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Recommendation

ITU-T F.748.40 (10/2024)

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Technical specification for artificial intelligence cloud platform: Data annotation

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Recommendation ITU-T F.748.40

Technical specification for artificial intelligence cloud platform: Data annotation

Summary

Recommendation ITU-T F.748.40 provides technical requirements for data annotation capabilities for artificial intelligence (AI) cloud platforms. This Recommendation could support the construction and operation of such platforms by providing general user guidelines.

History *

Edition	Recommendation	Approval	Study Group	Unique ID
1.0	ITU-T F.748.40	2024-10-29	16	11.1002/1000/16189

Keywords

Annotation tool, artificial intelligence, data annotation.

* To access the Recommendation, type the URL https://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID.

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Introduction

The importance of data annotation is gaining attention due to its role in improving the training of algorithmic models. Therefore, it is very important to evaluate the capability of data annotation. This proposal outlines the general requirements for the data annotation capabilities of AI cloud platforms, that can help industry players analyse and optimize their products, while also assisting users in building and selecting products that meet these requirements.

Recommendation ITU-T F.748.40

Technical specification for artificial intelligence cloud platform: Data annotation

1 Scope

This Recommendation is part of the series of technical specification for artificial intelligence cloud platforms and provides functional requirements for the data annotation section of the AI cloud platform. From the perspective of the entire AI data annotation process, this Recommendation mainly focuses on the data annotation capabilities that help both users and product parties to understand the level of annotation ability.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

None.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 artificial intelligence [b-ISO/IEC 22989]: Research and development of mechanisms and applications of AI systems.

3.1.2 dataset [b-ISO/IEC 22989]: Collection of data with a shared format.

3.1.3 data annotation [b-ISO/IEC 22989]: Process of attaching a set of descriptive information to data without any change to that data.

3.1.4 label [b-ISO/IEC 22989]: Target variable assigned to a sample.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

3D Three-dimensional

AAC Advanced Audio Coding

AI Artificial Intelligence

API Application Programming Interface

AVI Audio Video Interleave

BMP Bitmap

COCO	Common Objects in Context Dataset
CSV	Comma-Separated Values
FLAC	Free Lossless Audio Codec
FLV	Flash Video
GIF	Graphics Interchange Format
HLS	HTTP Live Streaming
JPG	Joint Photographic Group
JSON	JavaScript Object Notation
MKV	Matroska Video File
MOV	QuickTime File Format
MP3	MPEG-1or MPEG-2 Audio Layer III
MP4	MPEG-4 Part 14
PCD	Point Cloud Data
PLY	Polygon File Format
PNG	Portable Network Graphics
PTS	Pro Tools Session
RAR	Roshal Archive
RTMP	Real-Time Messaging Protocol
RTSP	Real Time Streaming Protocol
SDK	Software Development Kit
STL	STereoLithography
TAR	Tape Archive
TAR.GZ	Tarball Gzip
TIFF	Tagged Image File Format
TXT	Text File
VOC	Visual Object Classes Challenge
WAV	Waveform Audio File Format
XLS	Excel Spreadsheet
XML	Extensible Markup Language
YOLO	You Only Look Once
ZIP	Zipped File

5 Conventions

In this Recommendation:

− The keywords "**is required to**" indicate a requirement that must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

− The keywords "**is recommended to**" indicate a requirement that is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

6 Technical specification for artificial intelligence (AI) cloud platform-data annotation

The process of data annotation is mainly divided into data input, data annotation (manual annotation methods or intelligent annotation methods), and data delivery. There are different annotation tools for different data types. At the same time, production management guarantees the capability of the entire data annotation process. The standard organizes the callout functions involved in these steps.

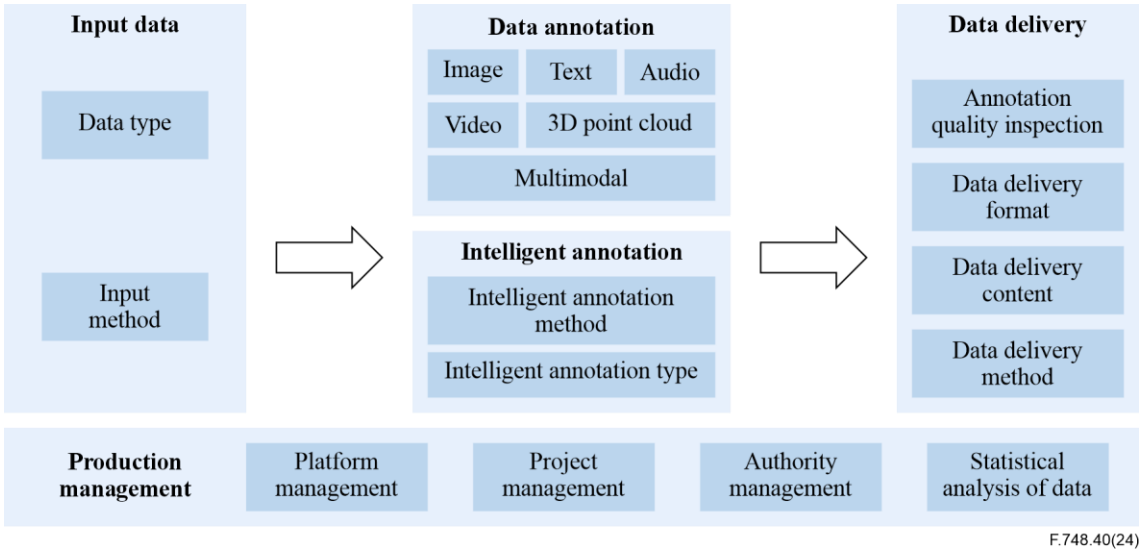

Figure 1 – Artificial intelligence data annotation framework

6.1 Input data

6.1.1 Data type

a) The platform is required to support the import of data, including the following categories:

i) Image: portable network graphics (PNG), joint photographic group (JPG), bitmap (BMP), tagged image file format (TIFF), graphics interchange format (GIF).

ii) Text: text file (TXT), JavaScript object notation (JSON), extensible markup language (XML), comma-separated values (CSV).

iii) Audio: waveform audio file format (WAV), MPEG-1or MPEG-2 audio layer III (MP3), advanced audio coding (AAC), free lossless audio codec (FLAC).

iv) Video: MPEG-4 Part 14 (MP4), audio video interleave (AVI), QuickTime file format (MOV), matroska video file (MKV).

v) three-dimensional (3D) point cloud: polygon file format (PLY), STereoLithography (STL), point cloud data (PCD), pro tools session (PTS).

vi) Multimodal: e.g., data fused by image and 3D point clouds.

b) The platform is recommended to support the import of the labelled data, and common datasets such as COCO (common objects in context dataset), VOC (visual object classes challenge), and YOLO (you only look once).

6.1.2 Data input mode

a) The platform is required to support the import of data as offline methods, where pre-generated data can be accessed as single or in batches, including:

i) **Upload files**: files, folders.

ii) **Archive files**: zipped file (ZIP), tape archive (TAR), tarball gzip (TAR.GZ), roshal archive (RAR).

iii) **Data sources**: object storage, file storage, database.

b) The platform is required to support the import of data as online methods, which can continuously access the data generated in real-time in the form of streams, including application programming interface (API), software development kit (SDK), and other real-time video streaming protocols, such as real time streaming protocol (RTSP), http live streaming (HLS), real-time messaging protocol (RTMP), and flash video (FLV).

6.2 Data annotation

6.2.1 Image data annotation

a) The platform is required to provide annotation tools to support the annotation of image data, including:

i) Annotation tools to support outline point or key point annotation on images.

ii) Annotation tools to support line annotation on images, such as polylines, table lines.

iii) Annotation tools to support region annotation on images, such as bounding boxes, polygons, ellipses.

iv) Annotation tools to support 3D frames annotation on images.

v) Annotation tools to support pixel-level segmentation of images.

vi) Annotation tools to support attribute annotation of images, such as the license plate, brands, and categories of a car.

b) The platform is recommended to provide aid tools to support the annotation of image data:

i) Aid tools to improve the efficiency of image annotation, e.g., keyboard shortcuts.

ii) Aid tools to improve the flexibility of image annotation, such as segmentation and cutting capabilities when annotating polygonal images.

iii) Aid tools to improve the accuracy of image annotation, e.g., zoom.

6.2.2 Text data annotation

a) The platform is required to provide annotation tools to support the annotation of text data:

i) Annotation tools to support the labelling of text data, e.g., attributes.

ii) Annotation tools to support intervals annotation of text data.

iii) Annotation tools to support relational annotation of text data.

iv) Annotation tools to support instruction fine-tuning annotation of text data.

b) The platform is recommended to provide aid tools to support the annotation of text data:

i) Aid tools to improve the efficiency of text annotation, e.g., keyboard shortcuts.

ii) Aid tools to improve the flexibility of text annotation, such as providing functions to modify attributes and global attributes.

iii) Aid tools to improve the accuracy of text annotation, e.g., text comparison.

6.2.3 Audio data annotation

a) The platform is required to provide annotation tools to support the annotation of audio data, including:

i) Annotation tools to support the annotation of single-paragraph audio.

ii) Annotation tools to support the annotation of multi-paragraph continuous audio.

iii) Annotation tools to support the annotation of multi-paragraph discontinuous audio.

b) The platform is recommended to provide aid tools to support the annotation of audio data:

i) Aid tools to improve the efficiency of audio annotation, e.g., keyboard shortcuts.

ii) Aid tools to improve the flexibility of audio annotation, such as providing play, pause, fast forward, fast backward.

iii) Aid tools to improve the accuracy of audio annotation, such as providing functions to view and manage the annotated audio.

6.2.4 Video data annotation

a) The platform is required to provide annotation tools to support the annotation of video data, including:

i) Annotation tools to support video data, such as annotating outline points, key points, polylines, table lines, bounding boxes, polygons, ellipses, and attributes.

ii) Annotation tools to support intervals annotation of video data.

b) The platform is recommended to provide aid tools to support the annotation of video data:

i) Aid tools to improve the efficiency of video annotation, e.g., keyboard shortcuts.

ii) Aid tools to improve the agility of video annotation, such as play, pause, navigate to a video frame, and move a video frame forward or backward.

iii) Aid tools to improve the accuracy of video annotation, such as the ability to view and manage annotated videos.

6.2.5 3D point cloud data annotation

a) The platform is required to provide annotation tools to support the annotation of 3D point cloud data, including:

i) Annotation tools to support the annotation of 3D point cloud data, such as outline points, key points, polylines, table lines, bounding boxes, polygons, ellipses and attributes.

ii) Annotation tools to support intervals of 3D point cloud data labelling in consecutive frames.

b) The platform is recommended to provide aid tools to support the annotation of 3D point cloud data:

i) Aid tools to improve the efficiency of 3D point cloud annotation, e.g., keyboard shortcuts.

ii) Aid tools to improve the flexibility of 3D point cloud annotation, such as providing functions to drag, rotate and modify cubes.

iii) Aid tools to improve the accuracy of 3D point cloud annotation, e.g., the ability to switch between different view options.

6.2.6 Multimodal data annotation

a) The multimodal data refers to data consists of two or more modalities. The platform is required to provide annotation tools to support the annotation of multimodal data, including:

i) Annotation tools to support multimodal single-frame annotation, such as outline points, key points, polylines, table lines, bounding boxes, polygons, ellipses, and relationships.

ii) Annotation tools to support multimodal cross-frame annotation, e.g., interval annotation.

iii) Annotation tools to support instruction fine-tuning annotation of multimodal data.

b) The platform is recommended to provide aid tools to support the annotation of multimodal data:

i) Aid tools to improve the efficiency of multimodal data annotation, e.g., keyboard shortcuts.

ii) Aid tools to improve the agility of multimodal data annotation, such as provide functions to drag, rotate, and modify bounding boxes.

iii) Aid tools to improve the accuracy of multimodal data annotation, e.g., provides the function of mapping the relationship between different modalities of data.

6.3 Intelligent annotation

6.3.1 Intelligent annotation method

a) Intelligent annotation is the process of automatically completing labelled data using artificial intelligence technology. The platform is required to provide intelligent annotation, including:

i) **Pre-annotation**: refers to providing corresponding labelling models according to the task type.

ii) **AI-assisted annotation**: refers to providing the functions that users only need to complete part of the annotation task, and the platform completes the remaining task based on the AI method e.g., active learning.

iii) **Human-machine collaboration**: refers to the platform providing algorithms to filter a certain percentage of essential data, users annotate these data, and then train AI models. The remaining labelling task would be done by the trained AI models.

iv) **Intelligent quality review**: refers to evaluating the quality of annotation by AI models.

v) **Management of intelligent annotation capabilities**: refers to the management of the above intelligent annotation capabilities, such as adding, editing, deleting.

6.3.2 Intelligent annotation type

a) The platform is required to provide images intelligent annotation and texts intelligent annotation.

b) The platform is recommended to provide audio, video, and 3D point cloud intelligent annotation.

6.4 Data delivery

6.4.1 Annotation quality inspection

a) The platform is required to provide the inspection of annotation quality including:

i) **Multi-data type**: refers to the platform providing the inspection including image, text, audio, and video data.

ii) **Multi-method**: refers to providing at least two quality inspection methods, such as full inspection and sampling inspection.

b) The platform is recommended to provide intelligent quality inspection, such as automatically evaluating the confidence level of data annotation by using relative algorithms.

c) The platform is recommended to provide a quality inspection report.

6.4.2 Data delivery format

a) The platform is required to provide data annotation results delivery formats, including:

i) **Label data**: JSON, XML, TXT.

ii) **Structured label data**: CSV, Excel spreadsheet (XLS).

6.4.3 Data delivery content

a) The platform is required to deliver original data and labelled data.

b) The platform is required to provide a description of the delivery data set, such as data source, data label distribution, and version management.

c) The platform is recommended to provide description information of the annotation process, such as abandonment rate, verification pass rate, inspection pass rate, annotation work duration, and work efficiency.

6.4.4 Data delivery method

a) The platform is required to provide offline data delivery, such as ZIP, and TAR.

b) The platform is required to provide online data delivery, such as API, and RTSP.

6.5 Production management

6.5.1 Platform management

a) The platform is required to provide basic operations for user management, such as user login authentication, adding, editing, and deleting.

b) The platform is recommended to provide platform-based communication modules, such as message push, notification management, problem reporting, and email alerts.

6.5.2 Project management

a) The platform is required to provide the management capabilities, including:

i) **Management of annotation tasks**: creation, query, editing, deleting.

ii) **Management of annotation tools**: configuration of tools, label attribute.

iii) **Management of annotation progress**: refers to providing functions that monitor the status.

iv) **Management of priorities**: refers to providing functions that adjust the priority of tasks.

6.5.3 Authority management

a) The platform is required to provide functions that manage permissions based on the role in the annotation task.

6.5.4 Statistical analysis of data

a) The platform is required to provide statistical analysis of tasks and data annotators.

b) The platform is required to provide visualization of various statistical data.

c) The platform is recommended to provide data analysis operations, such as sorting, and filtering.

Bibliography

[b-ISO/IEC 22989] ISO/IEC 22989:2022, *Information technology – Artificial intelligence – Artificial intelligence concepts and terminology*.
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