

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.862.2

(08/2020)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS
E-health multimedia systems, services and applications –
Multimedia e-health data exchange services

**Framework of annotation methods for biosignal
data**

Recommendation ITU-T H.862.2

ITU-T



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Recommendation ITU-T H.862.2

Framework of annotation methods for biosignal data

Summary

Recommendation ITU-T H.862.2 describes the framework of annotation methods for biosignal data. This Recommendation focuses on the method of temporally expressing the occurrence interval of an event generated from a biosignal, and the ontology for label mapping.

In many fields of human factors including healthcare, various types of data are produced by different institutions. In recent years, the use of these data in diagnosis, treatment and health management in the healthcare field has become an important issue. Health data generated from medical sites and individuals contains various types of information about health conditions. To utilize this, a process for annotating the obtained biosignal is required. A unified method of expressing data is needed in order to develop annotations across workers at various institutions. This Recommendation covers the ontology for label mapping.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H.862.2	2020-08-13	16	11.1002/1000/14353

Keywords

Sleep, sleep management services.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

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The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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Recommendation ITU-T H.862.2

Framework of annotation methods for biosignal data

1 Scope

This Recommendation describes the annotation method for biosignal data. The biosignal is temporal data and contains various events related to health. This Recommendation deals with a method of temporally expressing the occurrence interval of an event generated from a biosignal. Events are expressed in terms of incidence time and event labels. Labels can be written differently for different people, and this Recommendation covers the ontology for label mapping to complement it.

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.

[ISO 8601-1] ISO 8601-1:2019, *Date and time – Representations for information interchange – Part 1: Basic rules.*

[ISO 8601-2] ISO 8601-2:2019, *Date and time – Representations for information interchange – Part 2: Extensions.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 biosignal [b-ITU-T X.1094]: Any measurable signal in living beings (physical, chemical or electrical) that can be measured or monitored, such as a ballistocardiogram (BCG), electroencephalogram (EEG), electrocardiogram (ECG) and photoplethysmogram (PPG).

3.2 Terms defined in this Recommendation

This Recommendation defines no terms.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ECG	Electrocardiogram
EDF	European Data Format
EEG	Electroencephalogram
EMG	Electromyogram
EOG	Electrooculography
GSR	Galvanic Skin Response
ICD	International Classification of Diseases

MEG Magnetoencephalogram
SNOMED Systematized Nomenclature of Medicine
UMLS Unified Medical Language System

5 Conventions

In this Recommendation:

- The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.
- The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement needs not be present to claim conformance.
- The keywords "can optionally" and "may" indicate an optional requirement which is permissible, without implying any sense of being recommended. These terms are not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

Tables 2 to 5 use letters O and M to indicate optional and mandatory items, respectively.

6 Introduction

In the healthcare field, various types of data are produced by different institutions. In recent years, the use of these data in diagnosis, treatment and health management in the healthcare field has become an important issue. Health data generated from medical sites and individuals contain various information about health conditions. To utilize this, a process of annotating the obtained biosignal is required. A unified method of expressing data is needed to develop interoperable annotations across workers at various institutions. In the past, annotations were discussed by people at various institutions to agree on how to express and integrate the annotations, or by collecting data from one institution and manually reintegrating the annotations. This Recommendation includes methods for expressing annotations on various biosignal data. Figure 1 shows the general annotation process.

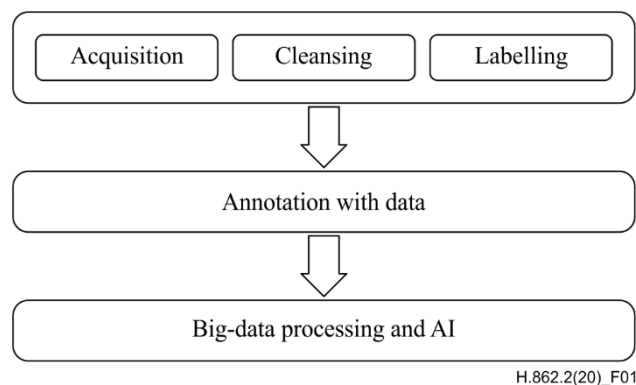


Figure 1 – General biosignal annotation process

7 Biosignals

7.1 Data of biosignals

Biosignals are various signal-based data obtained from the human body and include voice, temperature, ECG, EEG, EMG, etc. Table 1 introduces the well-known biosignals.

Table 1 – Well-known biosignals

Type	Target organ	Representation standards
Electroencephalogram (EEG)	Brain	EDF/EDF+
Electrocardiogram (ECG)	Heart	Annotated ECG (ANSI), DICOM-ECG (DICOM), SPC-ECG ([b-CEN 1064]), MFER ([b-ISO 22077]), EDF/EDF+
Electromyogram (EMG)	Muscle	
Electrooculography (EOG)	Corneo-retinal	
Galvanic skin response (GSR)	Skin	
Magnetoencephalogram (MEG)	Brain	
Voice	Voice	
Pulse	Heart	

7.2 Framework

In order to express the annotation on the signal data, labelling of the annotation is required at the event time of the signal data. For example, patients with arrhythmia do not always show arrhythmia on the ECG. Only the data at the time of the occurrence of the arrhythmia and the data before the occurrence of the arrhythmia signal are highly useful. To express this, accurate annotation of the data is required.

7.2.1 Data components

To express the annotation on the signal data, labelling of the annotation is required at the time of occurrence of the signal data. Figure 2 shows the annotation data structure for biosignals.

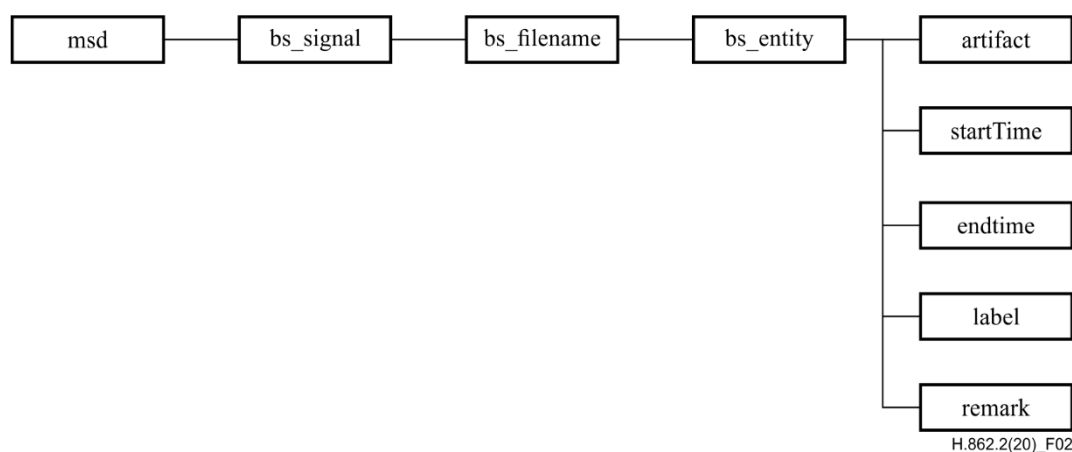


Figure 2 – Data structure for annotation of biosignal data

7.2.1.1 bs_signal

The "bs_signal" consists of "signalDesc" and "bs_dataFile". The "signalDesc" can contain a description of the signal data. The "bs_datafile" is composed of the data of the actual measured signal record as shown in Table 2.

Table 2 – bs_signal element

Item	Description	Data type	O/M
signalDesc	Data description	String	O
bs_datafile	Element of Bio signal data	Complex elements	M

7.2.1.2 bs_datafile

The "bs_datafile" consists of a description of the individual file ("bs_datainfo"), and comments on the actual signal file to be processed as shown in Table 3.

Table 3 – bs_datafile element

Item	Description	Data type	O/M
bs_datainfo	Information of data file	Complex elements	M
bs_entity	Information of annotation	Complex elements	M

7.2.1.3 bs_datainfo

The "bs_datainfo" includes a file name, a data file format for processing the file, and general information of the file as shown in Table 4.

Table 4 – bs_datainfo element

Item	Description	Data type	O/M
fileName	Saved data file name	String	M
fileFormatName	File format	String	M
fileSpec	If the file is not standard format, the structure of the file is described	Complex elements	O
remark	Remark	String	O

7.2.1.4 bs_entity

The "bs_entity" consists of the following elements as shown in Table 5.

Table 5 – bs_entity element

Item	Description	Data type	O/M
artifact	Event for artifact	String	M
startTime	Start time	ISO 8601 (Note)	M
endTime	End time	ISO 8601 (Note)	M
label	Label of target data	String	M
remark	Human readable description	String	O
NOTE – ISO 8601 designates the specifications in [ISO 8601-1] and [ISO 8601-2].			

7.2.2 Annotation mapping with ontologies

The written annotation can be expressed in various ways even with the same content. As a structure for expressing this in an integrated manner, mapping with standard terminology (ICD, SNOMED, UMLS, etc.) based on ontology can be used.

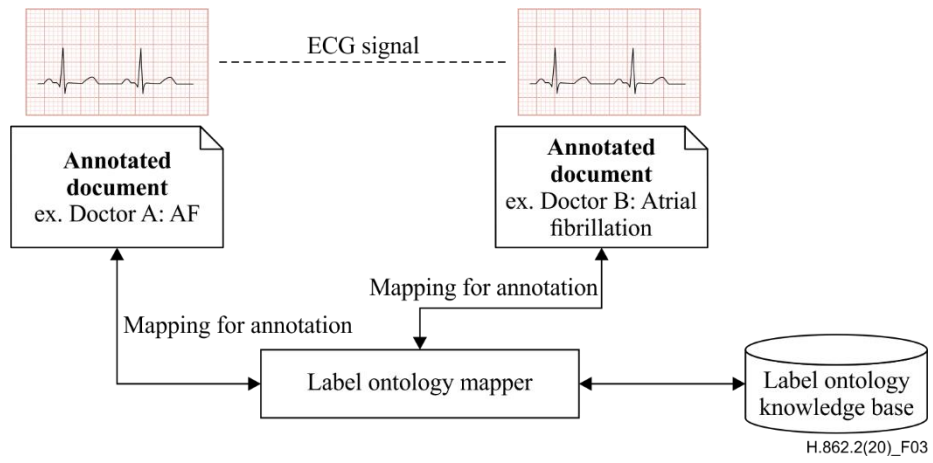


Figure 3 – Annotation mapping with ontologies

Annex A

Annotation schema

(This annex forms an integral part of this Recommendation.)

A.1 XML schema definition for biosignal data annotation

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
<xs:element name="msd">
<xs:complexType>
<xs:sequence>
<xs:element name="bs_signal">
<xs:complexType>
<xs:sequence>
<xs:element name="signalDesc">
<xs:complexType>
<xs:sequence>
<xs:element name="remark" type="xs:string" />
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element maxOccurs="unbounded" name="bs_datafile">
<xs:complexType mixed="true">
<xs:sequence minOccurs="0">
<xs:element name="dataDesc">
<xs:complexType>
<xs:sequence>
<xs:element name="bs_filename" type="xs:string" />
<xs:element name="fileFormat">
<xs:complexType>
<xs:simpleContent>
<xs:extension base="xs:string">
<xs:attribute name="srcStandard" type="xs:string" use="required" />
</xs:extension>
</xs:simpleContent>
</xs:complexType>
</xs:element>
<xs:element name="remark" type="xs:string" />
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</xs:complexType>
</xs:element>
<xs:element maxOccurs="unbounded" name="bs_entity">
<xs:complexType mixed="true">
<xs:sequence minOccurs="0">
<xs:element name="artifact">
<xs:complexType>
<xs:simpleContent>
<xs:extension base="xs:string">
<xs:attribute name="codingSystem" type="xs:string" use="required" />
<xs:attribute name="code" type="xs:string" use="required" />
</xs:extension>
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</xs:complexType>
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```

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</xs:element>  
</xs:sequence>  
</xs:complexType>  
</xs:element>  
</xs:schema>
```

Bibliography

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