International Standard

ISO 17097

First edition

3-D human body scan data — Methods for the processing of human body scan data

Données de numérisation 3D du corps humain — Méthodes relatives au traitement des données de numérisation du corps humain

PROOF/ÉPREUVE

Reference number
ISO 17097:2024(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) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 ISO 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes 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 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. ISO 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.

This document was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 3, *Anthropometry and biomechanics*.

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.

Introduction

Three-dimensional (3-D) human body scan data are the digitized 3-D shape information of the human body in the form of a point cloud. 3-D body scanners or 3-D image-capturing systems are used to obtain these data. The collected 3-D point-cloud data are processed using 3-D scan data processing software and then used for anthropometric measurement, body shape analysis and ergonomic product design.

Knowledge and experience in the processing and analysis of 3-D point-cloud and mesh are required to improve the quality of human body scan data while maintaining their morphological characteristics for their application to the design of a particular product, workplace or system. Custom software can be developed to support the processing of human body scan data by incorporating terms, methods and considerations in this document in a selective manner.

This document is intended to be used by software developers during the development of scan data processing software. It could also be helpful for anthropometric researchers and product designers when they establish 3-D human body scan databases to analyse human body shape and size. A 3-D human body scan database could benefit manufacturers, customers and employees by developing products, workplaces and systems with better fit, comfort and usability.

The purpose of this document is to enhance the utilization of 3-D human body scan data through appropriate processing. It is further intended to improve the accuracy and reliability of analysis of 3-D human body scan data.

3-D human body scan data — Methods for the processing of human body scan data

1 Scope

This document specifies methods for the processing of human body scan data acquired using a 3-D body scanner.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7250-1, *Basic human body measurements for technological design — Part 1: Body measurement definitions and landmarks*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7250-1 and the following 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 3-D anthropometry

3.1.1
3-D body scanner
hardware and software system that creates data representing a human form, or parts thereof, in three dimensions

[SOURCE: ISO 20685-1:2018, 3.2, modified — "creates digital data" has been replaced by "creates data" in the definition.]

3.1.2
3-D scanner hardware
physical components of a 3-D body scanner and any associated computer(s)

[SOURCE: ISO 20685-1:2018, 3.4]

3.1.3
3-D scanner software
operating system, user interface, programs, algorithms and instructions associated with a 3-D scanning system

[SOURCE: ISO 20685-1:2018, 3.3]

3.1.4
anatomical landmark
point clearly defined on the body that can be used for defining anthropometric measurements

[SOURCE: ISO 20685-1:2018, 3.6]

3.2 3-D scan data

3.2.1
3-D scan data
collection of the coordinate values of either 3-D points or the connection information of the 3-D points, or both

3.2.2
***x*, *y*, *z* coordinate system**
axis system
system for measuring the body with respect to the standing or sitting human where *x*, *y* and *z* refer to the fore-and-aft direction (the sagittal axis), the side-to-side direction (the transverse axis) and the top-to-bottom direction (the longitudinal axis), respectively

[SOURCE: ISO 20685-1:2018, 3.13, modified — the content of the definition has been restructured and Note 1 to entry has been removed.]

3.2.3
point cloud
collection of 3-D points in space referenced by their coordinate values

Note 1 to entry: See Table 1.

Table 1 — Point cloud consisting of *n* 3-D points

Point index	Column 1 (*x*-coordinate)	Column 2 (*y*-coordinate)	Column 3 (*z*-coordinate)
1	2,56	−21,94	91,31
2	2,69	−20,89	90,01
3	2,11	−22,83	92,84
⋮	⋮	⋮	⋮
n − 2	−28,57	−17,08	−27,89
n − 1	−9,69	−19,81	−29,03
n	−19,92	−9,61	−33,74

[SOURCE: ISO 20685-1:2018, 3.9, modified — Note 1 to entry has been replaced and Table 1 has been added.]

3.2.4
texture
visual information of colour in 3-D scan data

Note 1 to entry: The texture of each point is expressed as a value between 0 and 255 for the individual colours of red, green and blue, as shown in Table 2, in the .ply file format.

Table 2 — Point cloud consisting of *n* points with texture information

Point index	Column 1 (*x*-coordinate)	Column 2 (*y*-coordinate)	Column 3 (*z*-coordinate)	Column 4 (red)	Column 5 (green)	Column 6 (blue)
1	2,56	−21,94	91,31	127	127	127
2	2,69	−20,89	90,01	123	133	138
3	2,11	−22,83	92,84	92	97	215
⋮	⋮	⋮	⋮	⋮	⋮	⋮
n − 2	−28,57	−17,08	-27,89	238	200	210
n − 1	−9,69	−19,81	-29,03	255	230	243
n	−19,92	−9,61	-33,74	255	255	255

3.2.5
vertex
node
intersection of two or more lines, curves or edges

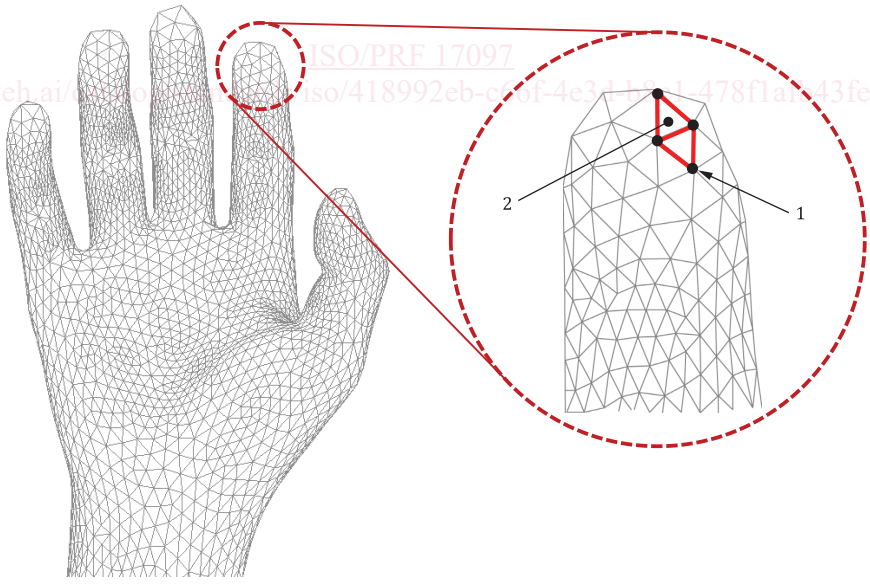
3.2.6
triangle face
surface (face) created by connecting three adjacent vertices

3.2.7
mesh
surface consisting of a set of vertices, edges and faces that define the shape of an object

Note 1 to entry: A triangular mesh consisting of a set of triangle faces (each of which is defined by the indices of three vertices, as shown in Table 3) is used to construct the 3-D digital form of the human body, as shown in Figure 1.

Table 3 — 3-D scan data presented by a triangular mesh with *m* triangle faces

Triangle face index	Column 1 (point index of the first vertex)	Column 2 (point index of the second vertex)	Column 3 (point index of the third vertex)
1	1	2	3
2	1	2	4
3	1	3	5
⋮	⋮	⋮	⋮
m − 2	8 345	8 346	8 347
m − 1	8 347	8 348	8 349
m	8 347	8 348	8 350



Key
1 vertex
2 triangle face

Figure 1 — 3-D human scan data in triangle faces

3.3 Processing of 3-D human scan data

3.3.1
point-cloud processing
manipulation of point cloud and texture data acquired by 3-D scanner hardware by applying operations such as merging, noise removal, meshing, resolution adjustment and texture mapping

3.3.2
mesh processing
manipulation of a mesh by applying operations such as hole filling, merging, smoothing, mesh subdivision, decimation, remesh, landmarking, alignment and template matching

3.3.3
resolution
density of vertices and triangle faces that consist of 3-D scan data

4 Methods for point-cloud processing

4.1 General

A point cloud obtained by scanning the human body shall be processed by one or more of the following operations: [11],[17],[19],[40],[46]

— registration (4.2);

— merging (4.3);

— denoising (4.4);

— adjustment of point-cloud resolution (4.5);

— meshing (4.6);

— texture mapping (4.7);

— saving of mesh (4.8).

NOTE The point-cloud processing operations are performed automatically or semi-automatically by 3-D scanner software or manually by using 3-D scan data processing software while following a general procedure of point-cloud processing, as shown in Figure 2.