3D Video Formats and Coding Standards

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Overview 3D Video

• Introduction, scenarios, requirements

• 3D video formats

• 3D coding standards

• Towards a new 3D video coding standard
3D Video Introduction

- Provision of left and right eye view
- Added depth sensation
- Resolved 2D viewing ambiguity
- Additional features (e.g. free viewpoint, depth-controlled object insertion)

→ 3D Video is more than adding 1 dimension to 2D!

Source: Philips
3D video scenarios

3D cinema
• Increasing number of 3D productions
• First studios start to release all productions also in 3D
• Technology: stereoscopic 3D, glasses based

3D home entertainment
• Different types of displays available: stereoscopic, auto-stereoscopic with 2 … $N$ views
• Various technologies, input formats and display sizes
• Glasses based systems may not be acceptable

3D mobile
• auto-stereoscopic 2 view display with fixed viewing position
• Good 3D viewing in spite of small display sizes
Requirements: 3D processing chain

Capture

Post-processing

Production Format

Transport Format

Coding

Transport Format

View Synthesis

Display Format

Display

- Stereo / multiview capturing, depth provision
- Production format specification (e.g. SMPTE)
- Rectification, color correction, format conversion
- 3D format specification
- 3D video coding (e.g. MPEG)
- High quality intermediate view synthesis (e.g. 2 view + 2 depth \(\rightarrow\) N view)
- High-resolution stereo/multiview display
The plethora of 3D Video Formats

- Conventional stereo video (CSV)
- Mixed resolution stereo (MRS)
- Video plus depth (V+D)
- Multiview video (MVV)
- Multiview video + depth (MVD)
- Layered depth video (LDV)
- Depth-enhanced stereo (DES)
assuming multiple views with color & depth...

Image Source: Interactive Visual Media Group of Microsoft Research
Stereo video (CSV)
Mixed resolution stereo (MRS)
Video plus depth (V+D)
Multiview video (MVV)
Multiview video plus depth (MVD)
Layered depth video (LDV)
Depth-enhance Stereo (DES)
3D Video Coding Standard(s)

- Advanced Video Coding (MPEG-4 AVC / H.264)
  - Simulcast
  - Stereo SEI
  - Auxilliary Picture Synthax

- MPEG-C part 3 (container format for V+D, e.g. with AVC coding)

- Multi-view Video Coding (MPEG-4 MVC / H.264)

→ All coding approaches are based on MPEG-4 AVC / H.264 standards family
Towards a new 3D Video Coding Standard

- MPEG develops a new 3D video coding standard

- Motivation for new standard:
  - Decouple production from coding format
  - MPEG-4 AVC/H.264 only optimized for 2D color video, but not for depth information
Coverage of 3D Video Coding

3D components under consideration:
- Transport format
- 3D video coding methods
- Intermediate view synthesis
Constraints for 3DVC

- Consider capturing technology, i.e. maximal 2-3 recorded views
- Break linear dependency of coding bitrate from number of target views (e.g. MVC)
- Provide scene geometry data in general form, i.e. pixel-wise depth data
- Consider statistical properties of depth (and supplementary) data
- Consider new quality evaluation methods for intermediate views
- Provide high-quality view synthesis for continuous viewing range
- Decrease depth and coding errors
Summary

• 3D Video technology is maturing due to world wide development from capturing to display

• Although a variety of 3D/stereo formats exist,…

• …only one underlying coding method with variations is used: MPEG-4/AVC

• For 3D video entertainment, new 3D Video coding beyond AVC/MVC is required and being developed
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