The current status report for IEEE 3D Human Factor WG(P3333.1.1/2/3)

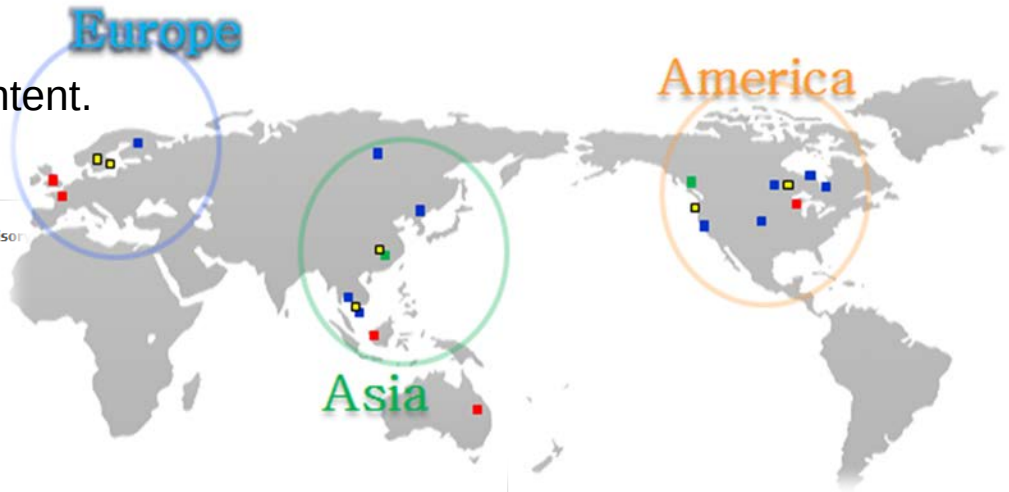
Nov 16, 2018

Chair: Sanghoon Lee, Yonsei University

Secretary: Anh-Duc Nguyen, Yonsei University

3D Human Factor Working Group

http://insight.yonsei.ac.kr/gnuboard/bbs/content.php?co_id=ieee_main



Standard for the Quality Assessment of Three Dimensional (3D) Displays, 3D Contents and 3D Devices based on Human Factors

This project is sponsored by the IEEE-SA Board of Governors/Corporate Advisor

Chair:
Sanghoon Lee

Vice Chair:
Patrick Le Callet

For Information:
P3333.1 WG Secretary

Title:
Standard for the Quality Assessment of Three Dimensional (3D) Displays, 3D Contents and 3D Devices based on Human Factors

Scope:

This standard establishes methods of quality assessment of 3D displays, 3D contents, and 3D devices based on human factors such as photosensitive seizures, motion sickness, and visual fatigue. This standard also identifies and quantifies the following causes of human factors:

viewers' characteristics, such as age, gender, posture, and risk level;

visual contents, such as disparity, camera setting, flicker, frame rate, contrast, luminance, color, and object velocity;

visual environment characteristics, such as light transfer, viewing distance, intensity of illuminance, and viewing freedom;

display characteristics, such as display size, color, resolution, refresh rate, and crosstalk;

devices, such as 3D glasses and 3D cameras.

Working Group History > Entity-based

IEEE-SA PAR submission: Feb. 18, 2011

IEEE-SA CAG approval: Mar. 7 – 8, 2011

IEEE-SASB approval: Mar. 29 – 31, 2011

WG - Call for participation: May. 27, 2011

Type of ballot : Entity

Entity members: LG Electronics, Korea Telecom (KT), Korea Electronics Association (KEA), Huawei, Mitsubishi Electronic, Electronics and Telecommunications Research Institute (ETRI)

- **1st meeting in Seoul (Palace hotel) / June 14, 2011**
- **2nd meeting in Seoul (Palace hotel) / Sep. 6, 2011**
- **3rd meeting in Seoul (Palace hotel) / Dec. 19, 2011**
- **4th meeting in Seoul (KEA) / April, 10, 2012**
- **5th meeting in Seoul (ETRI) / July, 27, 2012**
- **6th meeting in Seoul (Kintex) / Oct. 10, 2012**
- **7th meeting in Seoul (Silconfile) / Jan. 11, 2013**

Working Group History > Indi.-based

Type change of ballot : Entity ➔ Individual (Mar. 6, 2013)

Revised P3333.1.1 & new P3333.1.2 approved : Mar. 27, 2014

Current individual members: 17 nations, 71 members

- (Active) Korea, UK, France, China, Japan, Malaysia, Taiwan

*) For more detailed information, please refer to the WG roster

- 11th meeting in Seoul (TOZ Center) / Dec. 17, 2013
- 12th meeting in Seoul (TOZ Center) / Apr. 16, 2014
- 13th meeting in Seoul (TOZ Center) / Sep. 26, 2014
- 14th meeting in London (Kingston Univ.) / Oct. 31, 2014
- 15th meeting in Seoul (TOZ Center) / Jan. 26, 2015
- 16th meeting in Shanghai (Shanghai Univ.) / Mar. 27, 2015
- 17th meeting in Italy (Torino Incontra) / Jul 3, 2015
- 18th meeting in Seoul (Yonsei Univ.) / Nov 27, 2015.
- 19th meeting in Shanghai (Shanghai Univ.) / Mar 25, 2016.
- 20th meeting in Seoul (Yonsei Univ.) / Oct. 25, 2016.
- 21st meeting in Shenzhen (Tsinghua Univ.) / Dec 02, 2016
- 22nd meeting in Seoul (Yonsei Univ.) / April 3, 2017
- 23rd meeting in Seoul (Yonsei Univ.) / Oct 10, 2017
- 24th meeting in Seoul (Yonsei Univ.) / Apr 9, 2018
- 25th meeting in Seoul (Yonsei Univ.) / Jun 8, 2018

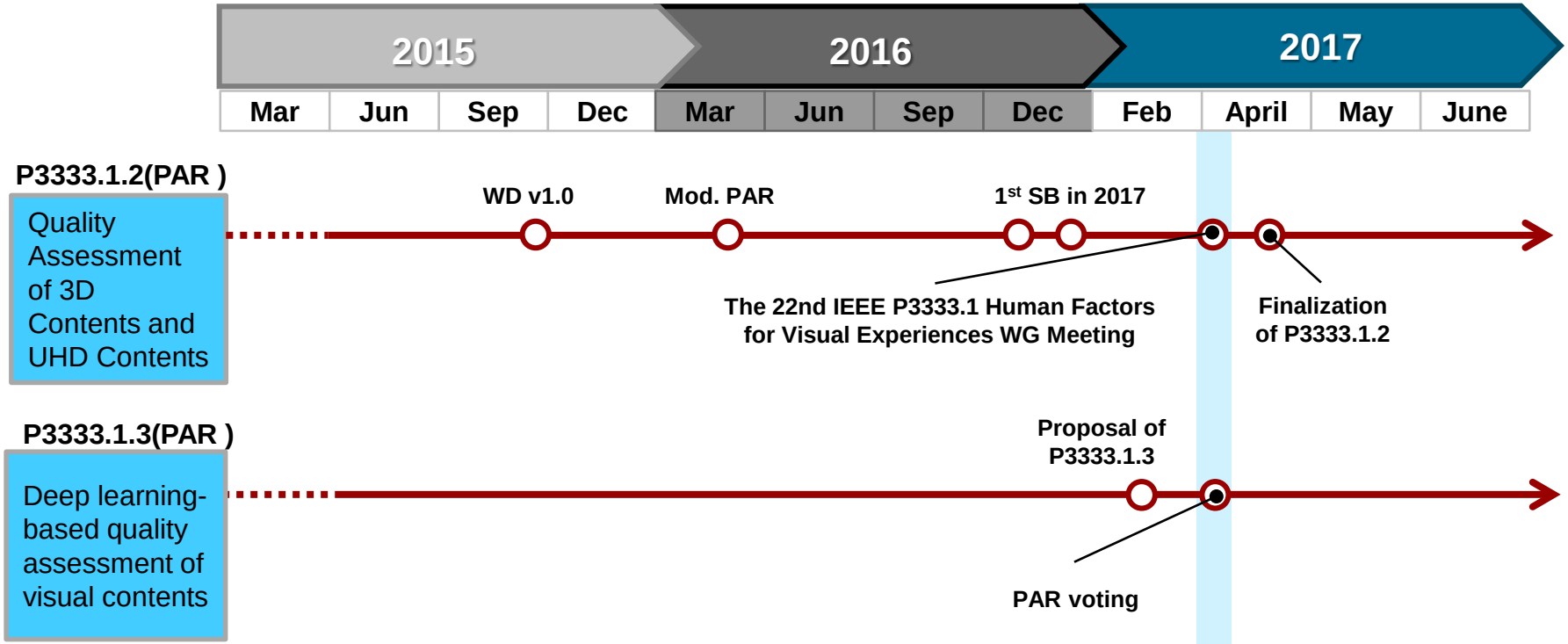
< Kingston London, UK >

< Shanghai, China >

Liaison & Collaboration

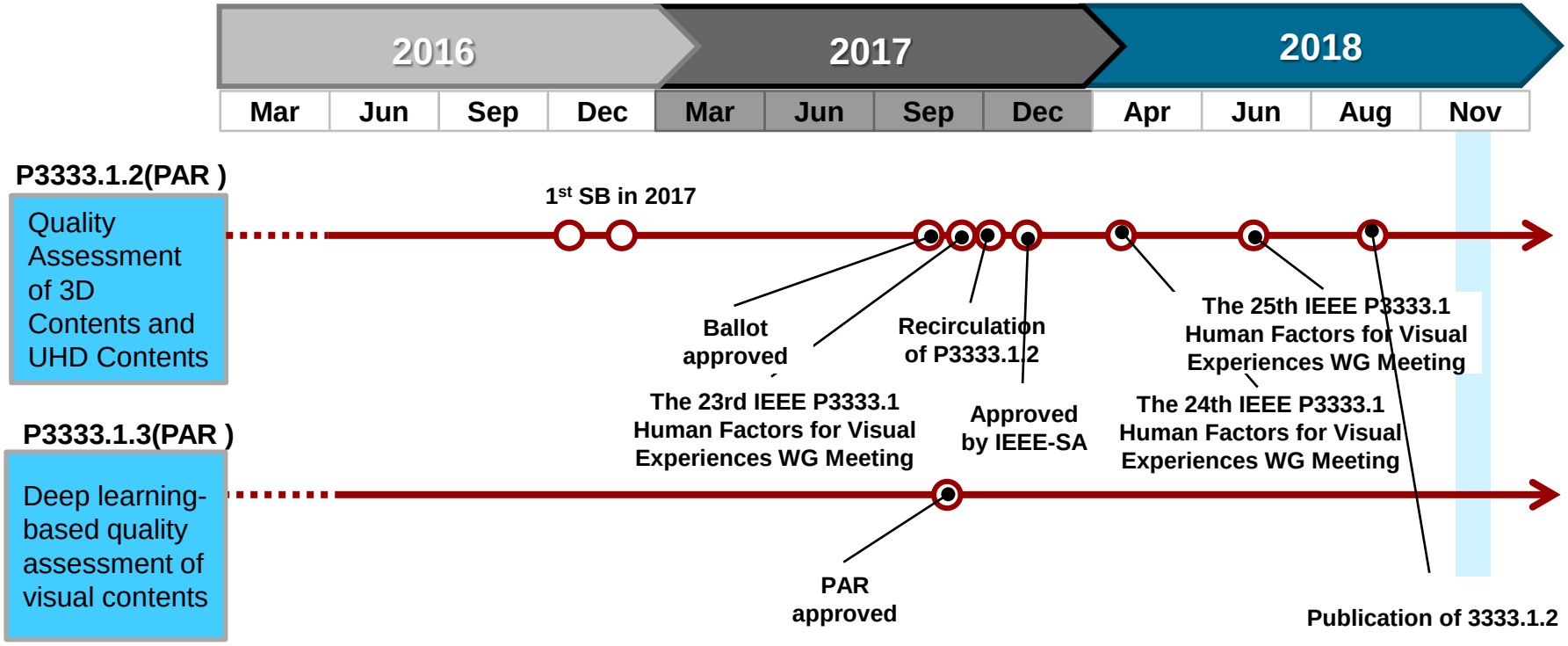
- **IEEE-SA P3333 and ISO/IEC JTC 1/SC 29/WG 11 - (Nov. 7)**
  - Establishment of Category C Liaison
- **Video Quality Expert Group (VQEG) - (Nov. 11, 2011)**
- **ISO-TC 159 WG12 – 3D Quality Assessment**
- **ITU-T SG9**
  - **Subjective assessment methods for 3D video quality**

Roadmap (C/SAB/HFVE_WG)



* WD : Working Draft
SB : Sponsor Ballot Request
AP : IEEE-SASB(RevCom) Approval
PB : Publication
MT : Standards
CfP : Call for PropMaintenanceosal

Roadmap (C/SAB/HFVE_WG)



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Scope Separation of P3333.1(Original)

P3333.1.1

- **Standard for the Quality of Experience (QoE) and Visual Comfort Assessments of Three Dimensional (3D) Contents based on Psychophysical Studies**
  - **Visual saliency prediction method**
  - **Visual contents analysis method**
    - Spatial characteristics of 3D contents
    - Temporal characteristics of 3D contents
  - **Subjective assessment method**
    - Continuous assessment methodology
    - Paired comparison methodology

P3333.1.2

- **Standard for the Perceptual Quality Assessment of Three Dimensional (3D) Contents based on Physiological Mechanisms**
  - **Saliency variation according to the 3D distortions**
  - **Quality assessment based on stereopsis, binocular rivalry and suppression**

Scope Separation of P3333.1(Original)

- **P3333.1.3**
  - **Standard for the deep learning-based assessment of visual experience based on human factors**
  - **Scope**:
    - Establish new deep learning-based metrics of content analysis and quality of experience (QoE) assessment for visual contents which have been partially considered in the previous two projects.
      - Deep learning models for QoE assessment (multilayer perceptrons, convolutional neural networks, deep generative models)
      - Deep metrics of visual experience from HD, UHD, 3D, HDR, VR, MR contents
      - Deep analysis of clinical (EEG, ECG, EOG and so on) and psychophysical (subjective test, SSQ) data for QoE assessment
      - Deep personalized preference assessment of visual contents

Published– P3333.1.1

Root PAR: P3333.1 (31-Mar-2011)

- 2nd revised PAR Approval Date: 27-Mar-2014
- Previous Title: Standard for the Quality Assessment of Three Dimensional (3D) Displays, 3D Contents and 3D Devices based on Human Factors
- Revised Title: **Standard for the Quality Assessment of Three Dimensional (3D) Contents based on Psychophysical Studies**
- Published in **July, 2015**

To be updated– P3333.1.1

Tentative papers

- “Deep Visual Discomfort Predictor for Stereoscopic 3D Images” – Heeseok Oh et al
- "Quality Assessment of Perceptual Crosstalk on Two-view Auto-stereoscopic Displays,“ – Jongyoo Kim et al.

Deep learning-based Stereoscopic 3D-related methods will be updated

Published – P3333.1.2

Request new PAR (06-Nov-2013)

- PAR Approval Date: 27-Mar-2014
- PAR Expiration Date: 31-Dec-2018
- Original title: **Standard for the Perceptual Quality Assessment of Three Dimensional (3D) Contents based on Physiological Mechanisms**
- Revised title: **Standard for the Perceptual Quality Assessment of Three Dimensional (3D) and Ultra High Definition (UHD) Contents**

Published – P3333.1.2

- **Current Status of WD**
  - **Common idea**: Image quality assessment metrics for 3D and UHD images

	Stereoscopic 3D	UHD

Metric	● FR-IQA (Cyclopean + FSIM-like) - Shanghai Univ.
	  ● Cyclopean image -> Gradient, Phase congruency,
	  ● Disparity
	● RR-IQA (SSIM-like) - Kingston Univ.
	  ● Luminance, Contrast,
	  ● Fused edge
	  ● Real-time
	● Spatial Pooling - Yonsei Univ.
	  ● Stereopsis / Binocular rivalry / binocular suppression
	  ● Saliency / foveation
	● IQA - Univ. of Rome
	  ● Synthesized images for multi-view
	● IQA – Tsinghua Univ
	  ● IQA model based on depth distortion
		● Sharpness assessment – Yonsei Univ.
		  ● Perceptual resolution (Viewing geometry)
		  ● DFT based local sharpness
		● UHD image preference assessment – Yonsei Univ.
		  ● Features of visual preference
		  ● Visual preference assessment model

DB	● Packet loss – Kingston Univ.
	  ● Quality
	  ● Discomfort, etc.
	● Stereoscopic images plus depth - Tsinghua Univ
	  ● Quality assessment	

To be updated – P3333.1.2

	Stereoscopic 3D	2D/HD/UHD

Metric	• FR-IQA (Cyclopean + FSIM-like) - Shanghai Univ.
	  • Cyclopean image -> Gradient, Phase congruency,
	  • Disparity
	• RR-IQA (SSIM-like) - Kingston Univ.
	  • Luminance, Contrast,
	  • Fused edge
	  • Real-time
	• Spatial Pooling - Yonsei Univ.
	  • Stereopsis / Binocular rivalry / binocular suppression
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		  • Perceptual resolution (Viewing geometry)
		  • DFT based local sharpness
		• UHD image preference assessment – Yonsei Univ.
		  • Features of visual preference
		  • Visual preference assessment model
		• 2D Image/Video quality assessment – Univ. of Texas at Austin
		  • SSIM/MS-SSIM
		  • VIF
		  • MOVIE
		  • NIQE
		  • SpEED-QA
		• 2D video quality assessment– Univ. of Southern California
		  • Objective Video Quality Assessment Based on Perceptually Weighted Mean Squared Error

DB	• Packet loss – Kingston Univ.
	  • Quality
	  • Discomfort, etc.
	• Stereoscopic images plus depth - Tsinghua Univ
	  • Quality assessment	

Approved project – P3333.1.3

- **PAR : P3333.1.3 approved on Sep 28, 2017**
  - **Title :**Standard for the deep learning-based assessment of visual experience based on human factors
  - **Scope :**
    - Establish new deep learning-based metrics of content analysis and quality of experience (QoE) assessment for visual contents which have been partially considered in the previous two projects.
      - Deep learning models for QoE assessment (multilayer perceptrons, convolutional neural networks, deep generative models)
      - Deep metrics of visual experience from HD, UHD, 3D, HDR, VR, MR contents
      - Deep analysis of clinical (EEG, ECG, EOG and so on) and psychophysical (subjective test, SSQ) data for QoE assessment
      - Deep personalized preference assessment of visual contents
  - **Available at** https://development.standards.ieee.org/get-file/P3333.1.3.pdf?t=94649700003

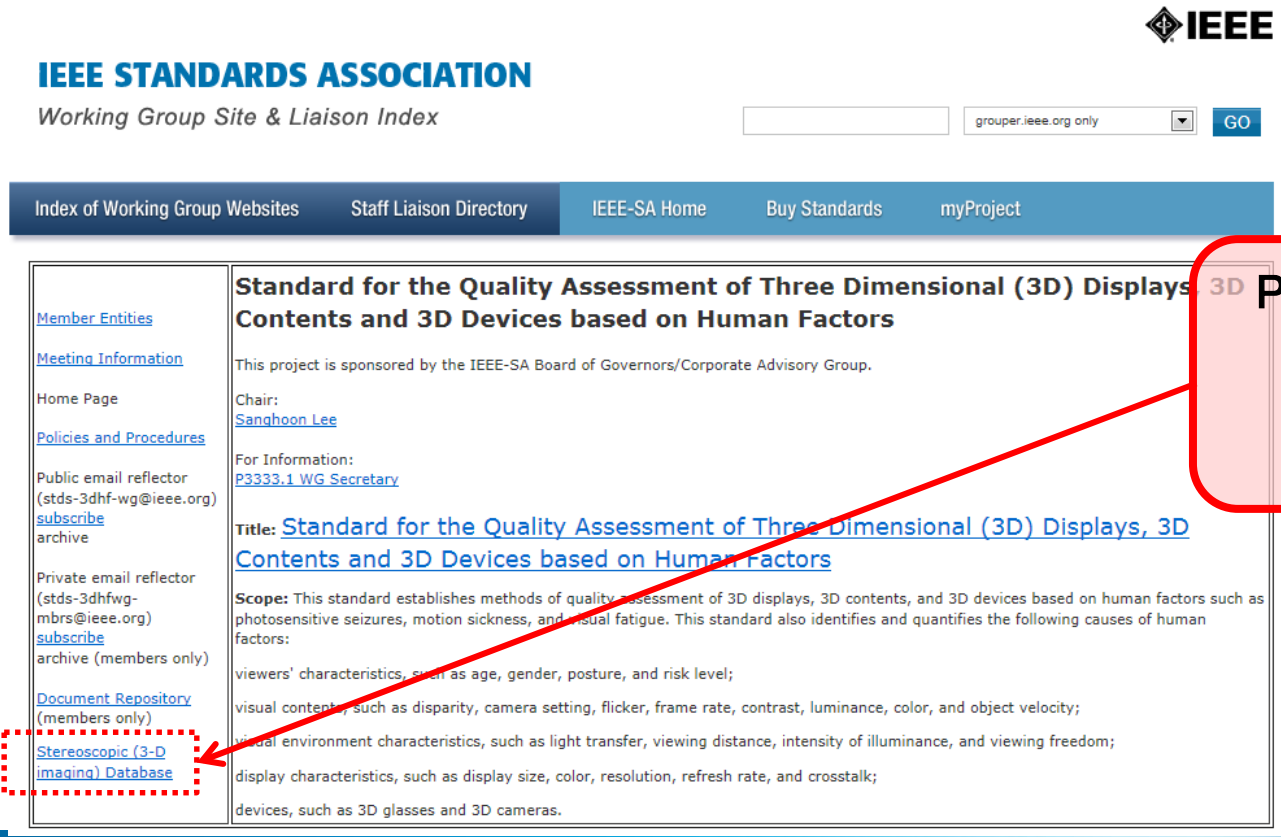
Modified PAR – P3333.1.3

- **PAR : modified P3333.1.3**
  - **Title :** Standard for the quality of experience assessment for AR, VR and MR based on human factors
  - **Scope :**
    - This standard defines quality of experience (QoE) metrics for Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR), which is an extension of P3333.1.1 (Standard for the Quality of Experience (QoE) and Visual-Comfort Assessments of Three-Dimensional (3D) Contents Based on Psychophysical Studies) and P3333.1.2 (Standard for the Perceptual Quality Assessment of Three Dimensional (3D) and Ultra High Definition (UHD) Contents). The scope covers the followings.
      - Quality assessment metrics of visual experience from AR, VR, MR.
      - Visual saliency detection on VR/AR/MR contents
      - Sickness and Presence assessment metrics of VR/AR contents based on human factor.
      - The hardware solutions for VR/AR sickness in terms of latency, display resolution, field of view (FoV), eye tracking.
      - Building new databases for performance benchmarking purpose if necessary

3D Video Database Construction

Database Server

- http://grouper.ieee.org/groups/3dhf/



Please click on the 'Stereoscopic (3-D imaging) Database' link.

Stereo Image Database

26 indoor and outdoor natural scenes with FHD size

Five types of distortion with five levels

① JPEG compression
② JP2000 compression
③ Additive white Gaussian noise
④ Gaussian blur
⑤ Transmission distortion over a fast-fading model

Totally, 650 (26 x 25) pairs

Next meeting schedule

- **The 26th IEEE P3333.1 Human Factors for Visual Experiences WG & P3333.1 Meeting**
  - Date : Dec, 2018
  - Location: Yonsei University, Seoul, Korea.
  - Subject :
    - P3333.1.3 scope revision