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Supporting European Experts Presence in International Standardisation Activities in ICT

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ICT STANDARDS AND ONGOING WORK AT INTERNATIONAL LEVEL IN THE AI FIELD - A LANDSCAPE ANALYSIS

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1.0	11.06.2019	Wolfgang Ziegler	Extended the European priorities with information from D2.2
1.1	25.06.2019	Wolfgang Ziegler	Added information on UN/ITU-T and OECD activities and G20 guidance to chapter 7 and tables 2 & 3

Disclaimer

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Executive Summary of the Report

With this report the StandICT.eu project presents a description of the ICT standards and ongoing work at international level in the field of Artificial Intelligence (AI) and a first analysis of the landscape.

The report identifies 5 Standards Development Organisations (SDOs): IEEE, ISO/IEC, ITU-T, ETSI and CEN-CENELEC. The first 4 bodies are active in AI standardisation at the time of writing this report. CEN-CENELEC are planning to launch activities in 2019.

For these 4 SDOs information on their active groups, details of their work and the respective state/outcome is provided in the main part of this report. Followed by the same exercise for the two identified Standards Settings Organisations (SSOs): W3C and IRTF, their active groups and the respective state/outcome.

With this information an initial analysis of the AI standardisation landscape as of the end of 2018 is performed in the next section with the main outcomes that the number of groups chaired by Europeans is significant, that there is room for European experts contributing to ongoing and future standardisation work.

The next sections focus on AI-related related Community and Industrial activities, EC Communication and reports, followed by European projects and platforms that StandICT.eu considers relevant for cooperating.

The report is concluded by considerations on future priorities.

1 Introduction

1.1 Introductory explanation of the report

As described in section 1.3 below the report comprises 9 sections and 2 annexes. The major part of the report is section 0 presenting the ongoing standardisation work, already established standards and other published documents of SDOs and SSOs. Section 0 presents different views and analyses of the AI standardisation landscape as of end of 2018. The following sections provide information on AI related activities, a brief presentation of related communications of the EC and reports, and information on three ongoing European projects StandICT.eu considers relevant in the context of this report.

1.2 Purpose and Scope

The report aims at providing an overview of the standardisation activities in the field of AI. Including with other AI related activities, e.g. other reports, recently launched European projects this document sketches the AI landscape along with an analysis. The report provides a snapshot of the AI related ongoing standardisation activities as of end of 2018. The StandICT.eu project will prepare an updated version of the report based on, e.g., the 2019 Rolling Plan on ICT Standardisation [2] developed with the support of the Multi Stakeholder Platform on ICT Standardisation [3], further publications of the High Level Experts Group on Artificial Intelligence [4], results and publications of European funded projects in the field, like AI4EU [8].

1.3 Structure of the document

The document is organized as follows:

- Section 1 Introduction
- Section 2 Background and Context
- Section 3 Ongoing standardisation work and already established standards
- Section 4 Landscape analysis
- Section 5 Presentation of the ongoing AI-related work of SDOs and SSOs
- Section 6 Community and industrial activities
- Section 7 Communication of the EC and reports
- Section 8 European projects and platforms
- Section 9 Future priorities
- Section 10 Conclusions
- Annex I References
- Annex II Acronyms

1.4 Relationship to other outcomes of the StandICT.eu project

The information regarding SDOs, SSOs, the respective working groups, research groups, documents and standards will be mainly used for (i) shaping the AI topic of future open calls, and (ii) form the base of the AI related part of the Standards Watch web pages of the StandICT.eu project.

1.5 Definitions

For the purposes of the present document, the following definitions will apply:

Standards Setting Organization (SSO):

Any entity whose primary activities are developing, coordinating, promulgating, revising, amending, reissuing, interpreting, or otherwise maintaining specifications and standards that address the interests of a wide base of users outside the standards development organization

Standards Development Organization (SDO):

A Standards Setting Organization that has a formal recognition by international treaties, regulation, etc. In this report the SDOs considered are: IEEE, ETSI, ISO/IEC, ITU-T, CEN-CENELEC.

Note: The SDOs are a subset of the SSOs.

Standards:

A Standard is an output from an SDO.

Specifications:

A Specification is an output from an SSO that may become a standard when ratified by an SDO.

2 Background and Context

The background of this report is the work of the European project StandICT.eu [18] which aims at supporting European experts' contribution to international ICT standardisation activities through grants in to proposals submitted in response to the open calls of the project. While the project started with standardisation in the five priority domains identified as critical for the Digital Single Market (DSM) – Cloud Computing, Big Data, IoT, Cyber Security and 5G – the more comprehensive list of topics from the Rolling Plan for ICT Standardisation was considered more appropriate for achieving the desired impact.

While the project was starting-up it became obvious that the globally emerging application of Artificial Intelligence (AI) needs standardisation to avoid fragmentation and support interoperability.

This report is in the context of the globally spreading use of AI technology providing an overview on ongoing international standardisation and related activities on a European level.

3 Ongoing standardisation work and already established standards

StandICT.eu has created a comprehensive overview on activities of Standards Setting Organisations (SSO) and Standards Developing Organisations (SDO) with activities related to AI. At the time of writing this report five SDOs and 2 SSOs had active groups working on standardisation or related activities.

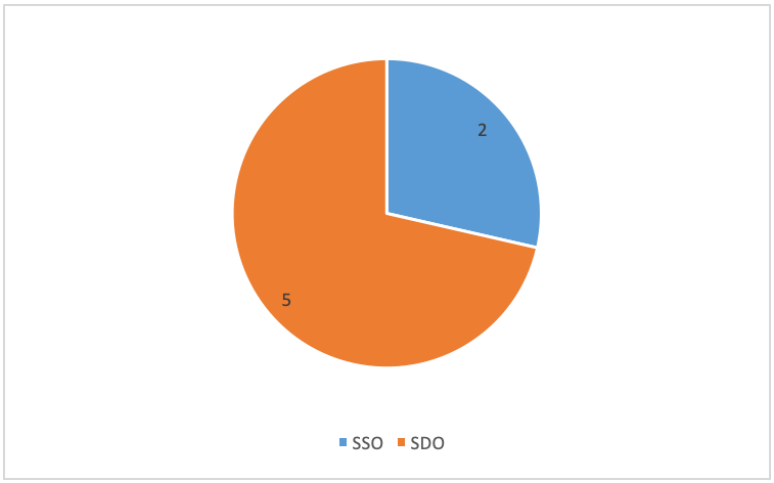

Figure 1: Number of SDOs and SSOs with activities related to AI standardisation

The five SDOs already active in 2018 or starting in 2019 are IEEE, ISO/IEC, ITU-T, ETSI, CEN-CENELEC. A brief description of the respective active groups can be found in section 3.1, details can be found in sections 4.4 (IEEE), 5.2 (ISO/IEC), 5.3 (ETSI) and 5.4 (ITU-T).

The two SSOs with already active groups in 2018 or groups starting in 2019 are W3C and IRTF (the research sister organisation of the IETF). A brief description of the respective active groups can be found in section 3.3, details can be found in section 5.5 (W3C) and 5.6 (IRTF).

In summary, with ETSI and CEN-CENELEC there are 2 European Standards Organisations (ESOs) with ongoing or preparatory activities in the field of AI standardisation out of 5 SDOs in total.

3.1 Standards Development Organisations

End of 2018 5 SDOs have activities related to AI or are in the process to launch related activities: IEEE, ISO/IEC, ITU-T, ETSI, CEN-CENELEC. The following list depicts the number of their respective working groups, study groups, focus groups, community groups, committees and initiatives with activities related to AI standardisation.

Working Groups typically aim at producing standards or other normative documents. Study and Focus Groups are usually dedicated to explore an area and to eventually use the results to create a Working Group. (ISO) Committees host Working Groups and Study Groups working in the same field. (IEEE) Initiatives host different activities dedicated to explore an area and to eventually use the results to create Working Groups. The following sections give a brief overview of the activities per SDO.

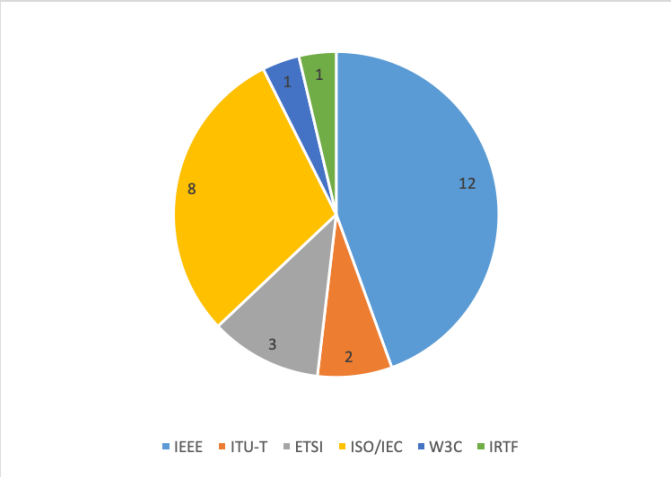

Figure 2: Number of active groups with standardisation or related activities per SDO/SSO

3.1.1 IEEE

End of 2018 in IEEE we can identify 11 working groups each of which is working on a distinct standard. Moreover, IEEE has launched the initiative Symbiotic Autonomous Systems (SAS) which aims at taking the lead in developing the new field of Symbiotic Systems Science, fostering interdisciplinary technology deployments that take into account Ethical, Legal, and Societal considerations, and promoting human-centric economic growth. More working groups may be started from SAS in future.

EMELC-WG - Engineering Methodologies for Ethical Life-Cycle Concerns Working Group (Working Group)

ASV WG_P7001- Autonomous Systems Validation Working Group_P700 (Working Group)

PDP - Personal Data Privacy Working Group (Working Group)

ALGB-WG - Algorithmic Bias Working Group (Working Group)

WG-CSDG - Working Group for Child and Student Data Governance (Working Group)

EDG-WG - Employer Data Governance working group (Working Group)

WG-PDAI - Personal Data AI Agent Working Group (Working Group)

EDARR-wg - WG for the Adoption of: Robots and robotic devices: Guide to the ethical design and application for robots and robotic systems (Working Group)

Ethical Nudging - Working Group for Ethically Driven Nudging for Robotic, Intelligent and Autonomous Systems (Working Group)

Fail-Safe Design - Standard for Fail-Safe Design of Autonomous and Semi-Autonomous Systems (Working Group)

Wellbeing for Ethical AI - Wellbeing Metrics Standard for Ethical Artificial Intelligence and Autonomous Systems (Working Group)

SAS - Symbiotic Autonomous Systems (Initiative)

3.1.2 ISO/IEC

End of 2018 two sub committees with 6 working groups and 1 study group with the goal to develop 10 AI standards are active in ISO/IEC.

JTC1 SC42 - Artificial Intelligence (Committee)

JTC1 SC42 JWG1 - Governance implications of AI (Working Group)

JTC1 SC42 Study Group 1 – Computational approaches and characteristics of artificial intelligence systems (Study Group)

JTC1 SC42 WG1 – Foundational standards (Working Group)

JTC1 SC42 WG2 – Big data (Working Group)

JTC1 SC42 WG3 – Trustworthiness (Working Group)

JTC1 SC42 WG4 – Use cases and applications (Working Group)

JTC1 SC27 WG4 - IT Security techniques (Committee)

3.1.3 ITU-T

ITU-T has set-up 2 Focus Groups to do supportive research for the application of AI in the health sector and for using machine learning for future networks. None of the groups aims at developing a standard but rather will produce different reports and specifications.

FG-AI4H - Artificial Intelligence for Health (Focus Group)

FG-5GML - Machine Learning for Future Networks including 5G (Focus Group)

3.1.4 ETSI

By end of 2019 ETSI has set up three working groups. Two of them are focussing on the application of AI in the domain of future network management. The third group will address standards for AI security.

SAI ISG - Secure AI Industry Specification Group (Working Group)

ZSM ISG - Zero touch network and Service Management Industry Specification Group (Working Group)

ENI ISG - Experiential Networked Intelligence Group (Working Group)

3.1.5 CEN-CENELEC

CERN-CENECLEC has decided to implement a focus Group on AI (no name has been assigned yet, the group will be launched in 2019).

3.2 SDOs' current standardisation activities

Sections 5.1 to 5.4 provide detailed information of the AI-related activities of the 4 SDOs with active groups end of 2018.

All sections share the same structure for the presentation (developed for StandICT.eu's Standards Watch) explained hereafter.

The overarching theme as to be defined in the 2019 Rolling Plan for ICT Standardisation (published with support of the Multi Stakeholder Platform) was not available yet at the time of writing this report. However, most probably AI will be subsumed under the overarching theme Key Enablers and Security. The theme will be adapted if necessary once the 2019 Rolling Plan has been published.

Group, Working Group, TC: The name of the group carrying out the work.

Chair: Information on the chair of the group (if available)

Scope: The scope of the group.

Standard: The name of the standard.

Description: Purpose, Context and other information on the standard.

Link: Usually a link to the group. If accessible, a link to the standard(s).

Readiness: Presents information about the state of the standard covering three aspects, Development Status (Published or under process); Openness (publicly available or restricted access); Ratification Process (the way a standard is agreed upon and finalised).

Supporting Organisations: Name of an affiliated organisation (if any).

IPR Policy Available: A link to the IPR policy under which the group (or the entire organisation) works.

Remarks: Additional information (if any).

3.3 Standards Setting Organisations

End of 2018 2 SSOs have activities related to AI or are in the process to launch related activities: W3C and IRTF. The following list depicts the working/study/focus groups/community groups and initiatives with activities related to AI.

Working Groups typically aim at producing standards or other normative documents. Research and Community Groups are usually dedicated to explore an area and to eventually use the results to create a Working Group.

3.3.1 W3C

At the end of 2018 W3C maintains one community group, which studies AI knowledge representation. No standards development is planned.

AI KR - Artificial Intelligence Knowledge Representation (Community Group)

3.3.2 IRTF

Similar, the three research groups of IRTF does work on studies on the possible role of AI in future networks. No standards development is planned.

NMLRG – Network Machine Learning Research Group (Research Group)

NMRG - Network Management Research Group

Computing in the Network Research Group - to be proposed after the IRTF Special Meeting on AI/ML in Networking during IRTF 102, July 19th 2018. Will start working in 2019 (Research Group)

3.4 SSOs' current standardisation activities

Sections 5.5 and 5.6 provide detailed information of the AI-related activities of the 2 SSOs with active groups end of 2018.

All sections share the same structure for the presentation (developed for StandICT.eu's Standards Watch) explained hereafter.

As described in the SDO section the overarching theme is expected to be Key Enablers and Security.

Group, Working Group, TC: The name of the group carrying out the work.

Chair: Information on the chair of the group (if available)

Scope: The scope of the group.

Standard: The name of the standard.

Description: Purpose, Context and other information on the standard.

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Supporting Organisations: Name of an affiliated organisation (if any).

IPR Policy Available: A link to the IPR policy under which the group (or the entire organisation) works.

Remarks: Additional information (if any).

4 Landscape Analysis

In this section a first analysis of the AI standardisation landscape is presented. Based on the information collected in sections 3.2 and 3.4 several charts depict the results of evaluations of, e.g., the European impact estimated through the distribution of countries of the working group chairs, the thematic distribution of AI standardisation across SDOs and SSO.

4.1 Ongoing standardisation activities

Table 1 presents the different activities as described in 3.2 and 3.4 in a matrix of themes (challenges, pre-standardisation, standards) and SDOs/SSOs. As can be seen, there is little overlap in activities of different SDOs/SSOs with respect to the themes.

Only for AI usage four SDOs (IEEE, ITU-T, ETSI, IOS/IEC) and one SSO (IRTF) have parallel activities. However, these activities are either in different fields or are of different nature, e.g. standards development (ISO(IEC) versus research (IRTF), AI for network management (ETSI) versus the symbiotic autonomous systems initiative (IEEE).

Two SDOs have non-overlapping activities related to AI security: ISO/IEC JTC1 SC27 is preparing a security standard for Big Data (AWI 20547-4) while the new ETSI SAI ISG group will focus on a Threat Ontology and a document providing the Securing AI Problem Statement.

The last theme with two SDOs (IEEE and ISO/IEC) having parallel activities is AI foundational standards. Again, there is no risk of competing developments. While IEEE is focussing on a standard for Fail-Safe Design of Autonomous and Semi-Autonomous Systems the ISO/IEC JTC1 SC42 WG 1 is focusing on defining AI concepts and terminology (WD 22989) and a framework for AI systems using machine learning (WD 23053).

The world map presented in Figure 3 shows the distribution of the group chairs of the working and study groups across the region North America and Canada, the Asia-Pacific region and Europe.

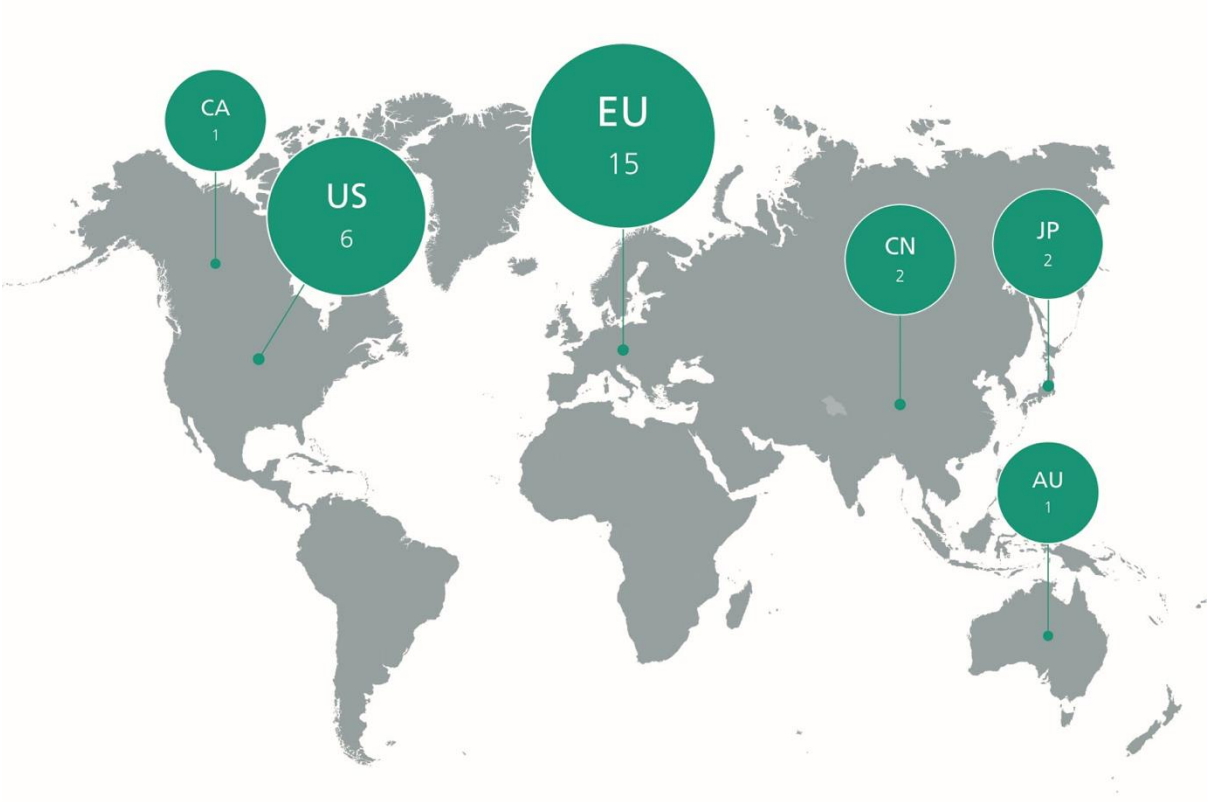

Figure 3: Countries of the group chairs

Table 1: **AI related activities: Themes/Challenges/Areas vs SDOs and SSOs**

SDO/SSO	IEEE	ITU-T	ETSI	ISO/IEC	W3C	IETF
Personalised AI	WG-PDAI (P7006)					
Trustworthiness	PDP (P7002)			SC 42 WG3 (NP TR 24027, NP TR 24028, NP TR 24029-1)		
Ethics	EMELC-WG (P7000) Ethical Nudging (P708) EDARR-wg (P7007)					
AI Security			SAI ISG	SC27 WG4 (AWI 20547-4)		
Transparency of autonomous systems	ASV WG_P7001 (P7001) ALGB-WG (P7003)					
AI usage	SAS	ML5G	ENI ISG ZSM ISG	SC42 WG4 (NP TR 24030)		NMRG
Wellbeing metrics	Wellbeing for Ethical AI (7010)					
Big Data				SC42 WG2 (20546, TR 20547-1, TR 20547-2, TR 20547-3, TR 20547-5)		
AI foundational standards	Fail-Safe Design (P7009)			SC42 WG1 (WD 22989 WD 23053)		
AI Governance				SC42 JWG1 (NP 38507)		
Computational approaches				SC42 Study Group 1		
AI for health		AI4H				
Transparency of data processing	WG-CSDG (P7004) EDG-WG (P7005)					
Conceptualization and specification of domain knowledge					AI KR	

Figure 4 provides a detailed view on the countries of the 15 European chairing working groups or study groups of the SDOs and SSOs with activities in AI standardisation. As can be seen, as of end of 2018 the Eastern part of Europe and the South-Eastern part do not send out chairs to these groups. This corresponds to the fact that applications for StandICT.eu grants for supporting European contributions to ICT standardisation from these countries are quite limited.

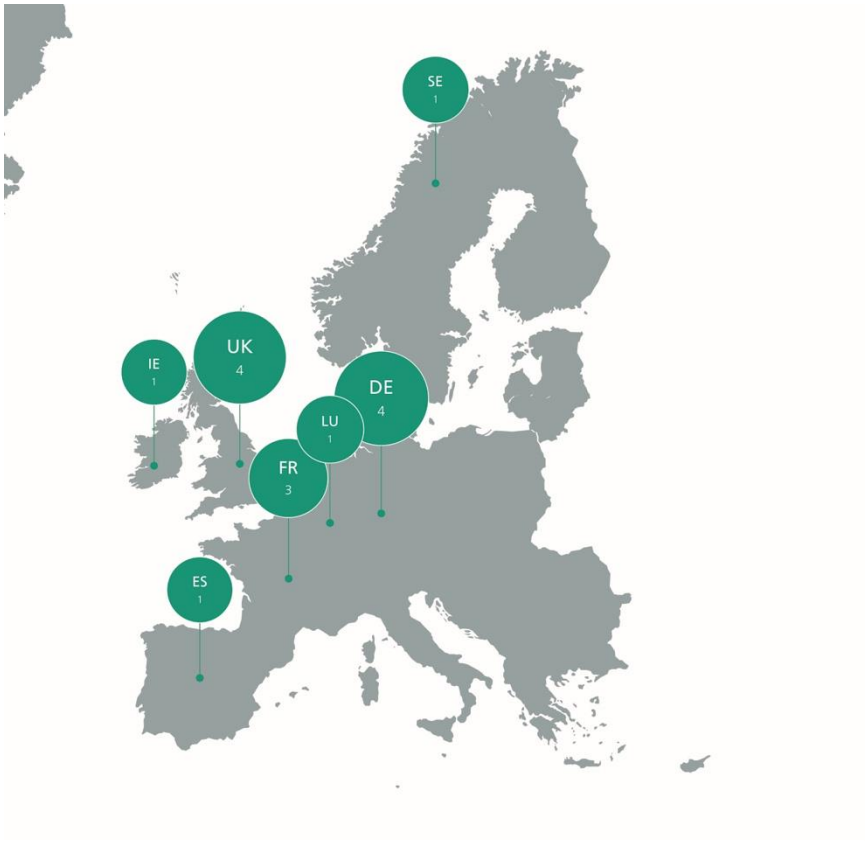

Figure 4: Distribution of European chairs

Figure 5 presents an overview on the different kind of groups addressing AI themes in the SDOs and SSOs. Despite the fact that there are four times more working groups than study or research groups a closer look on the goals of the different working groups (depicted in Figure 6) shows that as of end of 2018 about half of the activities are not focusing on defining a standard but rather focus on studying the respective fields and aim at delivering technical reports (which might well be the base for a new standardisation activity later).

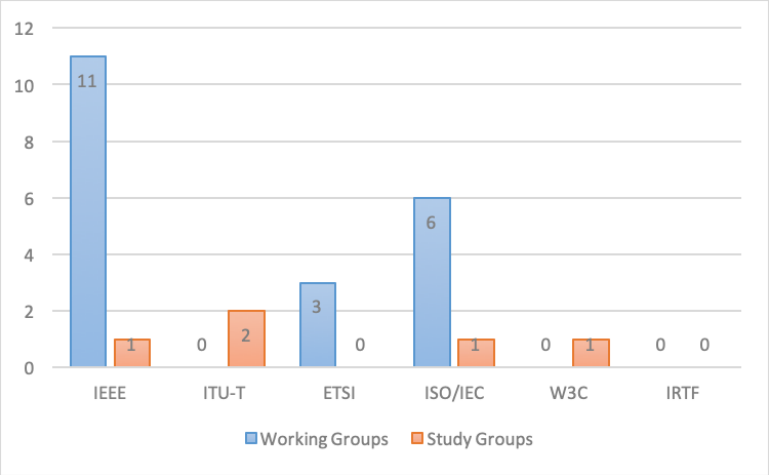

Figure 5: Relation of number of working groups to study groups per SDO and SSO

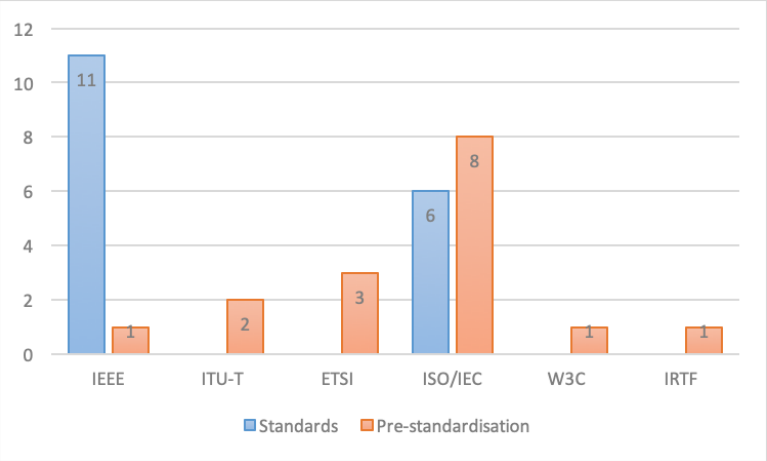

Figure 6: Relation of standardisation to pre-standardisation activities

Figure 7 provides an overview on themes and the number of AI activities. The themes Ethics, Trustworthiness and Transparency of Autonomous Systems all relate to activities aiming at ensuring that humans fully remain in control of AI technologies and include the highest number of activities. This coincides well with the current goals of the EU as presented for example in their Communication and its Annex [12][11][10] or with the findings of the first report of the High Level Expert Group on AI [7].

The second highest number of activities can be found in the theme usage of AI. The reason for this is that most of the SDOs and SSOs observed in this report define different (in general non-overlapping) use-cases depending on the focus of their AI standardisation activities.

The third highest number can be observed in the Big Data theme. This is due to the fact that the ISO/IEC JTC1 WP9 (Big Data) program was merged with JTC1 SC42 (Artificial Intelligence) in 2018 because of the increased relevance of (big) data in several AI approaches. The previous Big Data activities are now part of the Artificial Intelligence standardisation activities of ISO/IEC JTC1 SC42, though the integration with the other themes of SC42 still needs to be done.

Similar to AI usage, the theme AI foundational standards comprises activities with different foci (see Sections 5.2.5 and 5.1.10 for details).

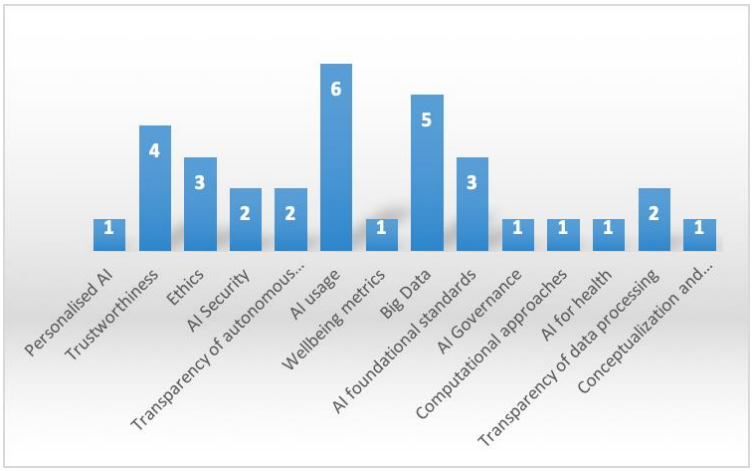

Figure 7: Themes and number of activities

As shown in Figure 8, end of 2018 the number of Europeans chairing groups in the different SDOs and SSOs with activities related to AI outperforms those of the individual other countries and these countries together. This indicates that there is a strong European guidance in the development of the respective standards. However, since the nationality of the active members is only available to the members of the individual groups the active participation of Europeans beyond the chair cannot be determined. The StandICT.eu approach to support European presence and contribution for this groups and especially for those not chaired by a European is therefore considered useful to increase the European impact.

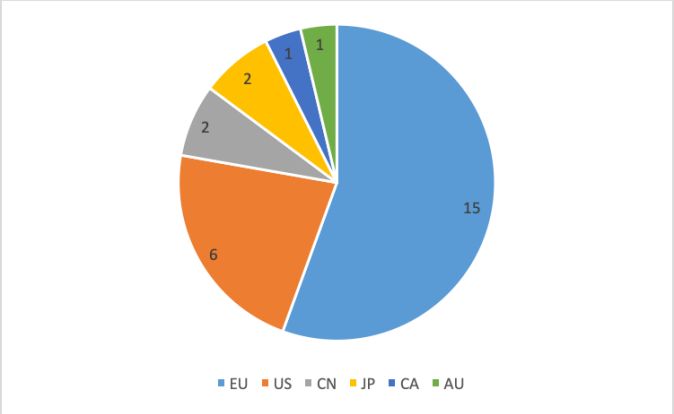

Figure 8: Country distribution of the group chairs

4.3 Maturity of the standards

End of 2018 only two AI-related standards have been published yet. As can be seen in Figure 9 most groups are declaring their work being in progress. The two standards being published stem from the work of JTC1 WG9 and are standards for Big Data which now are part of the Artificial Intelligence activities after WG9 has been merged with JTC1 SC42.

The large number of standards activities being work in progress on the other hand clearly indicates the opportunity for Europeans to engage in and contribute to these groups and their respective standards.

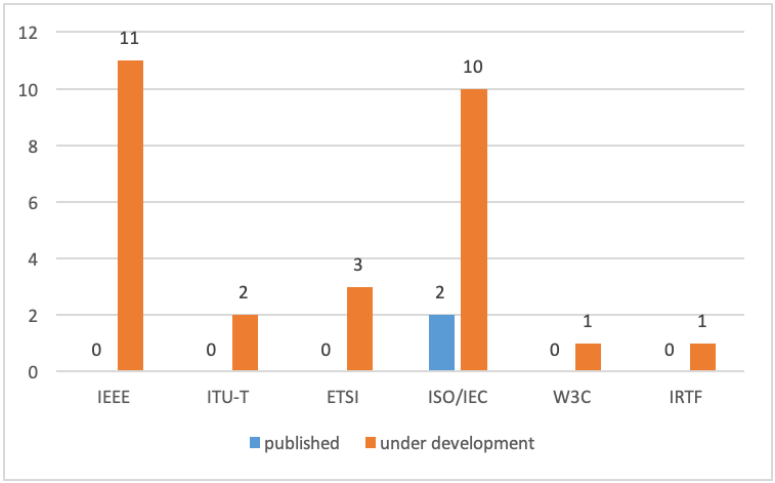

Figure 9: AI Standards Maturity

5 Presentation of the ongoing AI-related work of SDOs/SSOs

The following sections provide detailed information on the AI-related work in the different groups as presented in sections 3.1 to 3.4 above.

5.1 IEEE

5.1.1 EMELC-WG

5.1.1.1 Group, Working Group, TC

EMELC-WG - Engineering Methodologies for Ethical Life-Cycle Concerns Working Group

5.1.1.2 Chair

John C. Havens, johnchavens@gmail.com, US

5.1.1.3 Purpose

Engineers, technologists and other project stakeholders need a methodology for identifying, analysing and reconciling ethical concerns of end users at the beginning of systems and software life cycles.

The purpose of this standard is to enable the pragmatic application of this type of Value-Based System Design methodology which demonstrates that conceptual analysis of values and an extensive feasibility analysis can help to refine ethical system requirements in systems and software life cycles.

This standard will provide engineers and technologists with an implementable process aligning innovation management processes, IS system design approaches and software engineering methods to minimize ethical risk for their organizations, stakeholders and end users.

5.1.1.4 Standard

P7000 - Model Process for Addressing Ethical Concerns During System Design

5.1.1.5 Link

https://standards.ieee.org/develop/project/7000.html

5.1.1.6 Description

The standard establishes a process model by which engineers and technologists can address ethical consideration throughout the various stages of system initiation, analysis and design. Expected process requirements include management and engineering view of new IT product development, computer ethics and IT system design, value-sensitive design, and, stakeholder involvement in ethical IT system design.

5.1.1.7 Readiness

1. Development Status

Under development

2. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

Published standards can be purchased from IEEE.

3. Ratification process

Ballots organised by the sponsor of the working group.

5.1.1.8 Supporting organizations:

N/A

5.1.1.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.1.10 Remarks

5.1.2 ASV WG_P7001

5.1.2.1 Group, Working Group, TC

ASV WG_P7001 - Autonomous Systems Validation Working Group_P7001

5.1.2.2 Chair

Alan Winfield, alan.winfield@uwe.ac.uk, EU/UK

5.1.2.3 Purpose

A key concern over autonomous systems (AS) is that their operation must be transparent to a wide range of stakeholders, for different reasons. (i) For users, transparency is important because it builds trust in the system, by providing a simple way for the user to understand what the system is doing and why. If we take a care robot as an example, transparency means the user can quickly understand what the robot might do in different circumstances, or if the robot should do anything unexpected, the user should be able to ask the robot 'why did you just do that?'. (ii) For validation and certification of an AS transparency is important because it exposes the system's processes for scrutiny. (iii) If accidents occur, the AS will need to be transparent to an accident investigator; the internal process that led to the accident need to be traceable. Following an accident (iv) lawyers or other expert witnesses, who may be required to give evidence, require transparency to inform their evidence. And (v) for disruptive technologies, such as driverless cars, a certain level of transparency to wider society is needed in order to build public confidence in the technology. For designers, the standard will provide a guide for self-assessing transparency during development and suggest mechanisms for improving transparency (for instance the need for secure storage of sensor and internal state data, comparable to a flight data recorder or black box).

5.1.2.4 Standard

P7001 - Transparency of Autonomous Systems

5.1.2.5 Link

https://standards.ieee.org/develop/project/7001.html

5.1.2.6 Description

This standard describes measurable, testable levels of transparency, so that autonomous systems can be objectively assessed and levels of compliance determined.

5.1.2.7 Readiness

1. Development Status

Under development

2. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

Published standards can be purchased from IEEE.

3. Ratification process

Ballots organised by the sponsor of the working group.

5.1.2.8 Supporting organizations:

N/A

5.1.2.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.2.10 Remarks

5.1.3 PDP

5.1.3.1 Group, Working Group, TC

PDP - Personal Data Privacy Working Group

5.1.3.2 Chair

Michelle Dennedy, midenned@cisco.com, US

5.1.3.3 Purpose

The purpose of this standard is to have one overall methodological approach that specifies practices to manage privacy issues within the systems/software engineering life cycle processes.

5.1.3.4 Standard

P7002 - Data Privacy Process

5.1.3.5 Link

https://standards.ieee.org/develop/project/7002.html

5.1.3.6 Description

This standard defines requirements for a systems/software engineering process for privacy-oriented considerations regarding products, services, and systems utilizing employee, customer or other external user's personal data. It extends across the life cycle from policy through development, quality assurance, and value realization. It includes a use case and data model (including metadata). It applies to organizations and projects that are developing and deploying products, systems, processes, and applications that involve personal information. By providing specific procedures, diagrams, and checklists, users of this standard will be able to perform a conformity assessment on their specific privacy practices. Privacy impact assessments (PIAs) are described as a tool for both identifying where privacy controls and measures are needed and for confirming they are in place.

5.1.3.7 Readiness

1. Development Status

Under development

2. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

Published standards can be purchased from IEEE.

3. Ratification process

Ballots organised by the sponsor of the working group.

5.1.3.8 Supporting organizations:

N/A

5.1.3.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.3.10 Remarks

5.1.4 ALGB-WG

5.1.4.1 Group, Working Group, TC

ALGB-WG - Algorithmic Bias Working Group

5.1.4.2 Chair

Ansgar Koene, ansgar.koene@nottingham.ac.uk, EU/UK

5.1.4.3 Purpose

This standard is designed to provide individuals or organizations creating algorithms, largely in regards to autonomous or intelligent systems, certification-oriented methodologies to provide clearly articulated accountability and clarity around how algorithms are targeting, assessing and influencing the users and stakeholders of said algorithm. Certification under this standard will allow algorithm creators to communicate to users, and regulatory authorities, that up-to-date best practices were used in the design, testing and evaluation of the algorithm to avoid unjustified differential impact on users.

5.1.4.4 Standard

P7003 - Algorithmic Bias Considerations

5.1.4.5 Link

https://standards.ieee.org/develop/project/7003.html

5.1.4.6 Description

This standard describes specific methodologies to help users certify how they worked to address and eliminate issues of negative bias in the creation of their algorithms, where "negative bias" infers the usage of overly subjective or uniformed data sets or information known to be inconsistent with legislation concerning certain protected characteristics (such as race, gender, sexuality, etc.); or with instances of bias against groups not necessarily protected explicitly by legislation, but otherwise diminishing stakeholder or user well-being and for which there are good reasons to be considered inappropriate. Possible elements include (but are not limited to): benchmarking procedures and criteria for the selection of validation data sets for bias quality control; guidelines on establishing and communicating the application boundaries for which the algorithm has been designed and validated to guard against unintended consequences arising from out-of-bound application of algorithms; suggestions for user expectation management to mitigate bias due to incorrect interpretation of systems outputs by users (e.g. correlation vs. causation)

5.1.4.7 Readiness

1. Development Status

Under development

2. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

Published standards can be purchased from IEEE.

3. Ratification process

Ballots organised by the sponsor of the working group.

5.1.4.8 Supporting organizations:

N/A

5.1.4.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.4.10 Remarks

5.1.5 WG-CSDG

5.1.5.1 Group, Working Group, TC

WG-CSDG - Working Group for Child and Student Data Governance

5.1.5.2 Chair

Marsali Hancock, mhancock@dqinstitute.org, US

5.1.5.3 Purpose

This standard is designed to provide organizations handling child and student data governance-oriented processes and certifications guaranteeing the transparency and accountability of their actions as it relates to the safety and wellbeing of children, their parents, the educational institutions where they are enrolled, and the community and societies where they spend their time, both on and offline. It is also designed to help parents and educators, with an understanding that most individuals may not be tech-savvy enough to understand underlying issues of data usage, but still must be properly informed about the safety of their children's data and provided with tools and services that provide proper opportunities for content based, pre-informed choice regarding their family's data.

5.1.5.4 Standard

P7004 - Standard on Child and Student Data Governance

5.1.5.5 Link

https://standards.ieee.org/develop/project/7004.html

5.1.5.6 Description

The standard defines specific methodologies to help users certify how they approach accessing, collecting, storing, utilizing, sharing, and destroying child and student data. The standard provides specific metrics and conformance criteria regarding these types of uses from trusted global partners and how vendors and educational institutions can meet them.

5.1.5.7 Readiness

1. Development Status

Under development

2. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

Published standards can be purchased from IEEE.

3. Ratification process

Ballots organised by the sponsor of the working group.

5.1.5.8 Supporting organizations:

N/A

5.1.5.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.5.10 Remarks

5.1.6 EDG-WG

5.1.6.1 Group, Working Group, TC

EDG-WG - Employer Data Governance working group

5.1.6.2 Chair

Ulf Bengtsson, ulf.bengtsson@sverigesingenjorer.se, EU/SE

5.1.6.3 Purpose

This standard is designed to provide organizations with a set of clear guidelines and certifications guaranteeing they are storing, protecting, and utilizing employee data in an ethical and transparent way. It is also designed to help employers with an understanding that most individuals may not be tech-savvy enough to understand underlying issues of data usage, but still must be properly informed about the safety of their employee data to be provided with tools and services that provide proper opportunities for content based, pre-informed choice regarding how they share their information in the workplace. Modelled after the EU GDPR legislation, this Standard will be designed to be a form of "GDPR for Employees" guaranteeing that workers facing widespread automation issues potentially displacing their jobs will have control and influence over the personal information that directly represents a core asset of their identity and lives whether derived from work-flow monitoring or personal data storage.

5.1.6.4 Standard

P7005 - Standard for Transparent Employer Data Governance

5.1.6.5 Link

https://standards.ieee.org/develop/project/7005.html

5.1.6.6 Description

The standard defines specific methodologies to help employers to certify how they approach accessing, collecting, storing, utilizing, sharing, and destroying employee data. The standard provides specific metrics and conformance criteria regarding these types of uses from trusted global partners and how vendors and employers can meet them.

5.1.6.7 Readiness

1. Development Status

Under development

2. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

Published standards can be purchased from IEEE.

3. Ratification process

Ballots organised by the sponsor of the working group.

5.1.6.8 Supporting organizations:

N/A

5.1.6.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.6.10 Remarks

5.1.7 WG-PDAI

5.1.7.1 Group, Working Group, TC

WG-PDAI - Personal Data AI Agent Working Group

5.1.7.2 Chair

Katryna Dow, katryna.dow@meeco.me, AU, EU/UK

5.1.7.3 Purpose

With the advent and rise of AI there is a risk that machine-to-machine decisions will be made with black-box inputs determined without input transparency to humans. In order to enable ethics-based AI, individuals will require the means to influence and determine the values, rules and inputs that guide the development of personalized algorithms and Artificial Intelligence. They will need an agent that can negotiate their individual rights and agency in a system of shared social norms, ethics and human rights that also foresee and helps the individual mitigate ethical implications of data processing. This approach will enable individuals to safely organize and share their personal information at a machine-readable level and enable a personalized AI to act as a proxy for machine-to-machine decisions. A key goal for the creation of this standard is to educate government and commercial actors why it is in their best interests to create the mechanisms for individuals to train Personal AI Agents to move beyond asymmetry and harmonize personal data usage for the future.

5.1.7.4 Standard

P7006 - Standard for Personal Data Artificial Intelligence (AI) Agent

5.1.7.5 Link

https://standards.ieee.org/develop/project/7006.html

5.1.7.6 Description

This standard describes the technical elements required to create and grant access to a personalized Artificial Intelligence (AI) that will comprise inputs, learning, ethics, rules and values controlled by individuals.

5.1.7.7 Readiness

1. Development Status

Under development

2. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

Published standards can be purchased from IEEE.

3. Ratification process

Ballots organised by the sponsor of the working group.

5.1.7.8 Supporting organizations:

N/A

5.1.7.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.7.10 Remarks

Standard for Personal Data Artificial Intelligence (AI) Agent.

5.1.8 EDARR-wg

5.1.8.1 Group, Working Group, TC

EDARR-wg - WG for the Adoption of: Robots and robotic devices: Guide to the ethical design and application or robots and robotic systems

5.1.8.2 Chair

John Havens, johnchavens@gmail.com, US

5.1.8.3 Purpose

The standard establishes a set of definitions and their relationships that will enable the development of Robotics and Automation Systems in accordance with worldwide Ethics and Moral theories, with a particular emphasis on aligning the ethics and engineering communities to understand how to pragmatically design and implement these systems in unison. These definitions allow for a precise communication among global experts of different domains that includes Robotics, Automation and Ethics.

The use of ontologies for representing knowledge in any domain has several benefits that include a) formal definition of concepts of a particular domain in a language-independent representation, i.e., they are not dependent of a specific programming language, however, they are formally described to be implemented in a target language; b) tools for analysing concepts and their relationships in searching of inconsistency, incompleteness and redundancy; c) language for being used in the communication process among Robots from different manufacturers; etc.

5.1.8.4 Standard

P7007 - Ontological Standard for Ethically Driven Robotics and Automation Systems

5.1.8.5 Link

https://standards.ieee.org/develop/project/7007.html

5.1.8.6 Description

The standard establishes a set of ontologies with different abstraction levels that contain concepts, definitions and axioms which are necessary to establish ethically driven methodologies for the design of Robots and Automation Systems.

5.1.8.7 Readiness

1. Development Status

Under development

2. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

Published standards can be purchased from IEEE.

3. Ratification process

Ballots organised by the sponsor of the working group.

5.1.8.8 Supporting organizations:

N/A

5.1.8.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.8.10 Remarks

5.1.9 Ethical Nudging

5.1.9.1 Group, Working Group, TC

Ethical Nudging - Working Group for Ethically Driven Nudging for Robotic, Intelligent and Autonomous Systems

5.1.9.2 Chair

Laurence Devillers, devil@limsi.fr, EU/FR

5.1.9.3 Purpose

The Standard for Ethically Driven Nudging for Robotic, Intelligent and Autonomous Systems establishes a set of definition of functions and their relationships with benefits depending on cultural aspects of users (well-being, health, ...) that enables the development of Robotics, Intelligent and Autonomous Systems in accordance with worldwide Ethics and Moral theories, with a particular emphasis on aligning the ethics and engineering communities to understand how to pragmatically design and implement these systems in unison. This standard along with definitions allows for precise communication among global experts of different domains that includes Robotics, Artificial Intelligence, Autonomous Systems, and Ethics.

5.1.9.4 Standard

P7008 - Standard for Ethically Driven Nudging for Robotic, Intelligent and Autonomous Systems

5.1.9.5 Link

https://standards.ieee.org/develop/project/7008.html

5.1.9.6 Description

"Nudges" as exhibited by robotic, intelligent or autonomous systems are defined as overt or hidden suggestions or manipulations designed to influence the behaviour or emotions of a user. This standard establishes a delineation of typical nudges (currently in use or that could be created). It contains concepts, functions and benefits necessary to establish and ensure ethically driven methodologies for the design of the robotic, intelligent and autonomous systems that incorporate them.

5.1.9.7 Readiness

1. Development Status

Under development

2. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

Published standards can be purchased from IEEE.

3. Ratification process

Ballots organised by the sponsor of the working group.

5.1.9.8 Supporting organizations:

N/A

5.1.9.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.9.10 Remarks

5.1.10 Fail-Safe Design

5.1.10.1 Group, Working Group, TC

Fail-Safe Design - Standard for Fail-Safe Design of Autonomous and Semi-Autonomous Systems

5.1.10.2 Chair

Danit Gal, gal.danit@gmail.com, JP

5.1.10.3 Purpose

Autonomous and semi-autonomous systems which remain operational after an intended or unintended malfunction can disadvantage and harm users, society, and the environment. There is a need for definition of effective fail-safe mechanisms to help mitigate risks related to system malfunction and provide developers, installers and operators with clear technical criteria to terminate unsuccessful or compromised operations in a safe and consistent manner.

5.1.10.4 Standard

P7009 - Standard for Fail-Safe Design of Autonomous and Semi-Autonomous Systems

5.1.10.5 Link

https://standards.ieee.org/develop/project/7009.html

5.1.10.6 Description

This standard establishes a practical, technical baseline of specific methodologies and tools for the development, implementation, and use of effective fail-safe mechanisms in autonomous and semi-autonomous systems. The standard includes (but is not limited to): clear procedures for measuring, testing, and certifying a system's ability to fail safely on a scale from weak to strong, and instructions for improvement in the case of unsatisfactory performance. The standard serves as the basis for developers, as well as users and regulators, to design fail-safe mechanisms in a robust, transparent, and accountable manner.

5.1.10.7 Readiness

1. Development Status

Under development

2. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

3. Ratification process

Ballots organised by the sponsor of the working group.

5.1.10.8 Supporting organizations:

N/A

5.1.10.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.10.10 Remarks

5.1.11 Wellbeing for Ethical AI

5.1.11.1 Group, Working Group, TC

Wellbeing for Ethical AI - Wellbeing Metrics Standard for Ethical Artificial Intelligence and Autonomous Systems

5.1.11.2 Chair

Loi Lei Lai, l.l.lai@ieee.org, CN

5.1.11.3 Purpose

The Wellbeing Metrics Standard for Ethical Artificial Intelligence and Autonomous Systems enables programmers, engineers, and technologists to better consider how the products and services they create can increase human wellbeing based on a wider spectrum of measures than growth and productivity alone. Today, affective systems utilizing emotion recognizing sensors are quantified primarily by their economic value in the marketplace beyond their efficacy within certain fields (psychology, etc.). While it is often understood that ethical considerations for intelligent and autonomous systems might hinder innovation by the introduction of unwanted regulation, without metrics that value mental and emotional health at both an individual and societal level, innovation is impossible to quantify. The introduction and use of these metrics for programmers and technologists means that beyond economic increase human wellbeing can be measured and better improved.

5.1.11.4 Standard

P7010 - Wellbeing Metrics Standard for Ethical Artificial Intelligence and Autonomous Systems

5.1.11.5 Link

https://standards.ieee.org/project/7010.html

5.1.11.6 Description

This standard establishes wellbeing metrics relating to human factors directly affected by intelligent and autonomous systems and establishes a baseline for the types of objective and subjective data these systems should analyse and include (in their programming and functioning) to proactively increase human wellbeing.

5.1.11.7 Readiness

1. Development Status

Under development

2. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

3. Ratification process

Ballots organised by the sponsor of the working group.

5.1.11.8 Supporting organizations:

N/A

5.1.11.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.11.10 Remarks

Wellbeing Metrics Standard for Ethical Artificial Intelligence and Autonomous System.

5.1.12 Standard for the Process of Identifying and Rating the Trustworthiness of News Sources

5.1.12.1 Group, Working Group, TC

NST_WG - News Site Trustworthiness Working Group

5.1.12.2 Chair

Joshua Hyman, josh@pitt.edu, US

5.1.12.3 Purpose

The purpose of the standard is to address the negative impacts of the unchecked proliferation of fake news by providing an open system of easy-to-understand ratings. In so doing, it shall assist in the restoration of trust in some purveyors, appropriately discredit other purveyors, provide a disincentive for the publication of fake news, and promote a path of improvement for purveyors wishing to do so. The standards shall target a representative sample set of news stories in order to provide a meaningful and accurate rating scorecard.

5.1.12.4 Standard

P7011 - Standard for the Process of Identifying and Rating the Trustworthiness of News Sources

5.1.12.5 Link

https://standards.ieee.org/project/7011.html

5.1.12.6 Description

This standard provides semi-autonomous processes using standards to create and maintain news purveyor ratings for purposes of public awareness. It standardizes processes to identify and rate the factual a ccuracy of news stories in order to produce a rating of online news purveyors and the online portion of multimedia news purveyors. This process will be used to produce truthfulness scorecards through multi-faceted and multi-sourced approaches. The standard defines an algorithm using open source software and a score card rating system as methodology for rating trustworthiness as a core tenant in an effort to establish trust and acceptance.

5.1.12.7 Readiness

2. Development Status

Under development

3. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

4. Ratification process

Ballots organised by the sponsor of the working group.

5.1.12.8 Supporting organizations:

N/A

5.1.12.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.12.10 Remarks

5.1.13 Standard for Machine Readable Personal Privacy Terms

5.1.13.1 Group, Working Group, TC

Working Group on Machine Readable Privacy Terms (SSIT/SC/MachReadPrivacy)

5.1.13.2 Chair

David Reed, dpreed@reed.com, US

5.1.13.3 Purpose

The purpose of the standard is to provide individuals with means to proffer their own terms respecting personal privacy, in ways that can be read, acknowledged and agreed to by machines operated by others in the networked world. In a more formal sense, the purpose of the standard is to enable individuals to operate as first parties in agreements with others--mostly companies--operating as second parties.

5.1.13.4 Standard

P7012 - Standard for Machine Readable Personal Privacy Terms

5.1.13.5 Link

https://standards.ieee.org/project/7012.html

5.1.13.6 Description

The standard identifies/addresses the manner in which personal privacy terms are proffered and how they can be read and agreed to by machines.

5.1.13.7 Readiness

3. Development Status

Under development

4. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

5. Ratification process

Ballots organised by the sponsor of the working group.

5.1.13.8 Supporting organizations:

N/A

5.1.13.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.13.10 Remarks

5.1.14 Inclusion and Application Standards for Automated Facial Analysis Technology

5.1.14.1 Group, Working Group, TC

Working Group on on Benchmarking Accuracy, Increasing Transparency, and Governing Use of Automated Facial Analysis Technology (SSIT/SC/Face WG)

5.1.14.2 Chair

Joy Buolamwini, joyab@mit.edu, US

5.1.14.3 Purpose

Research continues to show that artificial intelligence which is used for automated facial analysis is susceptible to bias that can exacerbate human prejudice and systematically disadvantage individuals based on gender, ethnicity, age, and other factors.

The purpose of the standard is to provide inclusion guidelines for developing and benchmarking automated facial analysis technology to mitigate demographic and phenotypic bias and discrimination.

The reporting rubrics/protocols established in this standard serve to increase transparency of this automated technology so that developers and decision makers can compare available options to choose the most appropriate technology based on target populations and intended use cases. Given the sensitivity of the biometric data provided from a human face, the standard also delineates appropriate and inappropriate uses of automated facial analysis based on accuracy and values established by a global community.

5.1.14.4 Standard

P7013 - Inclusion and Application Standards for Automated Facial Analysis Technology

5.1.14.5 Link

https://standards.ieee.org/project/7013.html

5.1.14.6 Description

The standard provides phenotypic and demographic definitions that technologists and auditors can use to assess the diversity of face data used for training and benchmarking algorithmic performance, establishes accuracy reporting and data diversity protocols/rubrics for automated facial analysis, and outlines a rating system to determine contexts in which automated facial analysis technology should not be used.

5.1.14.7 Readiness

4. Development Status

Under development

5. Openness

Working groups are open for experts and their contributions but experts need to either become IEEE-SA Members by paying an annual member fee or pay a per-ballot fee in order to participate in ballots.

6. Ratification process

Ballots organised by the sponsor of the working group.

5.1.14.8 Supporting organizations:

N/A

5.1.14.9 IPR Policy Available

https://standards.ieee.org/ipr/index.html

5.1.14.10 Remarks

5.1.15 SAS

Group, Working Group, TC

SAS - Symbiotic Autonomous Systems

5.1.15.1 Mission Statement

The Symbiotic Autonomous Systems (SAS) initiative fosters studies and applications focused on the convergence of human augmentation with the increasing intelligence and awareness of artefacts, leading towards a symbiosis of humans and machines. This will have significant implications for human society as a whole, affecting culture and the economy and prompting new questions about our place on Earth.

5.1.15.2 Standard

N/A

5.1.15.3 Link

https://symbiotic-autonomous-systems.ieee.org/standards

5.1.15.4 Description of the expected implications

IMPLICATIONS ETHICAL

· Augmentation issues · Augmentation stigma · Augmentation gap/divide

· Symbiotic "Self" · Evolution of the symbiotic "Self" · Dissolution of the symbiotic "Self" · Self vs Symbiotic Self · Symbiotic Self outlasting the Self

LEGAL

· Augmentation rights · Fair competition · Labour rules · Symbiotic rights and responsibility · Machine rights

· Standardization requirements

SOCIETAL

· Perception and cultural changes · Labour market changes

· Job losses · New skills needed · Human Machines as co-workers · Human Machine competition

5.1.15.5 Readiness

1. Development Status

Ongoing initiative

2. Openness

At this stage the initiative is open for new members and contributors. To join follow the link: https://www.ieee.org/membership-catalog/productdetail/showProductDetailPage.html?product=CMYSAS782.

3. Ratification process

N/A

5.1.15.6 Supporting organizations:

N/A

5.1.15.7 IPR Policy Available

5.1.15.8 Remarks

This SAS initiative has been launched by IEEE to broadly study the new field of Symbiotic Autonomous Systems. Dedicated groups working on identified lacking standards most probably will eventually emerge from this initiative. Some of the IEEE standards activities described in the sections above are closely related to the topic.

5.2 ISO/IEC

5.2.1 JTC1 SC42

5.2.1.1 Group, Working Group, TC

JTC1 SC42 – Artificial Intelligence

5.2.1.2 Chair

Wael William Diab, wael.william.diab@huawei.com, US, CN

5.2.1.3 Scope

Standardization in the area of Artificial Intelligence

Serve as the focus and proponent for JTC1's standardization program on Artificial Intelligence

Provide guidance to JTC1, IEC, and ISO committees developing Artificial Intelligence applications

5.2.1.4 Standard

10 Standards under development in 5 working groups: SC42 JWG1, WG1, WG2, WG3, WG4. 2 Standards published.

5.2.1.5 Link

https://www.iso.org/committee/6794475.html

5.2.1.6 Description

SC42 comprises the following study and working groups:

ISO/IEC JTC 1/SC 42/AHG 1 - Dissemination and outreach (not presented here)

ISO/IEC JTC 1/SC 42/AHG 2 - Liaison with SC 38 (not presented here)

ISO/IEC JTC 1/SC 42/AHG 3 - Intelligent systems engineering (not presented here)

ISO/IEC JTC 1/SC 42/JWG 1 - Joint Working Group ISO/IEC JTC1/SC 42 - ISO/IEC JTC1/SC 40: Governance implications of AI

ISO/IEC JTC 1/SC 42/SG 1 - Computational approaches and characteristics of artificial intelligence systems

ISO/IEC JTC 1/SC 42/WG 1 - Foundational standards

ISO/IEC JTC 1/SC 42/WG 2 - Big Data

ISO/IEC JTC 1/SC 42/WG 3 - Trustworthiness

ISO/IEC JTC 1/SC 42/WG 4 - Use cases and applications

5.2.1.7 Readiness

1. Development Status

10 standards under development, 2 standards published

2. Openness

Contribution to standards development possible for members of national bodies or experts from liaising organisations (without voting rights).

Published Standards documents can be purchased from ISO or the national bodies. Free access sometimes is granted upon request of the WG by decision of the JTC1 JAG.

3. Ratification process

Several rounds of modifications and balloting by members of national bodies.

5.2.1.8 Supporting organizations:

IEC/SyC AAL, ISO/IEC SC 7, 27, 26, 29, 34, 37, 38, 39, 40, TC 52, 69, 215, 299, 307, 309

IEEE, OGC

5.2.1.9 IPR Policy Available

https://www.iso.org/declaration-for-participants-in-iso-activities.html

5.2.1.10 Remarks

Originally work on Big Data was done in JTC 1/WG 9 – Big Data, which has been disbanded in 2017. With the establishment of SC 42, JTC 1 transferred the JTC 1/WG 9 program of work to SC 42 WG 2 "Artificial Intelligence"

5.2.2 JTC1 SC27 WG4

5.2.2.1 Group, Working Group, TC

JTC1 SC27 - IT Security techniques, WG4 - Security Controls and Services

5.2.2.2 Chair

Johann Amsenga, EU/LU

5.2.2.3 Scope

The development of standards for the protection of information and ICT. This includes generic methods, techniques and guidelines to address both security and privacy aspects, such as:

Security requirements capture methodology;

Management of information and ICT security; in particular information security management systems, security processes, and security controls and services;

Cryptographic and other security mechanisms, including but not limited to mechanisms for protecting the accountability, availability, integrity and confidentiality of information;

Security management support documentation including terminology, guidelines as well as procedures for the registration of security components;

Security aspects of identity management, biometrics and privacy;

Conformance assessment, accreditation and auditing requirements in the area of information security management systems;

Security evaluation criteria and methodology.

SC 27 engages in active liaison and collaboration with appropriate bodies to ensure the proper development and application of SC 27 standards and technical reports in relevant areas

5.2.2.4 Standard

ISO/IEC AWI 20547-4 - Information technology -- Big data reference architecture -- Part 4: Security and privacy

5.2.2.5 Link

https://www.iso.org/standard/71278.html

5.2.2.6 Description

5.2.2.7 Readiness

1. Development Status

Under development

2. Openness

Contribution to standards development possible for members of national bodies or experts from liaising organisations (without voting rights).

Published Standards documents can be purchased from ISO or the national bodies. Free access sometimes is granted upon request of the WG by decision of the JTC1 JAG.

3. Ratification process

Several rounds of modifications and balloting by members of national bodies.

5.2.2.8 Supporting organizations:

Too many to list them here. For liaisons see the Liaisons tab at

https://www.iso.org/committee/45306.html

5.2.2.9 IPR Policy Available

https://www.iso.org/declaration-for-participants-in-iso-activities.html

5.2.2.10 Remarks

Originally work done in JTC 1/WG 9 which has been disbanded in 2017. With the establishment of SC 42, JTC 1 transferred the JTC 1/WG 9 program of work to SC 42 "Artificial Intelligence"

Part 4 has been delegated from WG9 to SC27 WG4 and will return to SC42 once completed. Besides SC27 WG4 also SC27 WG5 - Identity Management and Privacy Technologies is contributing to 20547-4.

5.2.3 JTC1 SC42 JWG1

5.2.3.1 Group, Working Group, TC

JTC1 SC42 JWG1 - Governance implications of AI

5.2.3.2 Chair

Janna Lingenfelder, EU/DE

Gyeung-min Kim, KR (SC40)

5.2.3.3 Scope

Standardization in the area of Artificial Intelligence

Serve as the focus and proponent for JTC 1's standardization program on Artificial Intelligence

Provide guidance to JTC 1, IEC, and ISO committees developing Artificial Intelligence applications

5.2.3.4 Standard

ISO/IEC NP 38507 - Information technology -- Governance of IT -- Governance implications of the use of artificial intelligence by organizations

5.2.3.5 Link

https://www.iso.org/standard/74296.html?browse=tc

5.2.3.6 Description

Joint working group with JTC1 SC40 - IT Service Management and IT Governance. Working draft (WD) study initiated

5.2.3.7 Readiness

1. Development Status

Under development

2. Openness

Contribution to standards development possible for members of national bodies or experts from liaising organisations (without voting rights).

Published Standards documents can be purchased from ISO or the national bodies. Free access sometimes is granted upon request of the WG by decision of the JTC1 JAG.

3. Ratification process

Several rounds of modifications and balloting by members of national bodies.

5.2.3.8 Supporting organizations:

IEC/SyC AAL, ISO/IEC SC 7, 27, 26, 29, 34, 37, 38, 39, 40, TC 52, 69, 215, 299, 307, 309

IEEE, OGC

5.2.3.9 IPR Policy Available

https://www.iso.org/declaration-for-participants-in-iso-activities.html

5.2.3.10 Remarks

5.2.4 JTC1 SC42 Study Group 1

5.2.4.1 Group, Working Group, TC

JTC1 SC42 Study Group 1 - Computational approaches and characteristics of artificial intelligence systems.

5.2.4.2 Chair

Tangli Liu, CN

5.2.4.3 Scope

Standardization in the area of Artificial Intelligence

Serve as the focus and proponent for JTC 1's standardization program on Artificial Intelligence

Provide guidance to JTC 1, IEC, and ISO committees developing Artificial Intelligence applications

5.2.4.4 Standard

N/A

5.2.4.5 Link

https://isotc.iso.org/livelink/livelink?func=ll&objId=19903389&objAction=Open&viewType=1

5.2.4.6 Description

The computational approaches and characteristics of the artificial intelligence systems study group will

- Study different technologies (e.g., ML algorithms, reasoning etc.) used by the AI systems including their properties and characteristics.
- Study existing specialized AI systems (e.g., NLP or computer vision) to understand and identify their underlying computational approaches, architectures, and characteristics.
- Study industry practices, processes and methods for the application of AI systems.
- Develop new work item proposals as appropriate and recommend placement.

At the heart of artificial intelligence are the computational approaches and algorithmic techniques that empower the insights provided by the AI engines. The advances in ICT, specifically computational power, distributed computing methods and software capability techniques amongst others, allow for what once was science fiction to become science

faction. Standardization and best practices in this area are essential to allow for innovation to occur over open standards.

5.2.4.7 Readiness

1. Development Status

Under development

2. Openness

Contribution to standards development possible for members of national bodies or experts from liaising organisations (without voting rights).

Published Standards documents can be purchased from ISO or the national bodies. Free access sometimes is granted upon request of the WG by decision of the JTC1 JAG.

3. Ratification process

Several rounds of modifications and balloting by members of national bodies.

5.2.4.8 Supporting organizations:

IEC/SyC AAL, ISO/IEC SC 7, 27, 26, 29, 34, 37, 38, 39, 40, TC 52, 69, 215, 299, 307, 309

IEEE, OGC

5.2.4.9 IPR Policy Available

https://www.iso.org/declaration-for-participants-in-iso-activities.html

5.2.4.10 Remarks

5.2.5 JTC1 SC42 WG1

5.2.5.1 Group, Working Group, TC

JTC1 SC42 WG1 – Foundational standards

5.2.5.2 Chair

Paul Cotton, paul.cotton@outlook.com, CA

5.2.5.3 Scope

Standardization in the area of Artificial Intelligence

Serve as the focus and proponent for JTC 1's standardization program on Artificial Intelligence

Provide guidance to JTC 1, IEC, and ISO committees developing Artificial Intelligence applications

5.2.5.4 Standard

ISO/IEC WD 22989 - Artificial intelligence -- Concepts and terminology

ISO/IEC WD 23053 - Framework for Artificial Intelligence (AI) Systems Using Machine Learning (ML)

5.2.5.5 Link

https://www.iso.org/standard/74296.html?browse=tc

https://www.iso.org/standard/74438.html?browse=tc

5.2.5.6 Description

The foundational standards working group will take on the two currently approved projects: Artificial Intelligence Concepts and Terminology ISO/IEC AWI 22989, and Framework for Artificial Intelligence Systems Using Machine Learning ISO/IEC AWI 23053.

With such a diverse set of stakeholders for AI, it is essential to have foundational standards that provide for a framework and common set of vocabulary. Not only does this enable stakeholders of different backgrounds and perspectives to talk the same language, it also sets the stage of how the different stakeholders and technology providers/users interact with one another. Progressing these two foundational standards is a priority of SC 42.

5.2.5.7 Readiness

1. Development Status

Under development

2. Openness

Contribution to standards development possible for members of national bodies or experts from liaising organisations (without voting rights).

Published Standards documents can be purchased from ISO or the national bodies. Free access sometimes is granted upon request of the WG by decision of the JTC1 JAG.

3. Ratification process

Several rounds of modifications and balloting by members of national bodies.

5.2.5.8 Supporting organizations:

IEC/SyC AAL, ISO/IEC SC 7, 27, 26, 29, 34, 37, 38, 39, 40, TC 52, 69, 215, 299, 307, 309

IEEE, OGC

5.2.5.9 IPR Policy Available

https://www.iso.org/declaration-for-participants-in-iso-activities.html

5.2.5.10 Remarks

Work based on the outcome of JWG1

5.2.6 JTC1 SC42 WG2

5.2.6.1 Group, Working Group, TC

JTC1 SC42 WG2 – Big data

5.2.6.2 Chair

Wo Chang, US

5.2.6.3 Scope

Standardization in the area of Big Data

5.2.6.4 Standard

ISO/IEC 20546: Information technology — Big data — Overview and vocabulary

ISO/IEC TR 20547-1: Information technology — Big data reference architecture — Part 1: Framework and application process

ISO/IEC DIS 20547-3: Information technology — Big data reference architecture — Part 3: Reference architecture

5.2.6.5 Link

https://isotc.iso.org/livelink/livelink?func=ll&objId=20064458&objAction=browse&viewType=1

5.2.6.6 Description

WG2 – Big Data will be based on the program of work on Big Data (JTC 1/WG 9) which has been disbanded and the program transferred to JTC 1/SC 42.

The working group takes on the three currently approved and open big data projects:

- ISO/IEC 20546: Information technology — Big data — Overview and vocabulary
- ISO/IEC TR 20547-1: Information technology — Big data reference architecture — Part 1: Framework and application process
- ISO/IEC DIS 20547-3: Information technology — Big data reference architecture — Part 3: Reference architecture

JTC 1's program on Big Data, initiated a few years ago, has initiated two foundational multi-part projects around overview and vocabulary as well as a Big Data Reference Architecture (BDRA). These projects have received tremendous interest from the industry. As we look to the arc of future work, the roadmap for big data aligns well with that of SC 42. Moreover, from a data science perspective, expert participation, use cases and applications, future anticipated work on analytics, and the role of systems integration (working with other ISO,

IEC and JTC 1 committees on application areas), the program of work of big data and the initial program of work identified for SC 42 line up well together. From an industry practice point of view, it is hard to imagine applications where one technology is present without the other.

5.2.6.7 Readiness

1. Development Status

ISO/IEC AWI TR 20547-1, ISO/IEC DIS 20547-3: Under development

ISO/IEC 20546, ISO/IEC TR 20547-2, ISO/IEC TR 20547-5: Published

2. Openness

Contribution to standards development possible for members of national bodies or experts from liaising organisations (without voting rights).

Published Standards documents can be purchased from ISO or the national bodies. Free access sometimes is granted upon request of the WG by decision of the JTC1 JAG.

3. Ratification process

Several rounds of modifications and balloting by members of national bodies.

5.2.6.8 Supporting organizations:

IEC/SyC AAL, ISO/IEC SC 7, 27, 26, 29, 34, 37, 38, 39, 40, TC 52, 69, 215, 299, 307, 309

IEEE, OGC

5.2.6.9 IPR Policy Available

https://www.iso.org/declaration-for-participants-in-iso-activities.html

5.2.6.10 Remarks

5.2.7 JTC1 SC42 WG3

5.2.7.1 Group, Working Group, TC

JTC1 SC42 WG3 – Trustworthiness

5.2.7.2 Chair

David Filip, david.filip@adaptcentre.ie, EU/IE

5.2.7.3 Scope

Standardization in the area of AI Trustworthiness

5.2.7.4 Standard

ISO/IEC NP TR 24027 - Information technology -- Artificial Intelligence (AI) -- Bias in AI systems and AI aided decision making

ISO/IEC NP TR 24028 - Information technology -- Artificial Intelligence (AI -- Overview of trustworthiness in Artificial Intelligence

ISO/IEC NP TR 24029-1 - Artificial Intelligence (AI) -- Assessment of the robustness of neural networks -- Part 1: Overview

5.2.7.5 Link

https://isotc.iso.org/livelink/livelink?func=ll&objId=20069766&objAction=browse&viewType=1

5.2.7.6 Description

WG3 – Trustworthiness is based on the outcome of the SC42 Study Group 3.

The working group takes on the three newly approved trustworthiness projects:

- TR on Bias in AI systems and AI aided decision making
- TR on Overview of trustworthiness in Artificial Intelligence
- TR on Assessment of the robustness of neural networks – Part 1: Overview

5.2.7.7 Readiness

1. Development Status

Under development

2. Openness

Contribution to standards development possible for members of national bodies or experts from liaising organisations (without voting rights).

Published Standards documents can be purchased from ISO or the national bodies. Free access sometimes is granted upon request of the WG by decision of the JTC1 JAG.

3. Ratification process

Several rounds of modifications and balloting by members of national bodies.

5.2.7.8 Supporting organizations:

IEC/SyC AAL, ISO/IEC SC 7, 27, 26, 29, 34, 37, 38, 39, 40, TC 52, 69, 215, 299, 307, 309

IEEE, OGC

5.2.7.9 IPR Policy Available

https://www.iso.org/declaration-for-participants-in-iso-activities.html

5.2.7.10 Remarks

5.2.8 JTC1 SC42 WG4

5.2.8.1 Group, Working Group, TC

JTC1 SC42 WG4 - Use cases and applications

5.2.8.2 Chair

Fumihiro Maruyama, maruyama.f@jp.fujitsu.com, JP

5.2.8.3 Scope

Use cases and applications for AI Standardization

5.2.8.4 Standard

ISO/IEC NP TR 24030 - Information technology -- Artificial Intelligence (AI) -- Use cases

5.2.8.5 Link

https://isotc.iso.org/livelink/livelink?func=ll&objId=20072126&objAction=browse&viewType=1

5.2.8.6 Description

WG4 – Use cases and applications will be based on the outcome of the SC42 Study Group 3 which aimed at

- Identifying different AI application domains (e.g., social networks and embedded systems) and the different context of their use (e.g., fintech, health care, smart home, and autonomous cars).
- Collecting representative use cases.
- Describing applications and use cases using the terminology and concepts defined in ISO/IEC AWI 22989 and ISO/IEC AWI 23053 and extend the terms as necessary.
- Developing new work item proposals as appropriate and recommend placement.

The working group takes on one newly approved project:

- TR on Artificial intelligence: use cases

In addition to the assigned projects, this WG is tasked with remainder of the TORs from SG 3 for study.

5.2.8.7 Readiness

1. Development Status

Under development

2. Openness

Contribution to standards development possible for members of national bodies or experts from liaising organisations (without voting rights).

Published Standards documents can be purchased from ISO or the national bodies. Free access sometimes is granted upon request of the WG by decision of the JTC1 JAG.

3. Ratification process

Several rounds of modifications and balloting by members of national bodies.

5.2.8.8 Supporting organizations:

IEC/SyC AAL, ISO/IEC SC 7, 27, 26, 29, 34, 37, 38, 39, 40, TC 52, 69, 215, 299, 307, 309

IEEE, OGC

5.2.8.9 IPR Policy Available

https://www.iso.org/declaration-for-participants-in-iso-activities.html

5.2.8.10 Remarks

5.3 ETSI

5.3.1 ENI ISG

5.3.1.1 Group, Working Group, TC

Experiential Networked Intelligence Group (ENI ISG)

5.3.1.2 Chair

Raymond Forbes, EU/UK

5.3.1.3 Scope

The purpose of the ISG ENI is to consider standardization and to develop standards for a Secured AI Industry Specification Group (SAI ISG Cognitive Network Management system incorporating a closed loop control approach. The closed loop control approach is based on a "monitor-analyse- plan-execute" model and will be enhanced by learning capabilities.

The envisaged Cognitive Network Management system enables the steering of the usage of available network resources and services according to the real-time evolution of user needs, environmental conditions and business goals. Decisions taken by the Cognitive Network Management system rely on detailed information about the complex states of network resources and policies expressing operators' preferences. The unique added value of the ISG ENI approach is to quantify the Operator Experience by introducing a metric and the optimization and adjustment of the Operator Experience over time by taking advantage of machine learning and reasoning.

Different types of policies will be reviewed. These policies will be used to drive adaptive behavioural changes using various AI (Artificial Intelligence) mechanisms.

ISG ENI will wherever applicable review and reuse existing standardized solutions for legacy and evolving network functions like e.g. resource management, service management, orchestration and policy management etc.

The ISG will include the definition of:

(1) the requirements of the Operator Experience in and across legacy and virtualised networks including 5G networks, and

(2) a model-driven architecture that supports adaptive and intelligent service operation through Cognitive Network Management to provide the required Operator Experience.

The ISG scope is limited to the functional description of the management plane. Interactions and policy descriptions will be matched with business processes and control layers in the network as described in the architecture in Phase 2.

Note: it is not envisioned to change the existing Network Operator legacy OSS/BSSs. The existing network management systems will be augmented and improved by using the cognitive networked intelligence.

5.3.1.4 Standard

No AI standard planned but standards for AI application in the network management area.

5.3.1.5 Link

https://www.etsi.org/technologies-clusters/technologies/experiential-networked-intelligence

5.3.1.6 Description

The Experiential Networked Intelligence Industry Specification Group (ENI ISG) is defining a Cognitive Network Management architecture, using Artificial Intelligence (AI) techniques and context-aware policies to adjust offered services based on changes in user needs, environmental conditions and business goals.

The use of Artificial Intelligence techniques in the network management system should solve some of the problems of future network deployment and operation.

5.3.1.7 Readiness

1. Development Status

Ongoing work

2. Openness

Most of the standardization work is carried out in committees. The members of these committees are technical experts from ETSI member companies and organizations.

External experts can be proposed by ETSI members to work in a Specialist Task Force (STF) inside a TC. Observers and non-members may participate at the discretion of the TC Chairman in-line with clause 1.4 of the Technical Working Procedures.

ESTI membership requires a contribution (fee).

Standards documents can be purchased from ETSI.

3. Ratification process

Members only.

5.3.1.8 Supporting organizations:

N/A

5.3.1.9 IPR Policy Available

https://www.etsi.org/about/how-we-work/intellectual-property-rights-iprs

5.3.1.10 Remarks

This group does not work on AI standards but on the standardised use of Artificial Intelligence for network performance and quality of service.

5.3.2 SAI ISG

5.3.2.1 Group, Working Group, TC

Secured AI Industry Specification Group (SAI ISG)

5.3.2.2 Chair

tbd

5.3.2.3 Scope

The Secured AI Industry Specification Group (ISG SAI) will develop an ETSI consensual view of the technical knowledge required to develop technical specifications that mitigate against threats arising from the deployment of AI, and threats to AI, from both other AIs, and from conventional sources. As a pre-standardisation activity the ISG SAI is intended to frame the security concerns arising from AI and to build the foundation of a longer-term response to the threats from AI in sponsoring the future development of normative technical specifications.

The underlying rationale for ISG SAI is that autonomous mechanical/computing entities may make decisions that act against the relying parties either by design or as a result of malicious intent. The conventional cycle of risk analysis and countermeasure deployment represented by the Identify-Protect-Detect-Respond cycle needs to be re-assessed when an autonomous machine is involved. The purpose of the ISG SAI is to develop the technical knowledge that acts as a baseline in ensuring that AI is secure. The stakeholders impacted by the activity of the ISG includes all the member groups represented in ETSI and some of the wider societal environment that AIs will be deployed in. This includes end users, manufacturers, operators and governments, and the activity of the ISG will include gathering concerns of each stakeholder group to ensure that ETSI and the output of the ISG SAI address those concerns.

5.3.2.4 Standard

5.3.2.5 Link

5.3.2.6 Description

Areas of Activity

The ISG SAI will produce both informative documents (Group Reports) and normative documents (Group Specifications) and the work will initially focus on the following deliverables which will help refine the direction of the future ISG work:

AI Threat Ontology

Currently, there is no common understanding of what constitutes an "AI Threat" and how it might be created, hosted and propagated. The work to be undertaken here will seek to define what would be considered an AI threat and how it might differ from exclusively human created cyber or physically vectored threats.

Hence, the AI Threat Ontology deliverable seeks to align terminology across the different stakeholders and multiple industries. This document will define what is meant by these terms in the context of cyber and physical security and with an accompanying narrative that should be readily accessible by both experts and less informed audiences across the multiple industries.

This deliverable is expected to be developed within 6 months of ISG kick-off.

Securing AI Problem Statement

This document is modelled on the ETSI NFV "Security Problem Statement" which has been highly influential in guiding the scope of ETSI NFV and enabling "security by design" for NFV infrastructures. It will define and prioritise potential AI threats along with recommended actions.

The recommendations coming from this document will be used to define the scope and timescale for follow-up work within the ISG and by external bodies.

This document is expected to be developed in parallel with the AI Threat Ontology and to be completed within the 12 months of ISG kick-off.

5.3.2.7 Readiness

1. Development Status

Work will start February 2019.

2. Openness

Most of the standardization work is carried out in committees. The members of these committees are technical experts from ETSI member companies and organizations.

External experts can be proposed by ETSI members to work in a Specialist Task Force (STF) inside a TC. Observers and non-members may participate at the discretion of the TC Chairman in-line with clause 1.4 of the Technical Working Procedures.

ESTI membership requires a contribution (fee).

Standards documents can be purchased from ETSI.

3. Ratification process

Members only.

5.3.2.8 Supporting organizations:

N/A

5.3.2.9 IPR Policy Available

https://www.etsi.org/about/how-we-work/intellectual-property-rights-iprs

5.3.2.10 Remarks

Group to be a launched February 2019

5.3.3 ZSM ISG

5.3.3.1 Group, Working Group, TC

Zero touch network and Service Management Industry Specification Group (ZSM ISG)

5.3.3.2 Chair

Klaus Martiny, EU/DE

5.3.3.3 Scope

Zero touch network and Service Management is conceived as a next-generation management system that leverages the principles of Network Functions Virtualization (NFV) and Software Defined Networking (SDN). It will be designed for the new, cloud-based network infrastructures and functions, and based on cloud-native principles to address zero-touch (fully automated) management and operation.

The group strives for enabling agile, efficient and qualitative management and automation of future services

5.3.3.4 Standard

No AI standard planned but standards for AI application in the network management area.

5.3.3.5 Link

https://www.etsi.org/technologies-clusters/technologies/zero-touch-network-service-management

5.3.3.6 Description

The challenges introduced by the deployment of new network foundations such as NFV and new architectures such as 5G trigger the need to accelerate network transformation and radically change the way networks and services are managed and orchestrated.

These new network architectures come with an extreme range of requirements, including massive capacity (perceived as infinite in practice), imperceptible latency, ultra-high reliability, personalized services with dramatic improvements in customer-experience, global web-scale reach, and support for massive machine-to-machine communication. Networks are being transformed into programmable, software-driven, service-based and holistically-managed infrastructures, utilising enablers and catalysts, such as NFV, SDN and Edge Computing.

The ZSM ISG will initially focus on the 5G end-to-end network and service management such as network slicing management and will extend to the management for future network generations. The goal is to have all operational processes and tasks - delivery, deployment,

configuration, assurance, and optimization - executed automatically, ideally with 100% automation.

The group will define a new, future-proof, horizontal and vertical end-to-end operable framework enabling agile, efficient and qualitative management and automation of emerging and future networks and services. Horizontal end-to-end refers to cross-domain, cross-technology aspects. Vertical end-to-end refers to cross-layer aspects, from the resource-oriented up to the customer-oriented layers. The ZSM group will also facilitate the coordination and cooperation between relevant standardization bodies and open source projects.

5.3.3.7 Readiness

1. Development Status

Ongoing work

2. Openness

Most of the standardization work is carried out in committees. The members of these committees are technical experts from ETSI member companies and organizations.

External experts can be proposed by ETSI members to work in a Specialist Task Force (STF) inside a TC. Observers and non-members may participate at the discretion of the TC Chairman in-line with clause 1.4 of the Technical Working Procedures.

ESTI membership requires a contribution (fee).

Standards documents can be purchased from ETSI.

3. Ratification process

Members only.

5.3.3.8 Supporting organizations:

N/A

5.3.3.9 IPR Policy Available

https://www.etsi.org/about/how-we-work/intellectual-property-rights-iprs

5.3.3.10 Remarks

This group does not work on AI standards but on the standardised use of Artificial Intelligence-based framework for network management and automation.

5.4 ITU-T

5.4.1 AI4H

5.4.1.1 Group, Working Group, TC

AI4H - Artificial intelligence for health

5.4.1.2 Chair

Markus Wenzel, markus.wenzel@hhi.fraunhofer.de, EU/DE

5.4.1.3 Rationale and scope

Artificial intelligence (AI) has the potential to improve digital health significantly by improving medical diagnostics and treatment decision processes based on digital data. For example, in medical image processing research, machine learning systems increasingly attain, or at times even surpass, human accuracy for some classification or detection tasks (for example in the areas of skin diseases, retinoblastoma, and dysgraphia), and can thus in principle serve as pre-screening tools.

AI-based health services and applications could also be used by patients to help assess symptoms, or to help decide whether to contact a medical professional. In an emergency, user-collected data and an AI-generated medical diagnosis can be sent together in advance to a hospital. In regions with limited access to quality healthcare, these tools could greatly aid medical practitioners, allowing them to focus on critical cases. However, due to business, legal, technical, or other constraints, such solutions are rarely deployed in practice at a global scale.

The ITU-T Focus Group on "Artificial intelligence for health" (FG-AI4H) engages researchers, engineers, practitioners, entrepreneurs and policy makers, to enable leveraging such solutions in practice.

Many of the proposals in the AI + Health Session of the AI for Good Global Summit (2018) have identified common issues that benefit from a structure to share information, collaborate and deliver on their goals.

5.4.1.4 Standard

N/A

5.4.1.5 Link

https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/default.aspx

5.4.1.6 Description

Specific tasks and deliverables

Tasks and deliverables developed by the FG-AI4H may include the following:

To develop a list of standards bodies, forums, consortia, regulators, core research organizations, engineering teams, health professionals, entrepreneurs, digital health policy makers and other entities dealing with aspects of AI and to establish liaisons and relationships with some of the listed organizations.

To organise thematic workshops and forums on AI for health, which will bring together all stakeholders, and promote the FG activities and encourage both ITU members and non-ITU members to join its work.

To gather information on initiatives pertaining to AI for health and to identify existing standards, AI methods, best practises and challenges for the adoption. To review existing technologies, platforms, guidelines, standards and applications in AI for health.

To identify various use case descriptions of AI for health-based methods including the problem description. To identify potential health problems to which AI-relevant interventions and machine learning can be applied and assessed that are scalable.

To identify structured and normalized medical data required for testing AI algorithms that are part of emerging medical devices and diagnostics and to collect health data for the identified use cases.

To identify interfaces, criteria and to specify the framework for assessment and validation of AI-based solutions for the identified use cases.

To provide use case-specific benchmarking (results) of AI candidate algorithms and to generate reports.

To draft technical reports and specifications for assessment frameworks for AI for health, including for example data formats, interfaces, architecture, and protocols. Note, it is not intended to specify the AI for health algorithms themselves as an ITU Recommendation.

To write a report(s) of the FG activities including a recommendation how to proceed with AI for health standardization after the FG finished its work.

5.4.1.7 Readiness

1. Status

Ongoing activity

2. Openness

Participation in the FG-AI4H is free of charge and open to all.

3. Ratification process

Approval of deliverables shall be taken by consensus (members of the group).

5.4.1.8 Supporting organizations:

This Focus Group will work closely with relevant Study Groups in ITU (-R, -T and –D) including co-located meetings when possible. It will also establish and maintain task-appropriated collaboration arrangements with other groups in ITU and with WHO.

Furthermore, the FG-AI4H will collaborate (as required) with other relevant groups and entities, in accordance with Recommendation ITU-T A.7. These include governments, non-governmental organizations (NGOs), policy makers, SDOs, industry forums and consortia, companies, academic institutions, research institutions and other relevant organizations.

5.4.1.9 IPR Policy Available

https://www.itu.int/en/itu-t/ipr/Pages/default.aspx

5.4.1.10 Remarks

5.4.2 ML5G

5.4.2.1 Group, Working Group, TC

ML5G - Machine Learning for Future Networks including 5G

5.4.2.2 Chair

Slawomir Stanczak, slawomir.stanczak@hhi.fraunhofer.de, EU/DE

5.4.2.3 Rationale and scope

The areas of machine learning (ML) and communication technology are converging. The design and management of networks and communication components can be significantly enhanced when combined with advanced ML methods. In particular, fixed and mobile networks generate a huge amount of data at the network infrastructure level and at the user/customer level, which contain a wealth of useful information such as location information, mobility and call patterns. To improve network performance and enhance user's experience, new ML methods for big data analytics in communication networks can extract relevant information from the network data while considering limited communication resources, and then leverage this knowledge for autonomic network control and management as well as service provisioning. Considering the growing complexity of SDN/NFV and IMT2020/5G networks and beyond, ML may be well applicable for automatic network orchestration and network management. ML also impacts information and communication technology (ICT) in areas related to security or protection of personal information. Regulations in ICT may require that the learning algorithms do not provide personally identifiable information (PII). Hence, ML algorithms that also work under uncertainty and incompleteness are of increasing interest in ICT. These aspects are relevant when considering formats that deliver data to ML algorithms.

The standardization of interfaces, processes and data formats is of high importance in communications, because it increases the reliability, interoperability and modularity of a system and its respective components. Standardized formats may be needed to specify how to train, adapt, compress and exchange individual ML algorithms, as well as to ensure that multiple ML algorithms correctly interact with each other and that certain security or protection of personal information requirements are fulfilled.

Furthermore, it can be expected that a large number of new ICT applications would emerge, if the complexity of state-of-the-art ML algorithms, especially deep neural networks, can be reduced to a level, which allows their use in computationally/energy limited environments.

This Focus Group would play a role in providing a platform to study and advance the various ML approaches for future networks including 5G.

5.4.2.4 Standard

N/A

5.4.2.5 Link

https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages/default.aspx

5.4.2.6 Description

Specific Tasks and Deliverables

To provide terminology and taxonomy for ML in the context of future networks, as well as a guideline on the approaches, tools, applications and platforms related to this topic;

To gather information on initiatives pertaining to ML for future networks and to identify existing standards, ML methods, best practises and challenges for the adoption of ML in future networks;

To describe the ML ecosystem for future networks and the roles and activities related to different stakeholders in this ecosystem;

To analyse possible requirements on ML applied to future networks;

To draft technical reports and specifications for ML for future networks, including interfaces, network architectures, protocols, algorithms and data formats;

To analyse the impact of the adaption of ML for future networks (e.g. autonomic network control and management);

To send the final deliverables to ITU-T Study Group 13 at least four calendar weeks before the parent group's next meeting in accordance with Recommendation ITU-T A.7;

To analyse the standardization gaps related to ML for future networks and develop a future standardization roadmap, taking into consideration the activities currently undertaken by the various standards developing organizations (SDOs) and forums;

To develop a list of standards bodies, forums, consortia and other entities dealing with aspects of ML and liaise with organizations, which could contribute to the standardization activities on ML;

To organise thematic workshops and forums on ML for future networks, which will bring together all stakeholders, and promote the FG activities and encourage both ITU members and non-ITU members to join its work

5.4.2.7 Readiness

1. Development Status

Ongoing activity

2. Openness

Participation in the FG-AI4H is free of charge and open to all.

3. Ratification process

Approval of deliverables shall be taken by consensus (members of the group).

5.4.2.8 Supporting organizations:

This Focus Group will work closely with SG13 through co-located meetings when possible. It will establish and maintain collaboration arrangement with ITU-R WP5D by several means (for instance, liaison statements). Furthermore, the FG-ML5G will collaborate (as required) with other relevant groups and entities, in accordance with Recommendation ITU-T A.7. These include municipalities, non-governmental organizations (NGOs), policy makers, SDOs, industry forums and consortia, companies, academic institutions, research institutions and other relevant organizations.

5.4.2.9 IPR Policy Available

https://www.itu.int/en/itu-t/ipr/Pages/default.aspx

5.4.2.10 Remarks

5.5 W3C

5.5.1 AI KR

5.5.1.1 Group, Working Group, TC

AI KR - Artificial Intelligence Knowledge Representation Community Group

5.5.1.2 Chair

Paola Di Maio, paola.dimaio@strath.ac.uk, EU/UK

5.5.1.3 Scope

The overall goal/mission of this community group is to explore the requirements, best practices and implementation options for the conceptualization and specification of domain knowledge in AI.

5.5.1.4 Standard

N/A

5.5.1.5 Link

https://www.w3.org/community/aikr/

5.5.1.6 Description

Particular emphasis will be placed on the identification and the representation of AI facets and various aspects (technology, legislation, ethics, etc.) with the purpose to facilitate knowledge exchange and reuse.

Therefore, the proposed outcomes could be instrumental to research and advancement of science and inquiry, as well as to increase the level of public awareness in general to enable learning and participation.

Proposed outcomes:

- A comprehensive list of open access resources in both AI and KR (useful to teaching and research)
- A set of metadata derived from these resources
- A concept map of the domain
- A natural language vocabulary to represent various aspects of AI
- One or more encoding/implementations/ machine language version of the vocabulary, such as ChatBot Natural Language Understanding & Natural Language Generation

- Methods for KR management, especially Natural Language Learning / Semantic Memory

5.5.1.7 Readiness

1. Development Status

Ongoing activity

2. Openness

Anyone may join this Community Group. All participants in this group have to sign the W3C Community Contributor License Agreement. W3C Membership is not required. However, you must have a W3C account.

3. Ratification process

All W3C community groups group decision-making processes are self-determined, but required to be fair (e.g., to avoid anti-trust issues). The group has not published their decision-making process.

5.5.1.8 Supporting organizations:

N/A

5.5.1.9 IPR Policy Available

https://www.w3.org/community/about/agreements/summary/

5.5.1.10 Remarks

5.6 IRTF

5.6.1 NMLRG

5.6.1.1 Group, Working Group, TC

NMLRG – Network Machine Learning Research Group

5.6.1.2 Chair

Albert Cabellos, albert.cabellos@gmail.com, EU/ES

5.6.1.3 Scope

The Network Machine Learning Research Group (NMLRG) provides a forum for researchers to explore the potential of machine learning technologies for networks. In particular, the NMLRG will work on potential approaches that apply machine learning technologies in network control, network management, and supplying network data for upper-layer applications.

5.6.1.4 Standard

N/A

5.6.1.5 Link

https://datatracker.ietf.org/group/nmlrg

5.6.1.6 Description

The initial focus of the NMLRG will be on higher-layer concepts where the machine learning mechanism could be applied in order to enhance the network establishing, controlling, managing, network applications and customer services.

This includes mechanisms to acquire knowledge from the existing networks so that new networks can be established with minimum efforts; the potential to use machine learning mechanisms for routing control and optimization; using machine learning mechanisms in network management to predict future network status; using machine learning mechanisms to autonomic and dynamically manage the network; using machine learning mechanisms to analyse network faults and support recovery; learning network attacks and their behaviour, so that protection mechanisms could be self-developed; unifying the data structure and the communication interface between network/network devices and customers, so that the upper-layer applications could easily obtain relevant network information, etc.

The NMLRG is expected to identify and document requirements, to survey possible approaches, to provide specifications for proposed solutions, and to prove concepts with prototype implementations that can be tested in real-world environments.

The group will report its progress through a publicly accessible web site and presentations at IETF meetings. Specifications developed by the NMLRG will be submitted for publication as Experimental or Informational RFCs.

Both academic researchers and researchers from the network industry, including application providers, network operators and vendors, are welcome, as long as they are interested to apply machine learning in network area.

5.6.1.7 Readiness

1. Development Status

Abandoned

2. Openness

Membership is open to any interested parties/individuals.

3. Ratification process

5.6.1.8 Supporting organizations:

N/A

5.6.1.9 IPR Policy Available

https://www.ietf.org/rfc/rfc8179.txt

5.6.1.10 Remarks

The group stopped working in 2017.

5.6.2 NMRG

5.6.2.1 Group, Working Group, TC

NMRG - Network Management Research Group

5.6.2.2 Chair

Laurent Ciavaglia, laurent.ciavaglia@nokia.com, EU/FR

5.6.2.3 Scope

The Network Management Research Group (NMRG) provides a forum for researchers to explore new technologies for the management of the Internet. In particular, the NMRG will work on solutions for problems that are not yet considered well understood enough for engineering work within the IETF.

5.6.2.4 Standard

N/A

5.6.2.5 Link

https://datatracker.ietf.org/meeting/102/materials/agenda-102-nmrg-15

5.6.2.6 Description

The initial focus of the NMRG will be on higher-layer management services that interface with the current Internet management framework. This includes communication services between management systems, which may belong to different management domains, as well as customer-oriented management services. The NMRG is expected to identify and document requirements, to survey possible approaches, to provide specifications for proposed solutions, and to prove concepts with prototype implementations that can be tested in large-scale real-world environments.

The IETF Operations and Management Area Directors are members of the NMRG mailing list and invited to NMRG meetings in order to ensure free flow of information in both directions, and to avoid duplication of work with the various IETF working groups.

The group will report its progress through a publicly accessible web site and presentations at IETF meetings. Specifications developed by the NMRG will be submitted for publication as Experimental or Informational RFCs

5.6.2.7 Readiness

1. Development Status

Ongoing activity

2. Openness

Membership is open to any interested parties who intend to remain current with the published documents and mailing list issues.

3. Ratification process

5.6.2.8 Supporting organizations:

N/A

5.6.2.9 IPR Policy Available

https://www.ietf.org/rfc/rfc8179.txt

5.6.2.10 Remarks

NMRG has one research agenda item on "Use of AI techniques for Network Management".

5.6.3 Other AI-related activities

5.6.3.1 Group, Working Group, TC

No group has been created yet.

5.6.3.2 Chair

Laurent Ciavaglia, laurent.ciavaglia@nokia.com, EU/FR

Marie-José Montpetit, marie@mjmontpetit.com, US

5.6.3.3 Scope

The meeting intended to bring together the IETF and IRTF community that has interests and stakes in the development of both AI/ML based tools and on the networks that will support them.

5.6.3.4 Standard

N/A

5.6.3.5 Link

https://datatracker.ietf.org/meeting/102/materials/agenda-102-nmrg-15

5.6.3.6 Description

In the last few years and especially in the last few months, the use of Artificial Intelligence and Machine Learning in networking went from a nice future application to an almost must have. Diverse networking operations from trend detection in traffic monitoring, beam assignment in 5G, congestion control and intent-based networking have identified AI as a means to improve their overall performance under more and more dynamic conditions. One may also imagine how AI can impact the very design of networks and protocols, or else how to solve networking problems in original ways using novel and network-specific artificial intelligence techniques. Several special issues and conferences have already been organized under these themes and the community wanting to use these new tools is rapidly expanding. In addition to these, network architects and designers are also considering the impact of the use of AI/ML on the network themselves. For example: AI in vehicles generates very large data sets that need to be sent to the cloud for analysis or to rely on fog/edge computing. Traffic engineering also requires analysing very large amounts of real-time information that then needs to be sent back to the network nodes for updates and new features. And the application landscape is rapidly expanding each with its own requirements on the network.

5.6.3.7 Readiness

1. Development Status

Ongoing activity

2. Openness

Membership is open to any interested parties/individuals.

3. Ratification process

5.6.3.8 Supporting organizations:

N/A

5.6.3.9 IPR Policy Available

https://www.ietf.org/rfc/rfc8179.txt

5.6.3.10 Remarks

Laurent Ciavaglia and Marie-José Montpetit chaired the session on AI/ML in Networking during the IETF meeting 102 in Montreal 2018. The chairs are in the process to propose a new IRTF research group for this purpose: COIN - Computing in the Network.

6 Gap analysis

The following gap analysis is oriented along the Ethics Guidelines for Trustworthy AI [7] of the High-Level Expert Group on Artificial Intelligence and the ongoing standardisation activities in the field presented in Section **Errore. L'origine riferimento non è stata trovata.**.

The Ethics Guidelines identify three mandatory components of Trustworthy AI, which should be met throughout the system's entire life cycle:

1. it should be **lawful**, complying with all applicable laws and regulations;
2. it should be **ethical**, ensuring adherence to ethical principles and values; and
3. it should be **robust**, both from a technical and social perspective, since, even with good intentions, AI systems can cause unintentional harm.

Each component in itself is necessary but not sufficient for the achievement of Trustworthy AI. Ideally, all three components work in harmony and overlap in their operation. If, in practice, tensions arise between these components, society should endeavour to align them. As the Ethics Guidelines this report does not address aspects of lawfulness (which are considered out of scope for standardisation) but concentrates on the second and third components (ethical and robust AI).

6.1 Ethical AI

Achieving Trustworthy AI requires not only compliance with the law, which is but one of its three components. Laws are not always up to speed with technological developments, can at times be out of step with ethical norms or may simply not be well suited to addressing certain issues. For AI systems to be trustworthy, they should hence also be ethical, ensuring alignment with ethical norms.

AI systems should improve individual and collective wellbeing. This section lists four ethical principles, rooted in fundamental rights, which must be respected in order to ensure that AI systems are developed, deployed and used in a trustworthy manner. They are specified as ethical imperatives, such that AI practitioners should always strive to adhere to them. Without imposing a hierarchy, we list the principles here below in manner that mirrors the order of appearance of the fundamental rights upon which they are based in the EU Charter.

These are the principles of:

(i) Respect for human autonomy

(ii) Prevention of harm

(iii) Fairness

(iv) Explicability

These principles also apply to the development, deployment and use of other technologies, and hence are not specific to AI systems. In what follows, we have aimed to set out their relevance specifically in an AI-related context.

6.2 Robust AI

Even if an ethical purpose is ensured, individuals and society must also be confident that AI systems will not cause any unintentional harm. Such systems should perform in a safe, secure and reliable manner, and safeguards should be foreseen to prevent any unintended adverse impacts. It is therefore important to ensure that AI systems are robust. This is needed both from a technical perspective (ensuring the system’s technical robustness as appropriate in a given context, such as the application domain or life cycle phase), and from a social perspective (in due consideration of the context and environment in which the system operates).

The Guidelines provide a list of seven requirements. For some elements of the list standardisation is relevant to achieve the expected goals while for others standardisation is not appropriate or feasible or not needed.

1. Human agency and oversight
2. Technical robustness and safety
3. Privacy and data governance
4. Transparency
5. Diversity, non-discrimination and fairness
6. Societal and environmental wellbeing
7. Accountability

Figure 1: **Interrelationship of the seven requirements [7]**

The seven requirements are all of equal importance, support each other, and should be implemented and evaluated throughout the AI system's lifecycle.
Standards should also cover interoperability, which is crucial for offering consumers greater choices and ensuring fair competition. The further development and promotion of such safety standards and support in EU and international standardisation organisations will help enable European businesses to benefit from a competitive advantage, and increase consumer trust.

Table 2: **Standardization matrix of Artificial Intelligence (Ethical Component)**

Component	**Ethical** **ensuring adherence to ethical principles and values**			
Foundations / Properties	**Respect for human autonomy**	**Prevention of harm**	**Fairness**	**Explicability**
Augment, complement and empower human cognitive, social and cultural skills	IEEE P7008			
Human-centric design principles	IEEE P7000 IEEE P7008	IEEE P7000	IEEE P7000	
Securing human oversight	OECD AI Principles G20 AI Principles	OECD AI Principles G20 AI Principles	OECD AI Principles G20 AI Principles	OECD AI Principles G20 AI Principles
Protection of human dignity as well as mental and physical integrity	IEEE P7008 OECD AI Principles G20 AI Principles			
Safety and security	OECD AI Principles G20 AI Principles	OECD AI Principles G20 AI Principles	OECD AI Principles G20 AI Principles	OECD AI Principles G20 AI Principles
Consideration of the natural environment and all living beings				
Ensuring equal and just distributionof both benefits and costs			OECD AI Principles G20 AI Principles	OECD AI Principles G20 AI Principles
Ensuring that individuals and groups are free from unfair bias, discrimination and stigmatisation			OECD AI Principles G20 AI Principles	OECD AI Principles G20 AI Principles

Identifiability of the entity accountable for the decision				OECD AI Principles G20 AI Principles
Explicability of the decision-making processes				OECD AI Principles G20 AI Principles
Transparency of processes			IEEE P7001	IEEE P7001
Open communication of capabilities and purpose of AI systems	IEEE P7008	IEEE P7007 OECD AI Principles G20 AI Principles	IEEE P7007 OECD AI Principles G20 AI Principles	IEEE P7007 OECD AI Principles G20 AI Principles
Traceability, auditability and transparent communication on system capabilities		IEEE P7007	IEEE P7001 IEEE P7007 OECD AI Principles G20 AI Principles	IEEE P7001 IEEE P7007 OECD AI Principles G20 AI Principles

Crossed cells indicate that no standards may be needed, empty cells indicate potential gaps and standards typeset in bold depict work in progress.

Table 3: **Standardization matrix of Artificial Intelligence (Robust Component)**

Component	**Robust** **both from a technical and social perspective**						
Require-ments / **Properties**	**Human agency and oversight**	**Technical robust-ness and safety**	**Privacy and data gover-nance**	**Transpa-rency**	**Diversity non-dis-crimina-tion and fairness**	**Societal and environ-mental wellbe-ing**	**Account-ability**
Fundamental rights, human agency and human oversight	OECD AI Principles G20 AI Principles	OECD AI Principles G20 AI Principles AI for good summit	OECD AI Principles G20 AI Principles	OECD AI Principles G20 AI Principles AI for good summit	OECD AI Principles G20 AI Principles AI for good summit	OECD AI Principles G20 AI Principles AI for good summit	OECD AI Principles G20 AI Principles
Resilience to attack and security		**ETSI SAI ISG**					

Fallback plan and general safety							
Reliability and Reproducibility.		**IEEE P7009**					
Accuracy		**ISO/IEC JTC1 SC42 WD 23053**					
Privacy and data protection.	**IEEE P7002** **IEEE P7006**	**ISO/IEC JTC1 SC42 AWI 20547-4** **IEEE P700** **IEEE P7004** **IEEE P7005**	**ISO/IEC JTC1 SC42 AWI 20547-4** **IEEE P7002** **IEEE P7004** **IEEE P7005**				**IEEE P7004** **IEEE P7005**
Quality and integrity of data		**IEEE P7004** **IEEE P7005**	**IEEE P7004** **IEEE P7005**				**EEE P7004** **IEEE P7005**
Access to data	**IEEE P7006**	**ISO/IEC JTC1 SC42 TR 20547-1** **ISO/IEC JTC1 SC42 DIS 20547-3** **ISO/IEC JTC1 SC42 AWI 20547-4** **IEEE P7002** **IEEE P7006**	**ISO/IEC JTC1 SC42 TR 20547-1** **ISO/IEC JTC1 SC42 DIS 20547-3** **ISO/IEC JTC1 SC42 AWI 20547-4** **IEEE P7002** **IEEE P7006**				**EEE P7004** **IEEE P7005** **IEEE P7006**
Traceability							

Explainability							
Communication of the AI system's capabilities and limitations							
Avoidance of unfair bias		**IEEE P7003**		**ISO/IEC JTC1 SC42 NP TR 24027**	**IEEE P7003** **ISO/IEC JTC1 SC42 NP TR 24027**		
Accessibility and universal design							
Stakeholder Participation.							
Sustainable and environmentally friendly AI.							
Social impact.						**IEEE P7010**	
Society and Democracy							**ISO/IEC NP 38507**
Auditability							
Minimisation and reporting of negative impacts.							**ISO/IEC NP 38507**
Trade-offs.							
Redress							

Crossed cells indicate that standards probably are not needed or appropriate but (internationally) agreed policies and guidelines should be in place. Empty cells indicate potential gaps and standards typeset in bold depict work in progress.

7 Community and Industrial Activities

In this section we provide information on the relation of StandICT.eu with a number of identified community and industrial activities along with a brief description of the respective activity

7.1 The Multi Stakeholder Platform on ICT Standardisation (MSP)

The annual Rolling Plan for ICT Standardisation supported by the MSP is one of the major sources for defining the topics for the StandICT.eu open calls. The MSP also provides comments on StandICT.eu activities.

The European Multi Stakeholder Platform on ICT Standardisation [3] was set up at the end of 2011. Based on a European Commission Decision to advise on matters related to the implementation of ICT standardisation policies, it deals with:

- potential future ICT standardisation needs in support of European legislation, policies and public procurement;
- ICT-specifications: technical specifications for public procurements, developed by global ICT standards-developing organisations;
- cooperation between ICT standards-setting organisations;
- ICT-standardisation: The Rolling Plan, which provides a multi-annual overview of the needs for preliminary or complementary ICT standardisation activities in support of the EU policy activities

The Multi Stakeholder Platform is composed of representatives of national authorities from EU Member States & EFTA countries, by the European and international ICT standardisation bodies, and by stakeholder organisations that represent industry, small and medium-sized enterprises and consumers. It is co-chaired by the European Commission Directorates General Internal Market, Industry, Entrepreneurship and SME and CONNECT. It meets four times per year.

7.2 The European AI Alliance

Through one of its partners StandIICT.eu is a member of the European AI Alliance [5]. While not particularly focussed on AI standardisation the Alliance provides relevant up-to-date information on European industrial and academic activities in the AI field.

The European AI Alliance is a multi-stakeholder forum for engaging in a broad and open discussion of all aspects of AI development and its impact on the economy and society. It is steered by the High-Level Expert Group on AI (AI HLEG), which consists of 52 experts who have been selected by the Commission for this task. The AI HLEG will focus on two main deliverables, for which input from the members of the European AI Alliance will be sought:

(1) It will prepare draft AI ethics guidelines, which will offer guidance on how to implement ethical principles when developing and deploying AI, building on the work of the European Group on Ethics in Science and New Technologies and the European Union Agency for Fundamental Rights; and

(2) It will make mid- and long-term policy recommendations on AI-related challenges and opportunities, which will feed into the policy development process, the legislative evaluation process and the development of a next-generation digital strategy.

7.3 Fraunhofer Cluster of Excellence “Cognitive Internet Technologies” (CCIT)

The CCIT [16] is an initiative of several Fraunhofer institutes active in the area of AI with themes that are considered relevant for standardisation. Through its partner Fraunhofer SCAI StandICT.eu started establishing contacts with the CCIT to identify possible areas for cooperation.

CCIT comprises three sub-projects, namely Data Spaces (Industrial Data Spaces/International Data Spaces, Data Sovereignty), IOT-COMMS and Machine Learning.

7.4 Big Data Value Association (BDVA)

November 2018 the BDVA [17] published its position statement Data-driven Artificial Intelligence for European Economic Competitiveness and Societal Progress. The scope of the BDVA is considered relevant in the context of standardisation especially with regard to the Big Data standardisation activities in ISO/IEC JTC1 SC42.

The Big Data Value Association (BDVA) is an industry-driven international not–for-profit organisation with 200 members all over Europe and a well-balanced composition of large, small, and medium-sized industries as well as research and user organizations. BDVA is the private counterpart to the EU Commission to implement the Big Data Value PPP program. BDVA and the Big Data Value PPP pursue a common shared vision of positioning Europe as the world leader in the creation of Big Data Value.

The mission of the BDVA is to develop the Innovation Ecosystem that will enable the data and AI-driven digital transformation in Europe delivering maximum economic and societal benefit, and, achieving and sustaining Europe's leadership on Big Data Value creation and Artificial Intelligence.

7.5 High-Level Expert Group on Artificial Intelligence

The outcome of this group is of particular interest as their reports can be input for the definition of topics for future StandICT.eu's open calls. Besides references to already ongoing standardisation work the project expects guidance for new themes and new working groups where a European contribution could be organised from the very beginning.

The High-Level Expert Group on Artificial Intelligence (AI HLEG) [4] has as a general objective to support the implementation of the European strategy on Artificial Intelligence. This will include the elaboration of recommendations on future-related policy development and on ethical, legal and societal issues related to AI, including socio-economic challenges.

Moreover, the AI HLEG will serve as the steering group for the European AI Alliance's work, interact with other initiatives, help stimulate a multi-stakeholder dialogue, gather participants' views and reflect them in its analysis and reports.

In particular, the group is tasked to:

- Advise the Commission on next steps addressing AI-related mid to long-term challenges and opportunities through recommendations which will feed into the policy development process, the legislative evaluation process and the development of a next-generation digital strategy. In May 2019, the AI HLEG will also put forward policy & investment recommendation on how to strengthen Europe's competitiveness in AI, including guidance for a strategic research agenda on AI and on the establishment of a network of AI excellence centres.
- Support the Commission on further engagement and outreach mechanisms to interact with a broader set of stakeholders in the context of the AI Alliance, share information and gather their input on the group's and the Commission's work.

The AI HLEG proposed the first draft AI ethics guidelines to the Commission on the 18th December 2018, covering issues such as fairness, safety, transparency, the future of work, democracy and more broadly the impact on the application of the Charter of Fundamental Rights, including privacy and personal data protection, dignity, consumer protection and non-discrimination.

7.6 AI for Good Global Summit

The AI for Good Global Summit [21] is the leading United Nations platform for global and inclusive dialogue on AI. The Summit is hosted each year in Geneva by the ITU in partnership with UN Sister agencies, XPRIZE Foundation and ACM.

The summit follows a multi-stakeholder, multi-disciplinary approach with participants and contributors from governments, industry, UN agencies, civil society, international organisations, and academia. The event comprises exhibits and demos presenting latest innovations in AI on show, demonstrated by their supporting companies, governments and UN agencies.

The goals of the summit are to connect AI innovators with problem owners, to identify practical applications of AI to accelerate progress towards the UN Sustainable Development Goals. Ensure trusted, safe and inclusive development of AI technologies and equitable access to their benefits

The next summit will be organised 4-8 May 2020 in Geneva, Switzerland.

7.7 AI-related activities of the Organisation for Economic Co-operation and Development (OECD)

The AI-related activities of the OECD focus on the definition of principles [22] for the responsible stewardship of trustworthy AI. The policy guidelines agreed upon target to uphold international standards that aim to ensure AI systems are designed to be robust, safe, fair and trustworthy

The OECD Principles on Artificial Intelligence promote artificial intelligence (AI) that is innovative and trustworthy and that respects human rights and democratic values. They were adopted on 22 May 2019 by OECD member countries when they approved the OECD Council Recommendation on Artificial Intelligence. The OECD AI Principles are the first such principles signed up to by governments. Beyond OECD members, other countries including Argentina, Brazil, Colombia, Costa Rica, Peru and Romania have already adhered to the AI Principles, with further adherents welcomed.

The OECD AI Principles set standards for AI that are practical and flexible enough to stand the test of time in a rapidly evolving field. They complement existing OECD standards in areas such as privacy, digital security risk management and responsible business conduct.

7.8 AI-related activities of the G20

On 9 June 2019, the G20 adopted human-centred AI Principles [23] that draw from the OECD AI Principles. Ministers from the Group of 20 major economies kicked off two days of meetings on trade and the digital economy, during which they agreed on guiding principles for using artificial intelligence.

The G20 guidelines call for users and developers of AI to be fair and accountable, with transparent decision-making processes and to respect the rule of law and values including privacy, equality, diversity and internationally recognized labour rights.

8 Communications of the EC and Reports

8.1 Communication of the EC on Artificial Intelligence

The Communication of the EC on Artificial Intelligence [12] is a high-level document oriented to the European Parliament, the European Council, the European Economic and Social Committee and the Committee of the Regions. It provides an analysis of the current situation regarding AI in Europe and defines actions to be taken in order to sustain the European competitiveness in the field and to advance the European industry.

Although the Communication does not address standardisation, StandICT.eu considers it valuable to understand the EC's approach to AI in Europe.

8.2 IEEE Ethically Aligned Design version 2.

Created by committees of the IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems this report [1] is intended to provide information for an incubation space for new standards and solutions, certifications and codes of conduct, and consensus building for ethical implementation of intelligent technologies.

For StandICT.eu this report provides the framework for all AI-related standards activities and is therefore essential to understand IEEE's approach to AI standardisation and the realisation in the different groups described in section 4.4.

8.3 2018 Re-finding industry report

This report [13] defines two new key enabling technologies (KETs): (1) artificial intelligence, and (2) digital security and connectivity. Both are of interest for StandICT.eu, the first one especially in the context of this report and to shape future open calls.

8.4 2019 Rolling Plan for ICT Standardisation

At the time of writing this report the 2019 Rolling Plan was still ongoing work and not published. However, it may be expected that in contrast to the 2018 Rolling Plan the 2019 update will include standardisation activities for Artificial Intelligence. The Rolling Plan supported by the Multi Stakeholder Platform is a central resource for StandICT.eu to define topics for its open calls.

8.5 Artificial Intelligence: A European Perspective

While this report [9] does not include standardisation activities (except for an ISO standard related to energy efficiency of data centres) StandICT.eu considers this report as a comprehensive European view of Artificial Intelligence under different perspectives, e.g., legal, ethical, economical, cyber security. It also includes information on AI in China which is important given the increasing participation of Chinese experts in international standardisation bodies.

8.6 CEN/CENELEC Trustworthy AI

This report is an outcome of the Trustworthy AI stakeholder workshop in Brussels September 2018 organised by CEN-CENELEC. The report is expected to be relevant in the context of the standardisation activities of several SDOs concerning ethics and trustworthiness of AI. Moreover, CEN-CENELECT will launch an own related standardisation activity. As of the time of writing this report the CEN-CENELEC report hat not yet been published.

8.7 Draft Ethics Guidelines for Trustworthy AI

The report [7] of the High Level Expert Group on Artificial Intelligence focuses on the management of potential risks that may become important when AI technologies are more broadly deployed in industry and society. The report states that while having the capability to generate tremendous benefits for

individuals and society, AI also gives rise to certain risks that should be properly managed. Given that, on the whole, AI's benefits outweigh its risks, we must ensure to follow the road that maximises the benefits of AI while minimising its risks. To ensure that we stay on the right track, a human-centric approach to AI is needed, forcing us to keep in mind that the development and use of AI should not be seen as a means in itself, but as having the goal to increase human well-being. Trustworthy AI will be our north star, since human beings will only be able to confidently and fully reap the benefits of AI if they can trust the technology.

Trustworthy AI has two components: (1) it should respect fundamental rights, applicable regulation and core principles and values, ensuring an "ethical purpose" and (2) it should be technically robust and reliable since, even with good intentions, a lack of technological mastery can cause unintentional harm.

The Guidelines therefore set out a framework for Trustworthy AI:

- Chapter I deals with ensuring AI's ethical purpose, by setting out the fundamental rights, principles and values that it should comply with.
- From those principles, Chapter II derives guidance on the realisation of Trustworthy AI, tackling both ethical purpose and technical robustness. This is done by listing the requirements for Trustworthy AI and offering an overview of technical and non-technical methods that can be used for its implementation.
- Chapter III subsequently operationalises the requirements by providing a concrete but non-exhaustive assessment list for Trustworthy AI. This list is then adapted to specific use cases.

The Guidelines do not aim to provide yet another list of core values and principles for AI, but rather offer guidance on the concrete implementation and operationalisation thereof into AI systems.

The draft report is currently undergoing a public reviewing phase after which the updated final version will be published.

8.8 MIT Technology Review: An analysis where AI is headed next

In a begin of 2019 published report [20] the authors analyse the sudden rise and fall of different techniques that has characterized AI research for a long time. The analysis is based on abstracts of all 16,625 papers available in the "artificial intelligence" section of arXiv through November 18, 2018. The archive covers papers of the last 25 years (with the number of publications per year significantly increasing during the last 5 years). The authors tracked the words mentioned through the years to see how the field has evolved. The analysis found three major trends: a shift toward machine learning during the late 1990s and early 2000s, a rise in the popularity of neural networks beginning in the early 2010s, and growth in reinforcement learning in the past few years: "Through our analysis, we found three major trends: a shift toward machine learning during the late 1990s and early 2000s, a rise in the popularity of neural networks beginning in the early 2010s, and growth in reinforcement learning in the past few years. The biggest shift found was a transition away from knowledge-based systems by the early 2000s.".

The frequent changes of the research focus and subsequently of technology used predominantly can to some extent explain why standardisation in the area of Artificial Intelligence is still limited (as indicated in this report) and is mostly not addressing technical issues but rather aspects of ethics or trustworthiness.

8.9 WIPO Technology Trends – Artificial Intelligence

Also begin of 2019 the World Intellectual Property Organisation (WIPO) published a report [19] in their series Technology Trends on Artificial Intelligence. The report aims at offering evidence-based projections to inform global policymakers on the future of AI. In contrast to the MIT report exclusively based on arXiv archived publications it analyses data in patent applications and scientific publications to better understand the latest trends in the field.

For the report WIPO has devised a new framework for the understanding of developments in the field, with AI-related technologies grouped to reflect three dimensions of AI: techniques used in AI, such as

machine learning; functional applications, such as speech processing and computer vision; and application fields, including telecommunications and transportation.

For each of these areas, this report provides data and analysis that identify trends, key players, geographical spread and market activity, including acquisitions and litigation.

In addition, it includes contributions from AI experts from across the globe, addressing issues such as existing and potential uses and impact of AI technology, legal and regulatory questions, data protection and ethical concerns.

Some interesting findings in the context of this report: Since artificial intelligence emerged in the 1950s, innovators and researchers have filed applications for nearly 340,000 AI-related inventions and published over 1.6 million scientific publications. Notably, AI-related patenting is growing rapidly: over half of the identified inventions have been published since 2013. While scientific publications on AI date back decades, the boom in scientific publications on AI only started around 2001, approximately 12 years in advance of an upsurge in patent applications. Moreover, the ratio of scientific papers to inventions has decreased from 8:1 in 2010 to 3:1 in 2016 – indicative of a shift from theoretical research to the use of AI technologies in commercial products and services.

With this shift to the use of AI technologies an increase of AI standardisation activities could be expected in support of interoperability. However, these activities are still limited. The WIPO report also identifies the need for increasing AI related standardisation activities.

9 European Initiatives, Alliances, Projects and Platforms

The European Research Council has funded over 150 cutting edge AI projects by Europe's leading researchers in areas such as deep learning, neural networks, prediction, machine translation, natural language processing, computer vision, robotics, artificial agents and medical imaging as well as governance and standards [11].

StandICT.eu has identified two of the most recently started for possible cooperation. In particular, the AI4EU project will also carry out activities related to standardisation where the StandICT.eu and AI4EU already agreed to investigate possible cooperation after AI4EU has started early 2019. StandICT.eu also will contact the EURITO project to investigate and realise mutual benefits from a cooperation.

As Artificial Intelligence regularly includes the processing of vast amounts of data the availability of appropriate software and processing technology is crucial. The European Technology Platform in the area of High-Performance Computing (ETP4HPC) has identified AI as a relevant area in their working plan. StandICT.eu considers this as an environment where standards are beneficial, will monitor the platform's activities and try to establish a cooperation with respect to standards development.

Further, we consider the AI Alliance as the overarching multi-stakeholder forum for engaging in a broad and open discussion of all aspects of AI development and its impact on the economy and society. Another relevant activity in this context launched by the EC is the AI Watch driven by the EC's JRCs in Ispra and Sevilla.

9.1 AI Alliance

The European AI Alliance is a multi-stakeholder forum for engaging in a broad and open discussion of all aspects of AI development and its impact on the economy and society. It is steered by the High-Level Expert Group on AI (AI HLEG), which consists of 52 experts who have been selected by the Commission for this task. The AI HLEG will focus on two main deliverables, for which input from the members of the European AI Alliance will be sought:

(1) It will prepare draft AI ethics guidelines, which will offer guidance on how to implement ethical principles when developing and deploying AI, building on the work of the European Group on Ethics in Science and New Technologies and the European Union Agency for Fundamental Rights; and

(2) It will make mid- and long-term policy recommendations on AI-related challenges and opportunities, which will feed into the policy development process, the legislative evaluation process and the development of a next-generation digital strategy.

9.2 AI Watch

AI Watch provides analyses of AI development, uptake, spread, and more in nine topics: AI for the public sector, AI landscape and indicators, Data: a cornerstone for AI – Toward a Common European Data Space, Education and Skills, Evolution of AI technology, Evolution of AI uptake, Key Enablers, Social Perspective, and Strategic Action and Coordination.

9.3 AI4EU

Artificial Intelligence is a disruptive technology of our times with expected impacts rivalling those of electricity or printing. Resources for innovation are currently dominated by giant tech companies in North America and China. To ensure European independence and leadership, we must invest wisely by bundling, connecting and opening our AI resources. AI4EU [8] will efficiently build a comprehensive European AI-on-demand platform to lower barriers to innovation, to boost technology transfer and catalyse the growth of start-ups and SMEs in all sectors through Open calls and other actions. The platform will act as a broker, developer and one-stop shop providing and showcasing services, expertise, algorithms, software frameworks, development tools, components, modules, data, computing resources, prototyping functions and access to funding. Training will enable different user communities (engineers, civic leaders, etc.) to obtain skills and certifications. The AI4EU Platform will establish a world reference, built upon and interoperable with existing AI and data components and platforms. It will mobilize the whole European AI ecosystem and already unites 79 partners in 21 countries including

researchers, innovators and related talents. Eight industry-driven AI pilots will demonstrate the value of the platform as an innovation tool. In order to enhance the platform, research on five key interconnected AI scientific areas will be carried out using platform technologies and results will be implemented. The pilots and research will showcase how AI4EU can stimulate scientific discovery and technological innovation. The AI4EU Ethical Observatory will be established to ensure the respect of human centred AI values and European regulations. Sustainability will be ensured via the creation of the AI4EU Foundation. The results will feed a new and comprehensive Strategic Research Innovation Agenda for Europe.

9.4 EURITO

Big data and data analytics offer significant opportunities to transform Research and Innovation (R&I) policy with a new generation of more relevant, inclusive and timely indicators than those already available, potentially enabling better decisions with bigger (and better measured) impacts. However, concerns about the representativeness, accuracy and interpretability of new data sources and methods is slowing down their acceptance.

Funded by the European Commission, the 36-month project EURITO [15] (from 1 January 2018 to 31 December 2020) engages policymakers and researchers as stakeholder groups throughout the project, and promotes a user-driven, agile, rigorous and transparent process that goes from identifying policy needs to developing relevant indicators for R&I policy. The overall aim of the project is to develop new mapping methods (data, software and knowledge) of the innovation ecosystem, that will lead to better R&I policy, new opportunities for open innovation, an enhanced understanding of innovation systems and new networks between policymakers, researchers and data businesses.

9.5 ETP4HPC

ETP4HPC [14] is the European Technology Platform (ETP) in the area of High-Performance Computing (HPC). It is an industry-led think tank composed of European HPC technology stakeholders: technology vendors, research centres, and end users. The main task of ETP4HPC is to define research priorities and action plans in the area of HPC technology provision (i.e. the provision of supercomputing systems): “We issue and maintain a Strategic Research Agenda as a mechanism to help the European Commission define the contents of the HPC Technology Work Programmes. We also act as the “one voice” of the European HPC industry in relations with the European Commission and national authorities.”. ETP4HPC was formed in October 2011.

10 Future priorities

The European Commission has launched several activities resulting in recommendations and plans to support the European engagement in world-wide ICT standardisation. A particular focus will be on the Europe's approach for AI and how to increase the European impact in the worldwide efforts to establish AI as broadly available and used technology.

Future priorities are developed and will be guided by these activities. Some of them being

- the Multi Stakeholder Platform on ICT Standardisation and the annual Rolling Plan on ICT Standardisation,
- the High Level Expert Group on Artificial Intelligence,
- the AI Alliance
- the Coordinated Plan on Artificial Intelligence and its Annex
- the Artificial Intelligence: A European Perspective
- the AI Watch realised and maintained by EC's JRCs Ispra and Sevilla.

The activities are beneficial in several dimensions: The Rolling Plan on ICT Standardisation provides a comprehensive view on the ICT standardisation landscape that is considered relevant for building the Digital Single Market. The work of the High Level Expert Group on Artificial Intelligence puts emphasises on human-centric artificial intelligence by focusing on trustworthy AI as their north star, since human beings will only be able to confidently and fully reap the benefits of AI if they can trust the technology. The report Artificial Intelligence: A European Perspective as a comprehensive European view of Artificial Intelligence under different perspectives, e.g., legal, ethical, economical, cyber security. The Coordinated Plan on Artificial Intelligence and its Annex do not particularly address standardisation but it provides an analysis of the current situation regarding AI in Europe and defines actions to be taken in order to sustain the European competitiveness in the field and to advance the European industry. The AI Watch monitors the development, uptake and impact of Artificial Intelligence for Europe and aims at providing a comprehensive and detailed analysis of the field.

StandICT.eu will carefully monitor the outcome of the sources above and adapt its future open calls accordingly.

In addition, a deeper analysis of both the WIPO report and the MIT report and the application of techniques developed by the EURITO project can support a better understanding of this dynamic area.

As can be seen in the section on gaps in AI standardisation for the two components Ethics and Robust the matrix of the Ethics component is rather sparse, one reason being the difficulty of standardisation in this component. IEEE has launched a number of standardisation activities that cover both aspects of the Ethical and Robust components, whereas ISO/IEC activities are more technically and more suitable for addressing aspects of the Robust components.

Standards should also cover interoperability. Such standardisation activities are lacking so far but crucial for offering consumers greater choices and ensuring fair competition **Errore. L'origine riferimento non è stata trovata.**. The further development and promotion of safety standards and support in EU and international standardisation organisations will help enable European businesses to benefit from a competitive advantage, and increase consumer trust.

Testing of and experimenting with AI products and services is crucial to make them market-ready, ensure compliance with safety standards and rules as well as security by design and enable policymakers to gain experience with new technologies to devise suitable legal frameworks. The European Commission will support the set-up of testing and experimentation infrastructures that are open to businesses of all sizes and from all regions. Building on the established network of Digital Innovation Hubs, a first series of testing and experimentation infrastructures for AI products and services will be set up in the areas of healthcare, transport, infrastructure inspection and maintenance, agrifood and agile production.

European (supported) standardisation activities related to AI should be ensuring a high level of data protection, digital rights and ethical standards.

Table 4: **Priorities for European contributions in AI standardisation**

Relevant AI Standards Bodies	Areas for AI standardisation activities (partly ongoing	Relevant PPPs and sub-projects, associations and activities
ITU-T	Human agency and oversight	AI Alliance
IETF/IRTF	Technical robustness and safety	AI Watch
IEEE	Privacy and data governance	
ETSI	Transparency	
ISO/IEC	Diversity, non-discrimination and fairness	
W3C	Societal and environmental wellbeing	
	Accountability	
	Respect for human autonomy	
	Prevention of harm	
	Fairness	
	Explicability	

Please note: the three columns of the table are independent

11 Conclusions

With this report StandICT.eu provides an overview on the state of the standardisation in the area of Artificial Intelligence as of end of 2018

The report presents the SDOs and SSOs with active groups working on AI. The work of the groups is presented in detail and forms the major part of the report.

The information provided clearly indicates that there are a number of significant activities though little outcome with respect to standardisation. Based on this information the report provides an initial analysis of the AI standardisation landscape. The analysis suggests that there is a significant European share in group chairing but there is still opportunity for European experts to contribute to the work in progress.

The report is complemented with information on relevant new projects in the AI field, community and industrial AI-related activities, and a number of pertinent reports.

The final section provides suggestions for future priorities based on ongoing activities, the gap analysis and related documents of the EC. Current work on standardisation related to, e.g., ethics, bias, trustworthiness need attention to endure the inclusion of a European perspective and the still weak standardisation of technical aspects needs to be intensified, starting with an inventory of existing technical standards developed for other domains and used in AI and – based on this – a requirements analysis which could lead to a deeper gap analysis.

Annex I References

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Annex II Acronyms

AWI	Approved New Work Item
JTC1	Joint Technical Committee 1 (ISO and IEC)
MSP	Multi Stakeholder Platform
SDO	Standard Development Organisation
SSO	Standards Setting Organisation
TP	New Work Item Proposal
TR	Technical Report
WD	Working Draft