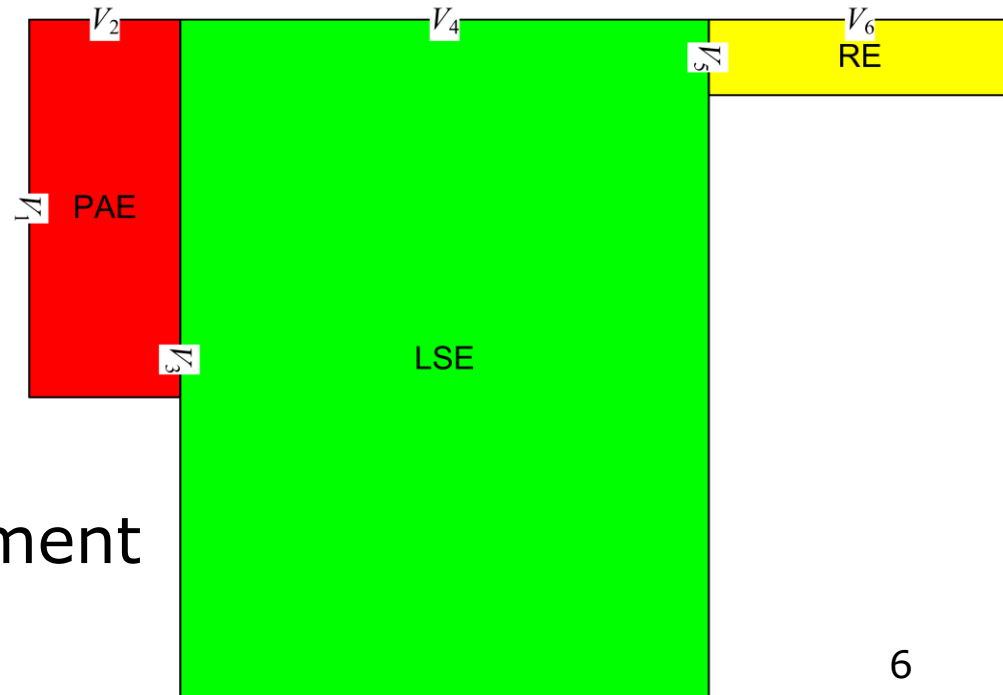
- Subjective quality-based, bubble sorting
- Indiscernible videos => diagnostic features
- 3 MPEG-4 video sequences, 8 CRs
- Group of physicians

Please click on "Play" in order to play videos. Please select the better quality video by clicking on it.



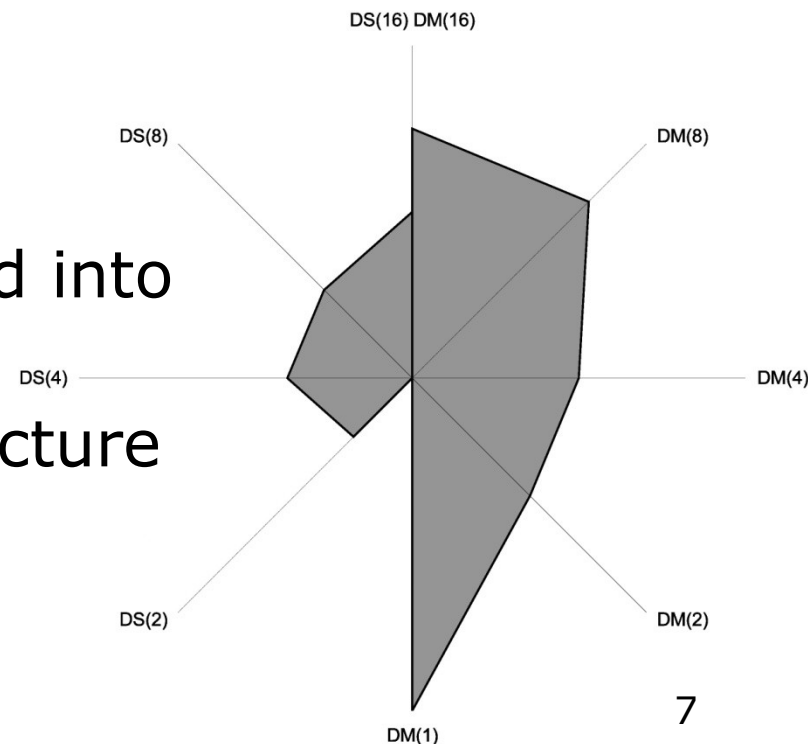
Objective Evaluation of a Reference Codec – Hybrid Vector Measure (HVM)

- Optimized with a subjective tests
- Strong correlation with diagnostic value of medical images previously proved
- Vector of 6 coefficients measuring various image depreciations
- 3×2 grouping
 - Point Accuracy Errors
 - Local Structured Errors
 - Random Errors
- Σ of areas = impairment



Objective Evaluation of a Reference Codec – Hosaka Plots

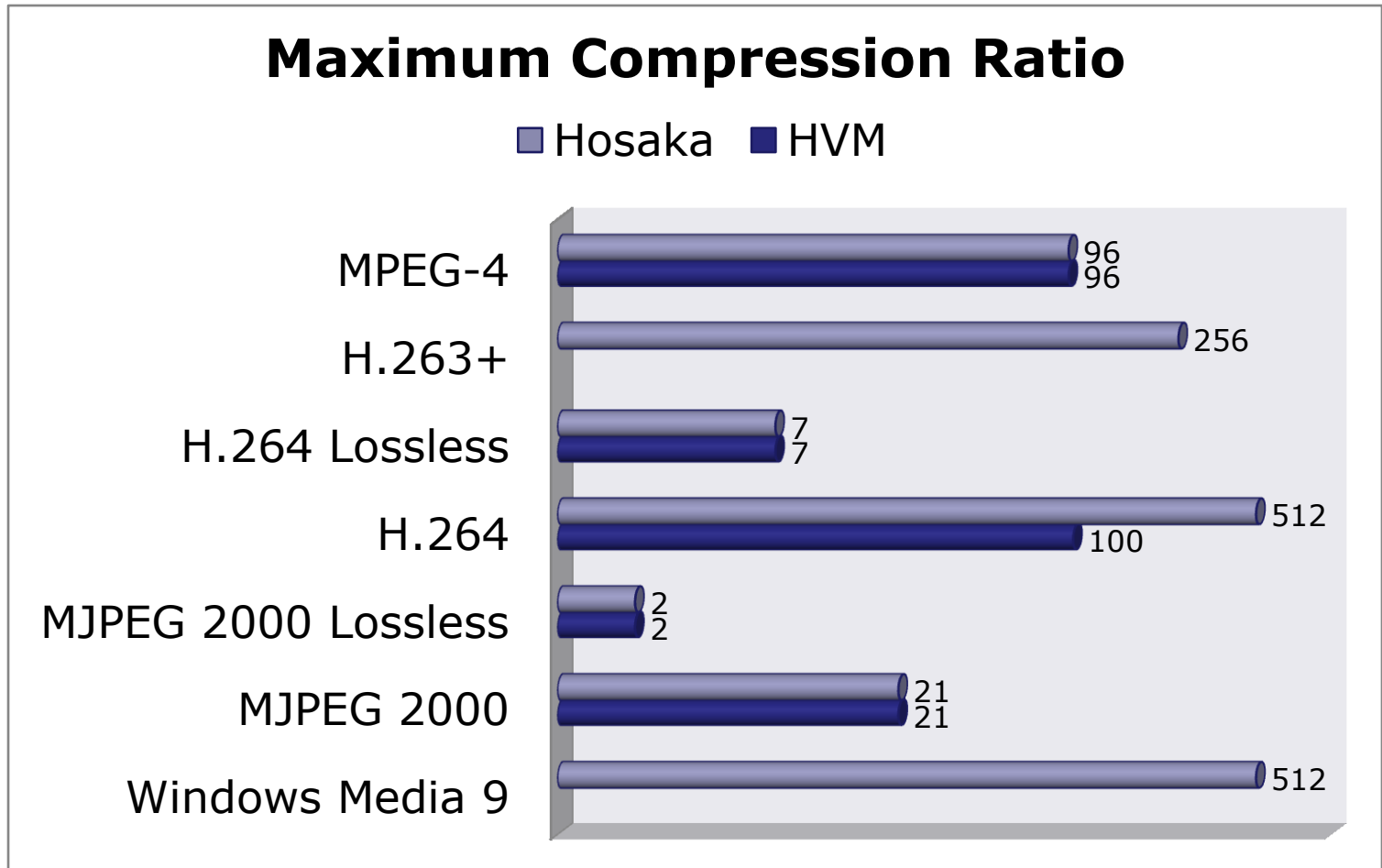
- Non-medical metric
- Not optimized for medical images
- Delivering polygon:
 - Fidelity of intensity reconstruction
 - Additive noise
- In pixel blocks divided into size groups
- Area = measure of picture impairment



Objective Evaluation of Other Codecs

- Modern video codecs chosen
 - H.263+
 - H.264
 - Lossless
 - Lossy
 - MJPEG 2000:
 - Lossless
 - Lossy
 - Windows Media Video 9
- Repeated objective tests for these codecs
- CR changed until HVM (all coefficients) and Hosaka metrics reach ones obtained for MPEG-4

Results of Codec Evaluation



Summary and General Conclusions

- Possible to effectively compress long-lasting and slow motion video sequences
- Preserving their diagnostic features
- Methodology applicable for and extendable into recording of other type of endoscopic procedures
 - Low level of motion
 - Long-lasting videos

Thank you for your attention
leszczuk@agh.edu.pl

Acknowledgments



- The work was supported by Ministry of Science and Higher Education (Grants: 3T11D01727, N517438833)
- The authors thank panel of physicians from Jagiellonian University for evaluation efforts