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IEEE Standard for the Perceptual Quality Assessment of Three-Dimensional (3D) and Ultra-High-Definition (UHD) Contents

IEEE Computer Society

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IEEE Std 3333.1.2™-2017

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Abstract: The world is witnessing a rapid advance in stereoscopic 3D (S3D), and ultra-high-definition (UHD) technology. As a result, the need for accurate quality and visual-comfort assessment techniques to foster the display device industry as well as signal-processing area. In this standard, thorough assessments with respect to the human visual system (HVS) for S3D and UHD contents shall be presented. Moreover, several image and video databases are also publicly provided for any research purpose.

Keywords: accommodation and vergence conflict, foveation, human visual system, HVS, IEEE 3333.1.2™, quality assessment, QoE, quality of experience, saliency detection, stereoscopic, stereoscopic display, subjective assessment, UHD, UHD display, ultra-high definition, visual contents analysis, visual comfort, visual discomfort

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Introduction

This introduction is not part of IEEE Std 3333.1.2-2017, IEEE Standard for the Perceptual Quality Assessment of Three-Dimensional (3D) and Ultra-High-Definition (UHD) Contents.

This standard is specifically written for high-end 3D and UHD service purveyors, 3D and UHD display makers, and the 3D digital cinema industry.

History

On 18 February 2011, a project was launched to develop IEEE P.3333.1™, Quality Assessment of Three Dimensional (3D) Contents Based on Psychophysical Studies Working Group (WG), later changed to Human Factors for Visual Experiences Working Group, and a PAR was submitted. The IEEE Standards Association Corporate Advisory Group approved it on 8 March 2011, and the IEEE Standards Association Standards Board approved it by 31 March 2011. On 5 April 2011 the project IEEE P3333.1 was official approved. Finally, the WG called for participation on 27 May 2011. On 29 March 2014, IEEE P3333.1 split in two groups (IEEE P3333.1.1™ and IEEE P3333.1.2™).

IEEE P3333.1.1, IEEE Draft Standard for the Quality of Experience (QoE) and Visual-Comfort Assessments of Three-Dimensional (3D) Contents Based on Psychophysical Studies: the PAR's request date was 6 November 2013, and its approval date was 26 March 2014. This standard establishes methods of visual discomfort and quality-of-experience (QoE) assessments of 3D contents based on psychophysical studies. These key factors are constructed in conjunction with the visual factors used to provide visual discomfort and QoE degradation. On 10 July 2015 the standard was officially published.

IEEE P3333.1.2, IEEE Draft Standard for the Perceptual Quality Assessment of Three-Dimensional (3D) and Ultra-High-Definition (UHD) Contents: the PAR's request date was 6 November 2013, and its approval date was 27 March 2014. Originally, the title was IEEE Draft Standard for the Perceptual Quality Assessment of Three Dimensional (3D) Contents Based on Physiological Mechanisms. However, on 4 March 2016 after being re-approved, the official name of the PAR changed to the current version. This standard establishes methods of quality assessment of 3D and UHD contents based on human visual system analysis, such as perceptual quality and visual attention.

Contents

IEEE Standard for the Perceptual Quality Assessment of Three-Dimensional (3D) and Ultra-High-Definition (UHD) Contents

1. Scope

This standard establishes methods for quality assessment of 3D and UHD contents based on physiological mechanisms such as perceptual quality and visual attention. This standard identifies and quantifies the following causes and visual attention of perceptual quality degradation for 3D and UHD image and video contents:

- Compression distortion, such as multi-view image and video compression
- Interpolation distortion by intermediate-view rendering, such as 3D and UHD warping, view synthesis
- Structural distortion, such as bit errors on wireless/wired transmission errors
- Visual attention according to the quality degradation

Key items are needed to characterize the 3D and UHD database in terms of the human visual system. These key factors are constructed in conjunction with the visual factors used to perceive quality and visual attention.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

Recommendation ITU-P.910, Subjective Video Quality Assessment Methods for Multimedia Applications.[1]

Recommendation ITU-R BT.500-12, Methodology for the Subjective Assessment of the Quality of Television Pictures.

[1] ITU-T publications are available from the International Telecommunications Union (http://www.itu.int/).