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Information technology — Computer graphics, image processing and environment data representation — Object/environmental representation for image-based rendering in virtual/mixed and augmented reality (VR/MAR)

Technologies de l'information — Infographie, traitement d'images et représentation des données environnementales — Représentation d'objets/environnements pour l'habillage à partir d'images réelles dans la réalité virtuelle/mixte et augmentée (VR/MAR)

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions and abbreviated terms **1**
3.1 Terms and definitions 1
3.2 Abbreviated terms 2
4 Domain and concepts **2**
4.1 General 2
4.2 Domain 2
4.3 Concepts 3
4.4 Basic components 4
4.4.1 General 4
4.4.2 Image set 4
4.4.3 3D model 5
4.4.4 3D model — Image set integration 6
4.4.5 XML based object model 6
5 Image-based representation usage example **8**
5.1 General 8
5.2 Image-based rendering 8
5.3 Multi-object representation 9
6 Conformance **9**
6.1 Objective 9
6.2 Minimum requirements 10
Annex A (informative) **Working example of the proposed information model** **11**
Bibliography **15**

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Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 24, *Computer graphics, image processing and environmental data representation*.

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Introduction

As virtual reality (VR) and augmented reality (AR) expand to applications in entertainment and education industries, many methods of augmenting reality to virtual space have been developed. Because of this expansion, the technology of capturing and representing objects in real environments is in high demand.

One of the proposed methods of capturing the real world is image-based representation. Image-based representation is a technique that can be used in various applications that require 3D model rendering at an arbitrary viewpoint, including virtual reality, augmented reality and video stabilization. Since image-based representation is a predominant alternative to using 3D models in the growing VR/MAR market, due to its realism, scalability, accuracy and efficiency, creating a standard for image-based representation is required.

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Information technology — Computer graphics, image processing and environment data representation — Object/environmental representation for image-based rendering in virtual/mixed and augmented reality (VR/MAR)

1 Scope

This document specifies an image-based representation model that represents target objects/environments using a set of images and optionally the underlying 3D model for accurate and efficient objects/environments representation at an arbitrary viewpoint. It is applicable to a wide range of graphic, virtual reality and mixed reality applications which require the method of representing a scene with various objects and environments.

This document:

— defines terms for image-based representation and 3D reconstruction techniques;

— specifies the required elements for image-based representation;

— specifies a method of representing the real world in the virtual space based on image-based representation;

— specifies how visible image patches can be integrated with the underlying 3D model for more accurate and rich objects/environments representation from arbitrary viewpoints;

— specifies how the proposed model allows multi-object representation;

— provides an XML based specification of the proposed representation model and an actual implementation example (see Annex A).

2 Normative references

There are no normative references in this document.

3 Terms and definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
camera parameter
extrinsic/external and intrinsic/internal attribute value of a (virtual or real) camera that describes the mathematical relationship between the 3D coordinates of a point in the world space and the 2D coordinates of its projection onto the image space

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3.1.2
image patch
set of connected pixels of an image that has the same visibility information

Note 1 to entry: Image patch is synonymous to image.

3.1.3
tessellation
process of dividing a face into sub-faces using sub-sampled vertices to attain enhanced visibility detection

3.1.4
viewpoint
rotation and position with respect to the reference coordinate system that determines visible parts of a 3D model in a representation system

Note 1 to entry: "Viewpoint" is different from "Camera (parameters)" in that it only includes the camera position and pose, where as the "Camera" has more information such as the internal *camera parameters* (3.1.1) including the focal length, field of view, near/far planes and skew parameters.

3.1.5
virtual image
image at an arbitrary *viewpoint* (3.1.4) that is generated by collecting visible photo information from real images

3.1.6
world reference frame
coordinate reference frame used to express positions/orientations of the camera, 3D models and other objects for a given scene

3.2 Abbreviated terms

IBR image-based rendering

XML extensible markup language

XSD XML schema definition

4 Domain and concepts

4.1 General

This clause describes the domain and key concepts. This includes the domain of image-based representation of objects/environments and overall description of its details.

4.2 Domain

Geometric and optionally photometric information is essential when representing target objects/environments as is done in ISO/IEC 19775-1. In this document, an alternative representation method, image-based, is pursued in which the objects/environments are represented only using the photogrammetric information (e.g. set of images and other related information) and optionally the underlying 3D geometric information.

Therefore, the image-based representation of objects/environments first requires a set of images and their photogrammetric information of the target objects/environments taken at various locations, and the 3D model represented using vertices and faces and the association between these two (if needed). Figure 1 shows the overall scene as represented a set of images (below), which have association to the 3D model (top). Note that with photogrammetric information alone, it is possible to render the target objects/environments from an arbitrary viewpoint by using and blending the sampled images around.

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