Artificial Intelligence

AI & Cognitive Systems Forum, IoTSWC 2019, Barcelona, October 2019

Wael William Diab, Chair SC 42 (Artificial Intelligence)

ISO JTC 1 IEC
INFORMATION TECHNOLOGY STANDARDS

SC 42 – Artificial Intelligence

Acknowledgement

Heather Benko (SC 42 Committee Manager)

Agenda

Overview of the Artificial Intelligence Market Opportunity

SC 42 Highlights: Progress and Key Topics

Concluding Remarks

Annexes: Additional Links and Program of Work

Enabling the Digital Transformation

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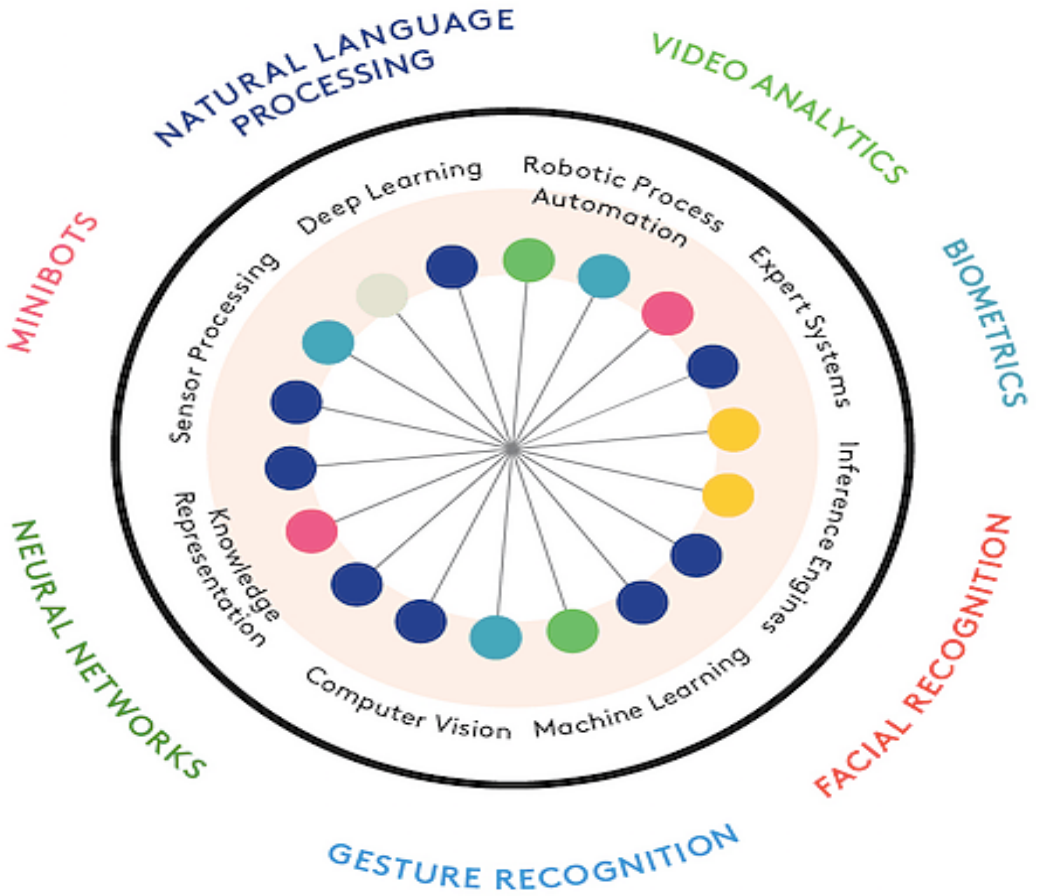

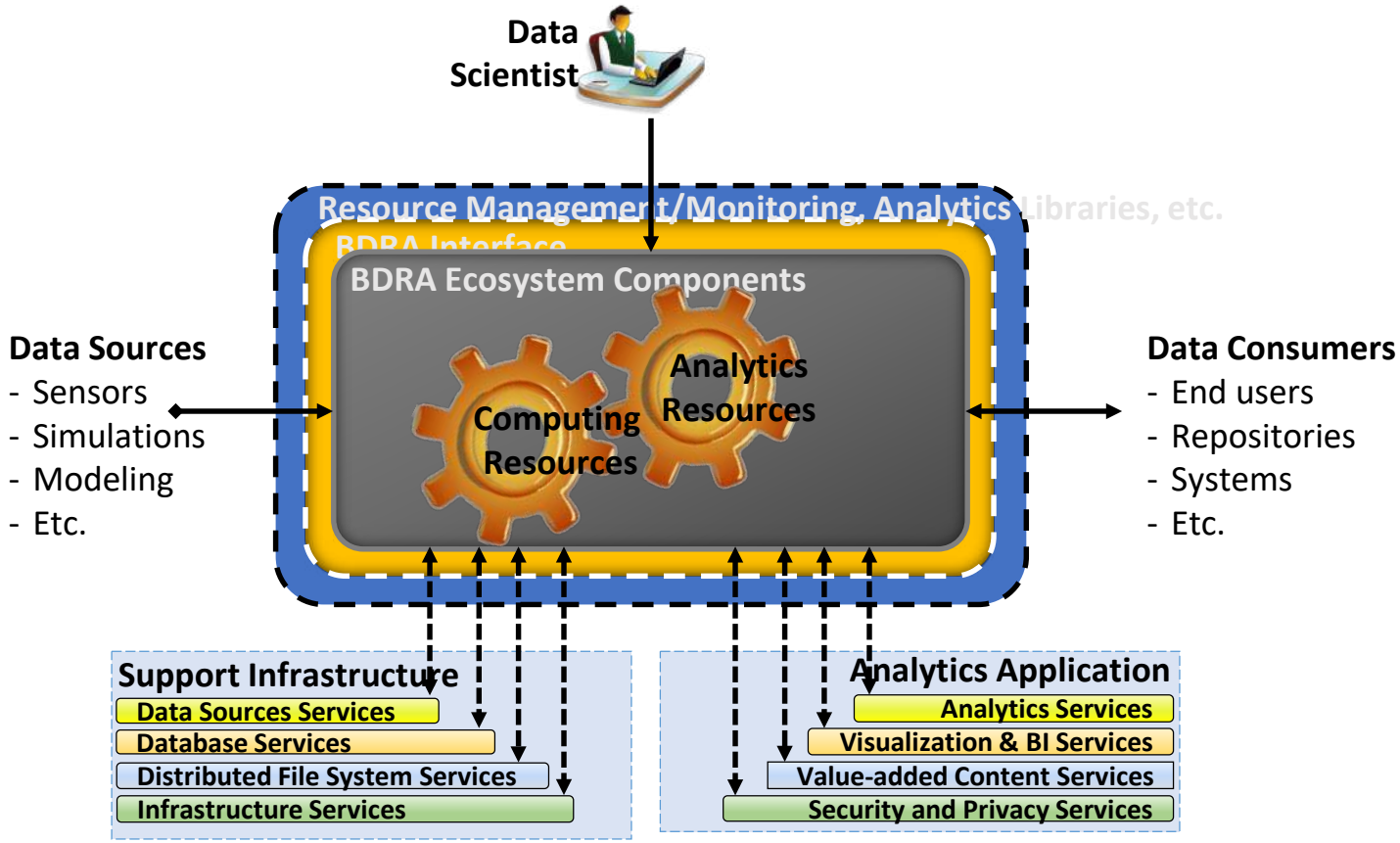

Artificial Intelligence
- not just one technology
- variety of SW / HW technologies applied in applications

Data Science
- Big Data ecosystem
- computational systems based on data characteristics across apps

Changing how we live, work and paly…

AI Use Cases, Applicability and Growth

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Traditionally, AI had been focused on large scale problems that were either too hard and complex to solve with traditional compute methods or were in specialized emerging areas

This is no longer the case. Machine learning has widened the applicability of AI. Focus on the **digital transformation** has created a demand for services and more intelligent analytics. Examples:

- AI expert systems are helping **healthcare** professionals make better decisions for patients with proper trustworthiness measures designed into the system,
- AI deployment in the **smart manufacturing** sector where it is driving higher efficiencies by allowing robots to work alongside human workers with the proper safety measures designed into the system,
- AI deployment in the **financial ecosystem** where it is enabling applications that range from asset management that takes into account factors such as the clients risk to fraud detection that reduces false-positives

Emerging applications are numerous and diverse e.g. **consumer**, **retail**, **digital assistants**, **expert systems** such as smart grid, **marketing intelligence** tools, enterprise etc.

Thus, it is not surprising that IDC estimates that **by 2019 40% of digital transformation initiatives will use AI services**, and **that by 2021 75% of enterprise applications will use AI**

Growing **demand for AI systems to provide insights into business problems**, is fueling the growth forecasts such as those by IDC that cognitive and **AI spending will grow to $52.2 billion** in 2021 achieving a **compound annual growth rate (CAGR) of 46.2%** over the 2016-2021 forecast period

Ecosystem is ripe for standardization

Ecosystem Approach

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Motivation

- AI is not a single technology but a collection of technologies
- Stakeholders are numerous and diverse
- Stakeholders are not treating AI and other key technologies as separate and disparate technology research areas
- Rather, stakeholders are approaching the deployment of AI systems from a business angle with a focus on customers needs, segments, services, products and regulatory requirements

Considerations for wide adoption

- While technology capability continues to be paramount it is not the only motivator
- Diverse stakeholder ecosystem necessitates industry collaboration across domains (e.g. IT/OT)
  - E.g. application areas such as transportation, medical, financial, robotics, manufacturing etc.
- By considering AI technologies against the backdrop of market segments / needs, additional synergies are being identified e.g. AI, analytics, Big Data, IoT
- Broad standardization approach that includes and goes beyond traditional interoperability

Structure of SC 42

WG 1 Foundational standards

WG 2 Big data

WG 3 Trustworthiness

WG 4 Use cases and applications

WG 5 Computational approaches and computational characteristics of AI systems

JWG 1 JWG SC 42 – SC 40 Governance implications of AI

AG 1 AI Management Systems Standard

AG 2 AI Systems Engineering

AHG 1 Dissemination and outreach

AHG 2 Liaison with JTC 1/SC 38

AHG 4 Liaison with JTC 1/SC 27

Highlights

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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

Strong growth of the committee and its program of work

- 29 P-members and 12 O-members. More than **doubled the number of NBs** participating since its creation
- Attendance ~150. Work program grew from 2 initial projects to 13 active projects
- >50% of work program progressed beyond working drafts
- Strong study areas for new work e.g. AGs on AI MSS and AI Systems Engineering

Extensive outreach activities

- Over two dozen IEC articles and multimedia engagements. Collaboration with the ISO Communications team for fall edition of ISO Focus on AI. **Thank you to the IEC (Antoinette, Mike) and ISO (Liz, Vivienne and team) staff!**
- SC 42 representation at key industry events

Active liaison relationships to support system integration mission

- Over 25 liaisons established, that include 5 Category A. Goal of wide adoption of SC 42 standards
- Engagement in strategic IEC and ISO initiatives e.g. ISO SMCC, IEC SEG 10, GSC-22, IEC YP, JTC 1 AGs

Keynote presentations at plenaries by European Commission AI Policy Lead and METI's Deputy-Director General

Key Topics: Foundational Standards

Overview

- Introduces an overview of the topic, terminology (vocabulary) and framework
- Describes the AI Machine Learning ecosystem

Motivation and current issues

- From a technology perspective, gives a high level description of the area and various components
- From a cross-stakeholder point of view (e.g. regulator, implementer, architect etc.) introduces common language
- Areas of current work
  - IS on **AI Concepts and Terminology**
  - IS on **Framework for AI Systems Using Machine learning**
  - AI Standards Lifecycle: Contributions included in the two existing projects

Key Topics: Big Data

Overview

- JTC 1's BD work initiated in 2015 under JTC 1/WG 9. Moved under SC 42 in May 2018
- Finishing original work. Started on BD analytics and exploring general AI/BD data issues

Motivation and current issues

- Foundational Big Data work maturing – 3 projects published. BDRA IS moving to FDIS
- Areas of current work
  - Completion of the BD foundational projects and potential revisions (e.g. use cases)
  - Process management framework for Big Data analytics (approved July 2019)
- Interest in considerations related to the data ecosystem for both AI and BD
  - Big Data quality
  - Exploration to expand WG 2's ToR to include all data considerations for AI and BD

Key Topics: Big Data Background

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Overview

- Big Data is a data set(s) with ***characteristics*** (e.g. volume, velocity, variety, variability, veracity, etc.) that for a particular problem domain at a given point in time ***cannot be efficiently processed*** using current/existing/established/***traditional technologies*** and techniques in order to *extract value*

Key Drivers of Big Data

- Key drivers in understanding the Big Data paradigm – how this is different from traditional data storage and compute / processing applications

- Volume: too big
- Velocity: arrives too fast
- Variability: changes too fast
- Veracity: contains too much noise
- Variety: too diverse

data set(s) characteristics

- The applications ***generating*** this data or requiring its ***analysis*** may have one more of the above aspects present

Emerging applications are creating a **paradigm shift** and enabling predictive analytics

Key Topics: Computational Methods

Overview

- Heart of AI looking at computational approaches and characteristics of AI systems

Motivation and current issues

- Initial project launched to provide **an overview of the state of the art of computational approaches for AI systems**, by describing: a) main computational characteristics of AI systems; b) main algorithms and approaches used in AI systems, referencing use cases contained in ISO/IEC TR 24030
- Desire to have some key industry agreed tenants for classification performance of algorithms – currently no such internationally agreed upon tenants / norms
  - NP Ballot from SC 42 based on recommendation by WG 5: **Assessment of classification performance for machine learning models and algorithms**

Key Topics: Trustworthiness

Overview

- Looking at a wide range of issues related to trustworthiness, security and privacy within the context of AI

Motivation and current issues

- Hot topic due to regulatory landscape (e.g. European privacy laws; discussions about social media engines)
- Key stakeholders view this as a necessary area for the success and broad market adoption of AI
- Frequently discussed within context of AI application areas. International standards will help tremendously
- Areas of current work
  - TRs on AI **bias**, **trustworthiness** overview and **robustness of neural networks**
    - **NP Ballot from SC 42 based on recommendation by WG 3: ISO/IEC 24029-2 Formal methods methodology**
  - IS on a **risk management framework for AI based on ISO 31000**
- Areas of continued study
  - Approaches to establish trust in AI systems through **transparency**, **verifiability**, **explainability**, **controllability**, etc.
  - Engineering pitfalls, **assess** typical **threats** and **risks** to AI systems with their **mitigation** techniques and methods
  - Approaches to achieve AI systems' **robustness**, **resiliency**, **reliability**, **accuracy**, **safety**, security, privacy, etc.

COMMON AI-RELATED ETHICAL AND SOCIETAL ISSUES*

*Source: Accenture (Liongosari)

Key Topics: Societal Concerns and Ethics

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Overview

- Adoption of transformative technologies like AI and BD create impacts that go beyond the technology
  - On the one hand, some issues captured by work on trustworthiness e.g. reliability, privacy, security etc.
  - On the other hand, some issues go beyond IT e.g. impact on labor force and economy
  - Emerging areas in between – context of technology's use e.g. algorithmic bias, safety directives in industrial AI, eavesdropping etc.
- AI ethical and societal considerations not limited to SC 42 but extend to IEC/ISO TCs in their applications

Motivation and current issues

- Standards can mitigate issues of AI ethics and societal concerns, allowing for broad and quicker adoption
  - Stakeholders include industry, regulatory, technologists, interest groups, application domain, society at large
- **Ethical and societal concerns considered across entire SC 42 program**
  - WG 3 providing overview and tie-in to trustworthiness, WG 4 via use cases, JWG 1 governance etc.
- SC 42 collaborating with other work programs e.g. PAI, OECD, IEEE and EC (EU Ethics guidelines for trustworthy AI). SC 42 Participates in IEC SEG 10 and OCEANIS (via IEC membership)

Key Topics: Use Cases and Applications

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Overview

- Identify AI application domains, context of AI use in those domains and develop guidance
- Collect representative use cases and analyze for derived requirements

Motivation and current issues

- From a broader industry perspective, interest in AI is in its current and growing application fields
- Use cases are the “currency” between SDO committees
  - Can include areas beyond pure IT e.g. trustworthiness and societal concerns
- By looking at different domains, ensures SC 42 deliverables are “broad enough to be horizontal”
- Current areas of work
  - Collected over 85 use cases since being approved and is reaching out to all liaisons for more use cases
  - Will consider the ethical and societal concerns within the context of use cases
- Current areas of study
  - provide best practices/generic guidance on application domains
  - AI lifecycle for software developers

Key Topics: Governance Implications of AI

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Overview

- Fueled by the digital transformation, AI technologies are being rapidly adopted across industries, cities, homes and infrastructures
- Thus, the need to address governance implications for the use of AI in organizations has become of paramount importance

Motivation and current issues

- The motivation is to help **organization boards and executives ask and answer key questions about AI technologies**
- By **combining the expertise of SC 42, which is looking at the entire AI ecosystem, with that of SC 40, which is looking at IT governance, a joint working group has been established** to develop an ISO/IEC standards on the governance implications of AI

Key Topic: Management Systems Standard

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AI technologies bring AI-specific concerns beyond those of traditional IT systems. For example

- ML based AI system may provide different results depending on the training data used
  - The choice of training data when using an AI system is an additional process that an organization needs to perform to ensure the intended overall system performance
- Consumers of AI products and services may lack trust in the AI supplier organization
  - Assurance that the organization considered for fairness, inclusiveness, accountability etc. of AI system

MSS containing AI-specific process requirements allows for assessment of conformance or auditability of the processes

- Allows organizations to check how well it meets their objectives in the use of an AI system
- For trusted 3rd party performing a check or audit, a certificate of conformance can be issued

SC 42 took initial step towards studying and if there is consensus developing a MSS proposal

- SC 42 created an advisory group (SC 42/AG 1) to prepare a Justification Study identifying elements and to substantiate viability of AI MSS. AG 1 to report its finding at the 5th plenary

Key Topic: AI Systems Engineering

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Design and integration of AI into systems present unique system engineering challenges. For example,

- (a) **adaptation** of well established software and systems engineering practices, standards etc. (b) **integration** of AI into and **interaction** with **outer system** and **lifecycle implications** (c) higher system-level **maintenance costs** than traditional systems due to computation and data sensitivity (d) use of **statistical predictability methods** versus deterministic approach of conventional systems (e) rethinking **testing, verification and validation** strategies (f) development of an AI **data quality model**

SC 42/AHG 3 studied intelligent systems engineering. AHG 3 completed its work with recs that SC 42 endorsed

- Assignment of study items to SC 42/WGs 2, 3 and 4 including (a) **application guidance from a lifecycle** and systems engineering perspective, (b) **requirements and acceptance criteria expressions** for AI systems, (c) **gap analysis of V&V** for traditional systems versus AI systems and (d) extension of a **data quality model for AI**
- Creation of **SC 42 advisor group (AG 2) on AI Systems Engineering** with these ToRs, some to be jointly done with WG 4*
  - **Gap analysis** between **existing engineering practices and AI best practices** to identify standardization opportunities
  - **Identify** ISO, IEC or JTC1 existing standards that may be impacted
  - **Feedback** between the AI **subsystem** / component and the **parent system***
  - **Redeployment, reuse, or transfer** of AI systems to different contexts requires unique considerations*
  - **Maintenance** of AI systems within the same context require unique considerations. Many AI system require retraining/recalibration that may impact on outer system validation. This has direct impact to the operation of AI system and associated OpEx*
  - **ML vs AI lifecycle** may have different needs. **AI systems vs AI services** may have different needs. Analyze if captured SC 42*

SC 42/AG 2 is created through the 6th plenary providing an interim report at the 5th plenary

Key Topics: Joint Work and Collaboration

Overview

- Due to its provenance, a number of groups are approaching SC 42 for joint work and/or collaboration
- Large ecosystems of liaisons (> 20) with other committees both internal (ISO, IEC, JTC 1) and external
- SC 42 participating in a number of ISO and IEC initiatives and is engaged in a number of JTC 1 AGs / AHGs

Motivation and current issues

- Both the IT and application side require AI/BD expertise to explore and develop standards in emerging domains
- For governance implications of AI, a JWG between SC 42 and SC 40 formed
- SC 42 is participating on the ISO TMB SMCC (Smart Manufacturing Coordinating Committee)
- SC 42 chair appointed as the JTC 1 liaison to IEC SEG 10 on Ethics in Autonomous and AI Systems
- SC 42 has representatives into JTC 1 Advisory Groups (AGs) and Ad-hoc Groups (AHGs) that include
  - Quantum Computing, Data Usage, Trustworthiness, Autonomous and Data Rich Vehicles, Meta Reference Architecture and Reference Architecture for Systems Integration, Digital Twin, Standards and Regulation, Open Source Software, JETI and Communications
- Feedback provided through ISO/IEC to the European Commission on Multi-Stakeholder Rolling Plan

ISO TMB SMCC

ISO TMB setup a Smart Manufacturing Coordinating Committee. SMCC coordinates SM across relevant ISO committees

Current membership includes TC 10, TC 39, TC 184, TC 184/SC 4, TC 184/SC 5, TC 199, TC 211, TC 261, TC 292, TC 299, JTC 1/SC 41 and others as well as a liaison to IEC, which covers IEC smart manufacturing including IEC TC 65 and system committee on SM. SC 42 is now a member. SC 42 was requested to join and approved by SMCC and the TMB

In addition to coordination, the group is tasked with defining smart manufacturing, providing a landscape, use cases and other foundational materials for ISO committees working on SM, maintenance of a directory of applicable standards, providing a GAP analysis on smart manufacturing activities across ISO. The tasks of maintenance of a directory and definition are joint with IEC. The group also oversees the SM2TF (Smart Manufacturing Standards Map Task Force), which will provide the first pass of the mapping of smart manufacturing activities across ISO

Concluding Remarks

SC 42 is the first of its kind international standards committee looking at the full AI ecosystem

- AI and Big Data are key technologies enabling the digital transformation

SC 42 has a rapidly growing work program

- Strong committee growth and execution on work program. 13 projects, 6 WGs, 2AGs and multiple AHGs
- Robust study program for anticipated new work addressing system level concerns with AI

SC 42 engaging in extensive outreach and global collaboration

- Tremendous outreach via ISO, IEC and national bodies. Extensive and diverse liaison network

Part of the ISO, IEC and JTC 1 families

- Access to broad, diverse and numerous committees that range from horizontal to vertical areas
- System integration committee providing guidance to ISO, IEC and JTC 1 committees looking at AI applications

Opportunity for international standards to fuel AI market growth and accelerate adoption

Excellent opportunity to engage

- If you are interested to participate, contact you national body mirror committee
  - e.g. ANSI in USA, DIN in Germany, SAC in China, NSAI in Ireland, SIS in Sweden, BIS in India etc.


The First Meeting of ISO/IEC JTC 1/SC 42
Hosted by
Standardization Administration of the P.R.C (SAC)


ISO IEC
ARTIFICIAL INTELLIGENCE
OCTOBER 8-12, 2018
WELCOME DELEGATES
ANSI


The First Meeting of ISO/IEC JTC 1/SC 42
Hosted by
Standardization Administration of the P.R.C.(SAC)
Coordinated by
China Electronics Standardization Institute


SC 42 Secretariat
SC 42 Chair


Japan
Korea


Denmark
Germany


Netherlands


Japan



SC42 Chair



United Kingdom


Australia

産総研


Annex A

Additional Links and Information

Additional Links and Information

ISO JTC 1 IEC
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SC 42 – Artificial Intelligence

- SC 42
  - Committee website
  - History website
- Press Coverage Related to SC 42 Formation, Overview and Program of Work
  - IEC news announcing the key outcomes of the 3rd plenary (April 23rd, 2019)
  - IEC news announcing the start of the 3rd plenary (April 9th 2019)
  - ISO news article (18th October 2018)
  - JTC 1 press committee article (30th May 2018)
  - IEC e-tech article (17th May 2018). Additional circulations
    - ISO retweeted the article (September 2018)
    - Published on ANSI (US National Body) website
    - Published on UNE (Spain National Body) website (September 2018)
    - Published on ILNAS (Luxemburg National Body) website (27th April 2018)
      - Note: not a direct reprint but used the photo
    - Published on Robotics Automation and News Magazine
  - ANSI news article on the formation of SC 42 (16th January 2018)
  - Introduction of SC 42 in the IEC MSB White Paper on Artificial Intelligence

Additional Links and Information

ISO JTC 1 IEC
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SC 42 – Artificial Intelligence

- Other media coverage
  - Twitter
    - ISO (@isostandards)
      - Tweet Chat on standards on Artificial Intelligence with Chair of SC 42 (25th October). Hashtags: #ISOchat #Standards4AI
    - IEC (@IECStandards)
      - Article on New international standard will help organization boards and executive managers ask and answer key questions about AI technologies (12th February 2019)
      - Article on International standards play a key role in addressing the ethical, technical, safety and security aspects (6th February 2019)
      - Article and video on Standardization can help eliminate data bias in AI (4th February 2019)
      - Article and video on Chair of SC 42 explains the growing influence of AI in Smart Manufacturing (4th February 2019)
      - Article on Chair of SC 42 will lead a session at the CEN/CENELEC workshop on Trustworthy Artificial Intelligence (10th Aug 2018)
  - IEC Medium Publications
    - IEC blog on Establishing trustworthiness is vital in our human-machine world (Sep 9th 2019)
    - IEC blog on AI and IoT industry leaders to consider a digital trust framework at Berlin forum (May 15th 2019)
    - IEC blog on The need for Big Data Standards (April 24th 2019)
    - IEC blog on New international standard will offer risk management framework for AI (March 18th 2019)
    - IEC blog on Helping organization boards and executives ask and answer key questions about AI technologies (Feb 12th 2019)
    - IEC e-tech article on AI in healthcare: keeping data safe and building trust (January 25th 2019)
    - IEC blog on Making AI safe (January 23rd 2019)
    - IEC e-tech article on Healthcare needs doctors and machines (December 10th, 2018)
    - IEC e-tech article on Eliminating data bias from machine learning systems (November 13th 2018)
    - IEC e-tech article on Smart homes are getting smarter (November 6th 2018)
    - IEC e-tech article on Machine learning is not a synonym for AI (October 17th 2018)
    - IEC e-tech article on Rethinking the healthcare ecosystem (reference to SC 42)

Additional Links and Information

ISO JTC 1 IEC
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SC 42 – Artificial Intelligence

- Other media coverage
  - ISO Multimedia
    - ISO video interview with Chair of SC 42 on Standards and Artificial Intelligence (November 14th 2018)
      - Artificial Intelligence and the role of International Standards in the implementation of this technology
    - ISO video interview with Chair of SC 42 on Standards and Artificial Intelligence Continued (November 14th 2018)
      - Artificial Intelligence and easing the mind of end-users including AI trustworthiness, ethics and societal concerns
  - IEC Multimedia
    - IEC video interview with Chair of SC 42 on How can we ensure AI is safe for Healthcare? (April 6th 2019)
    - IEC video interview with Chair of SC 42 on Is it too early to use machine learning for cybersecurity? (April 5th 2019)
    - IEC video interview with Chair of SC 42 on To what extent is AI ready for standardization? (April 5th 2019)
    - IEC video interview with Chair of SC 42 on What are some of the challenges you see with AI? (March 26th 2019)
    - IEC video interview with Chair of SC 42 on How to Define Artificial Intelligence (March 26th 2019)
    - IEC video interview with Chair of SC 42 on Why do we need standards for AI? (March 26th 2019)
    - IEC video interview with Chair of SC 42 on Artificial Intelligence (February 4th 2019)
      - The growing influence of AI in Smart Manufacturing and the important role of standards
    - IEC video interview with Chair of SC 42 on Artificial Intelligence (February 4th 2019)
      - Standardization can help eliminate data bias in AI

Additional Links and Information

ISO JTC 1 IEC
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SC 42 – Artificial Intelligence

- Other media coverage
  - Global Standards Collaboration (GSC-22) 2019 Session on Artificial Intelligence
    - ISO news on Standards cooperation is key to making AI and smart cities a reality (April 4th 2019)
    - IEC blog on 22nd Global Standards Collaboration meeting discusses need for standards to accelerate AI technology innovation and adoption (April 3rd 2019)

Annex B

Detailed Breakdown of SC 42/WGs, Liaisons and Work Program

SC 42 Published Standards

ISO/IEC 20546:2019 Information technology -- Big Data -- Overview and Vocabulary

- Publication date: 2019-02

This document provides a set of terms and definitions needed to promote improved communication and understanding of this area. It provides a terminological foundation for big data-related standards.

This document provides a conceptual overview of the field of big data, its relationship to other technical areas and standards efforts, and the concepts ascribed to big data that are not new to big data.

ISO/IEC TR 20547-2:2018 Information technology -- Big data reference architecture -- Part 2: Use cases and derived requirements

- Publication date: 2018-01

ISO/IEC TR 20547-2:2018 provides examples of big data use cases with application domains and technical considerations derived from the contributed use cases.

ISO/IEC TR 20547-5:2018 Information technology -- Big data reference architecture -- Part 5: Standards roadmap

- Publication date: 2018-02

ISO/IEC TR 20547-5:2018 describes big data relevant standards, both in existence and under development, along with priorities for future big data standards development based on gap analysis.

SC 42 Projects, Status and Leadership

SC 42/WG 1 Foundational standards

- Terms of reference: Development of foundational standards for Artificial Intelligence
- Convenor: Paul Cotton (Canada)
- ISO/IEC 22989: Artificial Intelligence Concepts and Terminology
  - Editor: Wei Wei (Germany)
  - Status: CD Ballot
- ISO/IEC 23053: Framework for Artificial Intelligence Systems Using Machine Learning
  - Editor: Milan Patel (United Kingdom)
  - Status: CD Ballot

SC 42/WG 2 Big data

- Terms of reference: Standardization in the area of Big Data
- Convenor: Wo Chang (United States)
- ISO/IEC TR 20547-1: Information technology -- Big Data reference architecture -- Part 1: Framework and application process
  - Editor: David Boyd (United States)
  - Status: DTR Ballot
- ISO/IEC 20547-3: Information technology -- Big Data reference architecture -- Part 3: Reference architecture
  - Editor: Ray Walshe (Ireland)
  - Status: FDIS Ballot
- ISO/IEC 24668: Information technology -- Artificial Intelligence -- Process management framework for Big data analytics
  - Editor: Gautam Banerjee (India)
  - Status: Working draft

SC 42 Projects, Status and Leadership

SC 42/WG 3 Trustworthiness

- Terms of reference: Standardization in the area of AI Trustworthiness
- Convenor: David Filip (Ireland)
- Secretariat: Barry Smith (Ireland)
- ISO/IEC NP TR 24027: Information technology -- Artificial Intelligence (AI) -- Bias in AI systems and AI aided decision making
  - Editor: Adam Leon Smith (United Kingdom)
  - Status: Working draft
- ISO/IEC 24028: Information technology -- Artificial Intelligence (AI) -- Overview of trustworthiness in Artificial Intelligence
  - Editor: Orit Levin (United States)
  - Status: PDTR Ballot passed. Comment resolution on PDTR
- ISO/IEC NP TR 24029-1: Information technology -- Artificial Intelligence (AI) -- Assessment of the robustness of neural networks
  - Editor: Arnault Ioualalen (France)
  - Status: DTR Ballot
- ISO/IEC AWI 23894 -- Information technology -- Artificial intelligence -- Risk management
  - Editor: Peter Deussen (Germany)
  - Status: Working draft
- ISO/IEC NP TR 24368: Information technology -- Artificial Intelligence (AI) -- Overview of Ethical and Societal Concerns
  - Editor: Mikael Hjalmarson (Sweden)
  - Status: Working draft

SC 42 Projects, Status and Leadership

SC 42/WG 4 Use cases and applications

- Terms of reference: Use cases and applications for AI standardization
- Convenor: Fumihiro Maruyama (Japan)
- Secretariat: Nobuhiro Hosokawa (Japan)
- ISO/IEC NP TR 24030: Information technology -- Artificial Intelligence (AI) -- Use cases
  - Editor: Yuchang Cheng (Japan)
  - Status: DTR ballot

SC 42/WG 5 Computational approaches and computational characteristics of AI systems

- Terms of reference: Standardization in the area of computational approaches and computational characteristics of AI systems
- Convenor: Tangli Liu (China)
- Secretariat: Qun Zhang (China)
- ISO/IEC NP TR 24372: Information technology -- Artificial Intelligence (AI) -- Overview of computational approaches for AI systems
  - Editor: Wanzhong Ma (China)
  - Status: Working draft

SC 42 Projects, Status and Leadership

SC 42/JWG 1 Governance implications of AI

[Joint WG with SC 40. Administered by SC 42]

- Convenor: Janna Lingenfelder (Germany)
- Co-Convenor: Gyeung-Min Kim (Republic of Korea)
- ISO/IEC AWI 38507 -- Information technology -- Governance of IT -- Governance implications of the use of artificial intelligence by organizations
  - Editor: Peter Brown (United Kingdom)
  - Status: Working draft

SC 42/AHG 1 Dissemination and outreach

- Convenor: Wael William Diab (SC 42 Chair)
- Secretariat: Heather Benko (SC 42 Committee Manager)

SC 42 Active AGs/AHGs on Specific Topics

- AG 1 on AI Management Systems Standard – Convenor: Jim McFie (Canada)
- AG 2 on AI Systems engineering – Convenor: Luigi Troiano (Italy)
- AHG 2 on Liaison with JTC 1/SC 38 – Convenor: Peter Duessen (Germany)
- AHG 4 on Liaison with JTC 1/SC 27 – Convenor: Peter Duessen (Germany)

SC 42 Projects, Status and Leadership

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INFORMATION TECHNOLOGY STANDARDS
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SC 42 Completed Study Groups

- SC 42/SG 1 Computational approaches and characteristics of artificial intelligence systems
  - Convenor: Tangli Liu (China)
  - Secretariat: Qun Zhang (China)
  - Status
    - SG report to be submitted by the SG leadership team to SC 42 by May 31st for consideration
    - NWIPs under discussion in the SG have been assigned to WG 5 to continue discussion and consideration
- SC 42/SG 2: Trustworthiness
  - Convenor: David Filip (Ireland)
  - Secretariat: Barry Smith (Ireland)
  - Status
    - Study group report on robustness completed and accepted by SC 42
    - Remaining items of study from terms of reference assigned as tasks to SC 42/WG 3
- SC 42/SG 3: Use cases and applications
  - Convener: Fumihiro Maruyama (Japan)
  - Secretariat: Nobuhiro Hosokawa (Japan)
  - Status: Remaining items of study from terms of reference assigned as tasks to SC 42/WG 4

SC 42 Completed AHGs

- Societal concerns
- Study groups terms of reference
- Business plan review 2018 and 2019
- Ethical and sustainable AI proposal
- AHG 3 on Intelligent systems engineering

SC 42 Liaisons

ISO JTC 1 IEC
INFORMATION TECHNOLOGY STANDARDS
SC 42 – Artificial Intelligence

SC 42 has established an extensive and comprehensive set of liaisons for collaboration

- SC 42 provides guidance to ISO, IEC and JTC 1 committees on AI applications
- Reflects strong internal and external interest in the AI standardization program of work

Approved Category A External Liaisons

- Institute of Electrical and Electronics Engineers (IEEE)
  - SC 42 liaison officer: Wei Sha (China)
  - IEEE liaison officers: Josh Hyman and Beth-Anne Schuelke-Leech
- Open Geospatial Consortium (OGC)
  - OGC liaison officers: George Percivall and Ingo Simonis
- Consumers International
- Big Data Value Association (BDVA)
  - SC 42 liaison officers: Abdellatif Benjelloun Touimi (U.K.) and Ray Walshe (Ireland)
  - BDVA liaison officers: Ana Garcia Robles and Abdellatif Benjelloun Touimi
- ITU
  - SC 42 liaison officer: Yoav Evenstein (Israel)
  - ITU liaison officers: Reinhard Scholl and Bilel Jamamoussi
- Partnership on AI (PAI)
  - SC 42 liaison officer: Tarek Besold (Germany)
  - PAI liaison officers: Terah Lyons, Peter Eckersley and Steven Adler

Approved Internal Liaisons to SC 42

- JTC 1 (WG 11) – Smart Cities
  - Officer: Howard Choe
- JTC 1/SC 7 – Software and systems engineering
  - Officers: Stuart Reid and Shuji Kinoshita
- JTC 1/SC 32 – Data management and interchange
- JTC 1/SC 36 – Information technology for learning, education and training
  - Officer: Jon Mason
- JTC 1/SC 37 – Biometrics
  - Officer: Markku Metsämäki (Finland)
- JTC 1/SC 38 – Cloud computing and distributed platforms
  - Officer: Toshiro Suzuki (Japan)
- JTC 1/SC 40 – IT Service Management and IT Governance
  - Officer: Terry Landers (Ireland)
- JTC 1/SC 41 – Internet of things and related technologies
  - Officers: Osten Franberg (Sweden) Luke Fay (United States)

SC 42 Liaisons

ISO JTC 1 IEC
INFORMATION TECHNOLOGY STANDARDS

SC 42 – Artificial Intelligence

Approved Internal Liaisons to SC 42

- ISO/PC 317 – Consumer protection: privacy by design for consumer goods and services
- ISO/TC 20 – Aircraft and space vehicles
- ISO/TC 37 – Language and terminology
- ISO/TC 42 – Photography
  - Officer: Scott Foshee (United States)
- ISO/TC 69 – Applications of statistical methods
  - Officer: Radouane Oudrhiri (United Kingdom)
- ISO/TC 211 – Geographic information/Geomatics
- ISO/TC 215 – Health infomatics
- ISO/TC 307 – Blockchain and distributed ledger technologies
  - Officer: Janna Lingenfelder (Germany)
- ISO/TC 309 – Governance of organizations
  - Officer: Michael Kayser
- IEC SyC AAL
  - Officer: Ulrike Haltrich
- IEC TC 65 – Industrial – Process measurement, control and automation
  - Officers: Rudy Belliardi (TC 65 Secretary) and Wael William Diab (SC 42 Chair)

Approved Internal Liaisons from SC 42

- IEC SyC Smart Cities
  - SC 42 Officer: Tangli Liu (China)
- IEC SyC AAL – Active Assisted Living
  - SC 42 Officer: David Martin (United States)
- IEC/TC 65 – Industrial – Process measurement, control and automation
  - SC 42 Officers: Wei Wei (Germany), Rudy Belliardi (TC 65 Secretary) and Wael William Diab (SC 42 Chair)
- IEC/TC 65/SC 65A – System Aspects
  - SC 42 Officer: Takashi Egawa (Japan)
- JTC 1/SC 7 – Software and systems engineering
  - SC 42 Officers: Yuchang Cheng (Japan) and Adam Leon Smith (UK)
- JTC 1/SC 27 – IT security techniques
  - SC 42 Officers: Peter Deussen (Germany), Sun Yan (China)
- JTC 1/SC 29 – Coding of audio, picture, multimedia and hypermedia information
  - SC 42 Officers: Wo Chang (United States) and Abdellatif Benjelloun Touimi (UK)
- JTC 1/SC 32 – Data management and interchange
  - SC 42 Officers: Wo Chang (US) and Guang Liang (China)
- JTC 1/SC 34 – Document description and processing languages

SC 42 Liaisons

Approved Internal Liaisons from SC 42

- JTC 1/SC 36 – Information technology for learning, education and training
  - SC 42 Officer: Bruce Peoples (United States)
- JTC 1/SC 37 – Biometrics
  - SC 42 Officers: Brianna Brownell (Canada), Frank Rudzicz (Canada)
- JTC 1/SC 38 – Cloud computing and distributed platforms
  - SC 42 Officers: Peter Deussen (Germany), David Filip (Ireland)
- JTC 1/SC 39 – Sustainability for and by Information Technology
  - SC 42 Officer: Yoav Evenstein (Israel)
- JTC 1/SC 40 – IT Service Management and IT Governance
  - SC 42 Officer: Geoff Clarke (Australia)
- JTC 1/SC 41 – Internet of things and related technologies
  - SC 42 Officer: Wei Wei (Germany)
- JTC 1 (WG 11) – Smart cities
  - SC 42 Officer: Tangli Liu (China)
- ISO/TC 37 – Language and terminology
  - SC 42 Officer: David Filip (Ireland)
- ISO/TC 37/SC 3 – Management of terminology resources
  - SC 42 Officer: David Filip (Ireland)
- ISO/TC 69 – Applications of statistical methods
  - SC 42 Officer: Radouane Oudrhiri (UK)
- ISO/TC 204 – Intelligent Transport Systems
  - SC 42 Officer: Wael William Diab (Chair)
- ISO/TC 215 – Health informatics
  - SC 42 Officer: Paolo Alcini (Italy)
- ISO/TC 262 – Risk management
  - SC 42 Officer: Pat Baird (United States)
- ISO/TC 299 – Robotics
  - SC 42 Officer: David Dubois (Canada)
- ISO/TC 307 – Blockchain and distributed ledger technologies
  - SC 42 Officers: Li Bin (China) and Dapeng Zhang (China)
- ISO/TC 309 – Governance of organizations
  - SC 42 Officer: Victoria Hailey (Canada)

Annex C

Additional Information on SC 42 Meeting Schedule

Upcoming Meetings

5th Plenary meeting

- April 6th – 10th, 2020
- Versailles (Paris), France
- Confirmed

6th Plenary meeting

- October 19th – 23rd, 2020
- Montreal, Canada
- Confirmed

7th Plenary meeting

- April, 2021
- Moscow, Russia
- Tentative

8th Plenary meeting

- September/October, 2021
- (City TBC), Italy
- Tentative

9th Plenary meeting

- April, 2022
- Sydney, Australia
- Tentative

10th Plenary meeting

- October, 2022
- Tel Aviv, Israel
- Tentative

11th Plenary meeting

- April, 2023
- Vienna, Austria
- Tentative

Past Meetings

4th Plenary meeting

- October 7th – 11th, 2019
- Tokyo, Japan

3rd Plenary meeting

- April 8th – 12th, 2019
- Dublin, Ireland

2nd Plenary meeting

- October 18th – 20th, 2018
- Sunnyvale, CA, USA

1st Plenary meeting

- April 18th – 20th, 2018
- Beijing, China

Annex D

Big Data Trends

Big Data Analysis and Predictions

ISO JTC 1 IEC
INFORMATION TECHNOLOGY STANDARDS
SC 42 – Artificial Intelligence

Tremendous market growth and job creation

Strong support that Big Data adoption is happening, cross-cutting and has significant implications and potential

Paradigm shift and predictive analytics

IDC – Predictions from the IDC FutureScape for Big Data and Analytics

1. Visual data discovery tools will be growing 2.5 times faster than rest of the business intelligence (BI) market. By 2018, investing in this enabler of end-user self service will become a requirement for all enterprises.
2. Over the next five years spending on cloud-based Big Data and analytics (BDA) solutions will grow three times faster than spending for on-premise solutions. Hybrid on/off premise deployments will become a requirement.
3. Shortage of skilled staff will persist. In the U.S. alone there will be 181,000 deep analytics roles in 2018 and five times that many positions requiring related skills in data management and interpretation.
4. By 2017 unified data platform architecture will become the foundation of BDA strategy. The unification will occur across information management, analysis, and search technology.
5. Growth in applications incorporating advanced and predictive analytics, including machine learning, will accelerate in 2015. These apps will grow 65% faster than apps without predictive functionality.
6. 70% of large organizations already purchase external data and 100% will do so by 2019. In parallel more organizations will begin to monetize their data by selling them or providing value-added content.

Big Data Analysis and Predictions

ISO JTC 1 IEC
INFORMATION TECHNOLOGY STANDARDS
SC 42 – Artificial Intelligence

Emerging Applications and Trends for BD

IDC – Predictions from the IDC FutureScape for Big Data and Analytics

7. Adoption of technology to continuously analyze streams of events will accelerate in 2015 as it is applied to Internet of Things (IoT) analytics, which is expected to grow at a five-year compound annual growth rate (CAGR) of 30%.
8. Decision management platforms will expand at a CAGR of 60% through 2019 in response to the need for greater consistency in decision making and decision making process knowledge retention.
9. Rich media (video, audio, image) analytics will at least triple in 2015 and emerge as the key driver for BDA technology investment.
10. By 2018 half of all consumers will interact with services based on cognitive computing on a regular basis.

Gartner

Bid Data Motivators within ICT Space

- On weather or not “Big data hype or substance?”
  - Beyond all the discussions, adoption of big data is simply inevitable
- Within key IT trends
  - Identifies Big Data expertise as essential
  - Identifies Big Data expertise as needed within Web-scale I, IoT and others
- Benefits of big data are not limited solely to better decision making
  - fewer than half of big data projects focus on direct decision making
  - most big data projects are geared to generating deeper business insights and optimizing, automating or even designing new processes

Annex E

Overview of JTC 1

Part of the ISO, IEC and JTC 1 Family

ISO JTC 1 IEC
INFORMATION TECHNOLOGY STANDARDS
SC 42 – Artificial Intelligence

JTC 1

- Jointly established under ISO and IEC covering the field of Information Technology
  - ICT building blocks for global markets
  - Standards for business and consumer applications
- 33 P-members and 62 O-members
- About 5000 active participants developing 580+ standards; over 3000 published
- Technical areas within JTC 1 include
  - Coded character sets – Telecommunications and information exchange between systems – Software and systems engineering – Cards and security devices for personal identification – Programming languages – Digitally recorded media – Computer graphics, image processing – IT security techniques – Office equipment (printing) – Coding of audio, picture, multimedia (JPEG, MPEG) – Automatic ID and data capture (RFID) – Data management – Document description, processing – User interfaces, IT for learning, education, training – Biometrics – Cloud computing – IT Sustainability – IT governance – Internet of Things – Artificial Intelligence – Smart cities – 3D printing and scanning – Quantum Computing
- Strategic topics covered within JTC 1 include
  - Digital transformation
    - Increased cooperation with other ISO and IEC TCs
    - Working with policy makers: standards and regulations
  - Systems integration
  - Cooperation with consortia
  - Trustworthiness
  - Emerging technologies
  - Open source

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