International Standard

ISO/IEC 16466

First edition
2025-08

Information technology — 3D printing and scanning — Assessment methods of 3D scanned data use in 3D printing

Reference number
ISO/IEC 16466:2025(en)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

ISO and IEC draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO and IEC take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO and IEC had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents and https://patents.iec.ch. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

This document was developed in response to the need for quality management of 3D printing and scanning technology through the use of information and communication technology (ICT).

3D scanning is the process of scanning a real-world object or environment to collect data on its shape and possibly its style attributes. The main purpose of 3D scanning is for generating high-precision digital 3D models.

A 3D scanner can be based on many different technologies, each with its own purposes and targets, limitations, and advantages. There could be many limitations in each type of target object that will be digitized. For example, optical technology often encounters many difficulties with dark, shiny, reflective, or transparent objects. Another example, as for computed tomography scanning, structured-light 3D scanners, and LiDAR technology, the generation of digital 3D models requires the use of non-destructive internal scanning technology.

Despite the rapid growth of 3D scanning applications, the accuracy, precision and reproducibility of generated 3D models from 3D scanned data have not been thoroughly investigated. Especially if 3D scanned data are used for 3D printing, their accuracy and precision are critical. Inaccuracies can arise due to errors that occur during the imaging, segmentation, postprocessing, and 3D printing steps. The total accuracy, precision, and reproducibility of 3D printed models are affected by the sum of errors introduced in each step involved in the creation of the 3D models.

For the spreading of 3D printing applications, it is necessary to review and evaluate the various factors in each step of the 3D model printing process that contribute to 3D model inaccuracy, including the intrinsic limitations of each printing technology.

In this context, it is important to evaluate the overall process of data processing. In order to minimize cumulative errors throughout the 3D printing life cycle using 3D scanned data, it is important to evaluate and correct initial errors. By identifying and addressing these initial inaccuracies, the impact of errors occurring during the 3D printing process can be greatly reduced. In addition, the method used to evaluate 3D scan data for 3D printing is also essential.

There are many algorithms for 3D scanned data such as semi-automatic segmentation, deformable model-based segmentation, and Convolutional Neural Network based segmentation. There are several well-known errors during image-based modelling of Region of Interest (ROI), which are over segmentation, under segmentation, outlier, inaccurate contour, and malalignment. Even though there are more than twenty metrics for evaluating 3D image segmentation, there is no consistent definition of metrics and suitable combination of assessment metrics for 3D printing.

Segmentation assessment is the task of comparing two segmentations by measuring the distance or similarity between them, where one is the segmentation to be assessed and the other is the corresponding ground truth segmentation.

There are three major requirements (accuracy, precision, and efficiency) of assessment for 3D scanned data. Accuracy is the degree to which the segmentation results agree with the ground truth segmentation. Precision is a measure of repeatability. Efficiency is mostly related with time.

This document proposes assessment methods for 3D scanned data to evaluate and enhance the quality of 3D printing models while minimizing errors.