Artificial Intelligence

ITU Workshop on AI, Machine Learning and Security, Geneva, January 2019

Wael William Diab, Chair SC 42 (Artificial Intelligence)

ISO JTC 1 IEC
INFORMATION TECHNOLOGY STANDARDS

SC 42 – Artificial Intelligence

Acknowledgement

Heather Benko (ANSI)

Agenda

Overview of Artificial Intelligence Market Opportunity

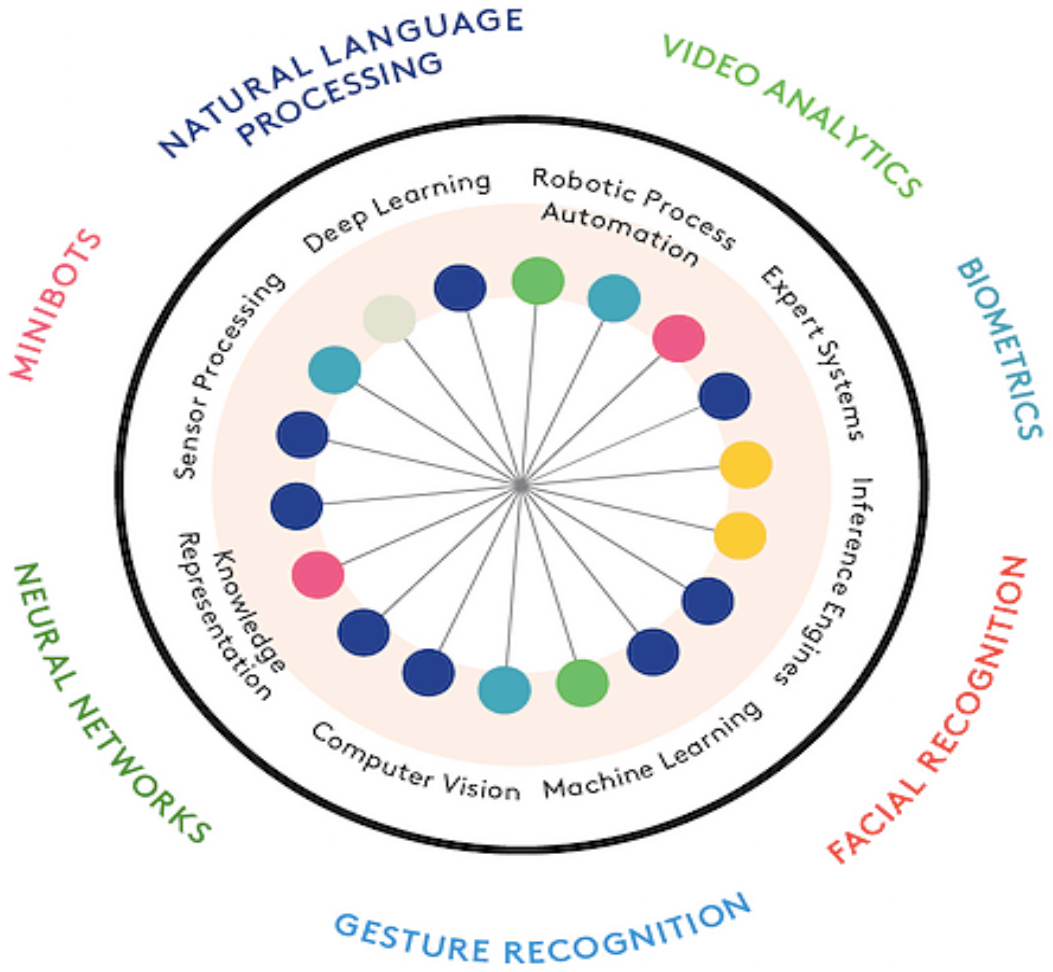
SC 42

- Introduction to the AI Standardization Committee
- Key topics, issues and opportunities

Concluding Remarks

Additional Links and Information

Artificial Intelligence Model*



Artificial Intelligence:

- not just one technology,

- a variety of software / hardware technologies

that can be applied in numerous ways for different applications.

*Source: Accenture

COMMON AI-RELATED ETHICAL AND SOCIETAL ISSUES*

*Source: Accenture (Liongosari)

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 IoT 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 **industrial 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**

The 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

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Overview of SC 42

Scope of SC 42

- 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

Chair: Wael William Diab (United States)

Secretary: Heather Benko (United States)

Membership to-date

- 22 p-members: Australia (SA), Austria (ASI), Canada (SCC), China (SAC), Denmark (DS), Finland (SFS), France (AFNOR), Germany (DIN), India (BIS), Ireland (NSAI), Israel (SII), Italy (UNI), Japan (JISC), Korea, Republic of (KATS), Luxembourg (ILNAS), Portugal (IPQ), Russian Federation (GOST R), Spain (UNE), Sweden (SIS), Switzerland (SNV), United Kingdom (BSI), United States (ANSI)
- 11 o-members: Argentina (IRAM), Belgium (NBN), Hungary (MSZT), Kenya (KEBS), Mexico (DGN), Netherlands (NEN), New Zealand (NZSO), Norway (SN), Philippines (BPS), Poland (PKN), Singapore (ESG)

Part of the ISO, IEC and JTC 1 Family

Website

Structure of SC 42

SC 42/WG 1 Foundational standards

SC 42/WG 2 Big data

SC 42/WG 3 Trustworthiness

SC 42/WG 4 Use cases and applications

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

SC 42/SG 1 Computational approaches and characteristics of artificial intelligence systems

SC 42/AHG Dissemination and outreach

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 AWI 22989: Artificial Intelligence Concepts and Terminology
  - Editor: Wei Wei (Germany)
  - Status: Working draft 1
- ISO/IEC AWI 23053: Framework for Artificial Intelligence Systems Using Machine Learning
  - Editor: Milan Patel (United Kingdom)
  - Status: Working draft 1

SC 42/WG 2 Big data

- Terms of reference: Standardization in the area of Big Data
- Convenor: Wo Chang (United States)
- ISO/IEC DIS 20546: Information technology – Big Data – Overview and Vocabulary
  - Editor: David Boyd (United States)
  - Status: Completed DIS ballot. Authorized for FDIS
- ISO/IEC TR 20547-1: Information technology – Big Data reference architecture – Part 1: Framework and application process
  - Status: Working draft
- ISO/IEC DIS 20547-3: Information technology – Big Data reference architecture – Part 3: Reference architecture
  - Editor: Ray Walshe (Ireland)
  - Status: Completed first DIS. CRM to be scheduled

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 TR 24027: Information technology – Artificial Intelligence (AI) – Bias in AI systems and AI aided decision making
  - Editor: Jutta Williams (United States)
  - Status: Editor draft
- ISO/IEC TR 24028: Information technology – Artificial Intelligence (AI) – Overview of trustworthiness in Artificial Intelligence
  - Editor: Orit Levin (United States)
  - Status: Editor draft
- ISO/IEC TR 24029: Information technology – Artificial Intelligence (AI) – Assessment of the robustness of neural networks
  - Editor: Arnault Ioualalen (France)
  - Status: Editor draft

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 TR 24030: Information technology – Artificial Intelligence (AI) – Use cases
  - Editor: Yuchang Cheng (Japan)
  - Status: Editor draft

SC 42 Projects, Status and Leadership

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

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

SC 42/SG 1 Computational approaches and characteristics of artificial intelligence systems

- Convenor: Tangli Liu (China)
- Secretariat: Qun Zhang (China)

SC 42/AHG Dissemination and outreach

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

SC 42 Projects, Status and Leadership

SC 42 Completed Study Groups

- 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

SC 42 Liaisons

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SC 42 – Artificial Intelligence

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

- Part of system integration entity mandate to provide guidance to ISO, IEC and JTC 1 committees on AI applications
- Reflects the 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

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)

Approved Internal Liaisons to SC 42

- 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)
- ISO/PC 317 – Consumer protection: privacy by design for consumer goods and services
- ISO/TC 20 – Aircraft and space vehicles
- 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 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

SC 42 Liaisons

ISO JTC 1 IEC
INFORMATION TECHNOLOGY STANDARDS

SC 42 – Artificial Intelligence

Approved Internal Liaisons from SC 42

- JTC 1/SC 7 – Software and systems engineering
- 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 Officer: Wo Chang (United States)
- JTC 1/SC 34 – Document description and processing languages
- 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
- JTC 1/SC 40 – IT Service Management and IT Governance
  - SC 42 Officer: Francois Lorek

Approved Internal Liaisons from SC 42

- 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 69 – Applications of statistical methods
- 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
- ISO/TC 299 – Robotics
  - SC 42 Officer: David Dubois (Canada)
- ISO/TC 307 – Blockchain and distributed ledger technologies
  - SC 42 Officer: Li Bin (China)
- ISO/TC 309 – Governance of organizations
  - SC 42 Officer: Victoria Hailey (Canada)
- IEC SyC Smart Cities
  - SC 42 Officer: Tangli Liu (China)
- IEC SyC AAL – Active Assisted Living
  - SC 42 Officer: David Martin (United States)

Agenda

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SC 42

- Introduction to the AI Standardization Committee
- Key topics, issues and opportunities

Concluding Remarks

Additional Links and Information

Key Topics: Foundational Standards

Overview

- Introduces an overview of the topic, terminology (vocabulary) and framework
- Common in recent JTC 1 systems, system of systems or horizontal technology programs of work to describe the ecosystem

Motivation and current issues

- From a technology perspective, gives a very high level description of the area and various components
- From a cross-domain point of view introduces roles for the various stakeholders
- 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
- Areas of study
  - Interest in exploring the lifecycle on AI

Relevant information and sources

- SC 42/WG 1: foundational standards working group
- ISO/IEC AWI 22989 Artificial Intelligence Concepts and Terminology
- ISO/IEC AWI 23053 Framework for Artificial Intelligence Systems Using Machine Learning
- AI lifecycle initial contribution materials

Key Topics: Computational Methods

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INFORMATION TECHNOLOGY STANDARDS
SC 42 – Artificial Intelligence

Overview

- Heart of AI looking at the computational approaches and characteristics of artificial intelligence systems

Motivation and current issues

- From a technology perspective, one of the most important areas for AI standardization
- Areas of study
  - Different technologies (e.g., ML algorithms, reasoning etc.) used by the AI systems including their properties and characteristics
  - Study of existing specialized AI systems (e.g., NLP or computer vision) to understand and identify their underlying computational approaches, architectures, and characteristics
  - Study of industry practices, processes and methods for the application of AI systems

Relevant information and sources

- SC 42/SG 1: computational approaches and characteristics of artificial intelligence systems study group
- SCC (Canada) proposals under study: Assessment of classification performance for machine learning models and algorithms (SC 42 N0154)

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 the context of various application areas looking to adopt AI. International standards (IS/TR etc.) will help tremendously
- Likely to motivate a number of liaisons (collaboration)
- Areas of current work
  - TRs on bias, trustworthiness overview and robustness
- Areas of study
  - Approaches to establish trust in AI systems through **transparency**, **verifiability**, **explainability**, **controllability**, etc.
  - Engineering pitfalls and **assess** typical associated **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.

Relevant information and sources

- SC 42/WG 3: trustworthiness working group
- Study group report on robustness
- ISO/IEC TRs 24027, 24028, 24029 on bias, trustworthiness overview and robustness
- SC 42 NP ballot to be launched for "Artificial Intelligence – Risk Management"

Key Topics: Societal Concerns and Ethics

Overview

- Broad technologies like IoT and AI have the ability to influence how we live, work and play for generations to come
- Consequently, their adoption creates impacts that go beyond the technology
  - On the one hand, some of these issues are captured by emerging established areas like trustworthiness where discussion on reliability, privacy, security etc. have become common place
  - On the other hand, some issues go well beyond IT like economic considerations (e.g. impact on labor force and economy of AI)
  - Increasingly emerging areas in between (e.g. algorithmic bias, safety directives in industrial AI, eavesdropping)
- Considerations of AI impact on society are not limited to SC 42 but extend into ISO and IEC TCs in their applications
- Relevant work within SC 42 scope and program of work. Other efforts include PAI, IEEE and EU Ethics guidelines for trustworthy AI
- Currently being considered across the work program of SC 42

Motivation and current issues

- Standards can mitigate and address concerns about the utilization of AI and its potential impact in society
- From an industry, regulatory, stakeholder and application domain perspectives, this will impact time and scale of adoption
- National and regional concerns, IEC SMB AHG 79 recommended formation of SEG 10 to consider ethics in autonomous and AI *Applications.* Scope is ethical and societal concerns in applications. Scope includes fostering cooperation between SC 42 and IEC TCs
- SC 42 collaborating with other external work programs via liaison. Participates in IEC SEG 10 and OCEANIS (via IEC membership)

Relevant information and sources

- SC 42, SC 42/WG 3, SC 42/WG 4, IEC SMB AHG 79, IEC SEG 10, OCEANIS, IEEE, EU Ethics guidelines for trustworthy AI

Key Topics: Use Cases and Applications

Overview

- Identify different AI application domains and the different context of their use
- Collect representative use cases

Motivation and current issues

- SC 42 is a first of its kind standardization effort looking at entire ecosystem. Has dual focus: AI horizontal technology enabler. Advising on application areas (2nd bullet of the committee's scope)
- From an ISO and IEC perspective, most of the standardization programs and TCs are in the application domain. From a broader industry perspective, the interest in AI is in its application to a growing number of fields
- Use cases are the "currency" between SDOs. Can include areas beyond pure IT e.g. trustworthiness and societal concerns
- By looking at different domains, ensures SC deliverables are "broad enough to be horizontal"
- Current areas of work
  - Use case repository captured in a technical report
- Current areas of study
  - provide best practices/guidance on domains
  - drive liaisons
  - garner insights from applications and suggest application area focus to SC 42

Relevant information and sources

- SC 42/WG 4: Use cases and applications working group
- ISO/IEC TR 24030 on use cases

Key Topics: Big Data

Overview

- JTC 1's Big Data program of work was initiated in 2015 (as a working group; study group prior) and housed under JTC 1/WG 9
- The program of work of Big Data was moved under SC 42 in May 2018. JTC 1/WG 9 was disbanded

Motivation and current issues

- The foundational work of Big Data is maturing
- Looking beyond foundation, areas like analytics present evolution interest to both AI and BD work
- Ecosystem expanding
  - over 50 use cases have been collected and published in ISO/IEC 20547-2
  - Collaboration with numerous application areas from MPEG to ITS engaged and technology areas like securty
- Areas of current work
  - Foundational standards and technical reports on the overview, vocabulary and reference architecture
- Areas of study
  - Business process management for analytics (proposed by India)
  - Characteristics, capabilities and best practices of interfaces (proposed by China)

Relevant information and sources

- SC 42/WG 2
- ISO/IEC 20546, ISO/IEC 20547-1 and ISO/IEC 20547-3. Published: ISO/IEC 20547-2 and 20547-5
- BIS (India) and SCC (China) new proposals under study

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) between SC 42 and other committees both internal (ISO, IEC, JTC 1) and external
- SC 42 is participating in a number of ISO and IEC initiatives and is engaged in a number of JTC 1 SGs / SWGs

Motivation and current issues

- Within both the IT and the application side, AI expertise is needed to explore and develop standards in emerging areas
- For governance implications of AI, a JWG between SC 42 and SC 40 has been formed
  - SC 42/JWG 1 JWG SC 42 – SC 40 Governance implications of AI
    - ISO/IEC AWI 38507 – Governance implications of the use of artificial intelligence by organizations
- 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 SGs / SWGs that include
  - Quantum Computing SG, Data Usage SG, Autonomous and Data Rich Vehicles SG, Meta Reference Architecture and Reference Architecture for Systems Integration SG, SWG on JETI and SWG on Communications

Relevant information and sources

- SC 42 JWG 1 SC 42 – SC 40 Governance implications of AI
- ISO TMB SMCC, IEC SEG 10
- JTC 1 subgroups on emerging and new study areas

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 was requested to join and approved by SMCC with final TMB approval in progress

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

Upcoming Meetings

3rd Plenary meeting

- Week of April 8th , 2019
- Dublin, Ireland
- Confirmed

4th Plenary meeting

- Week of October 7th, 2019
- Tokyo, Japan
- Confirmed

5th Plenary meeting

- April 2020
- Paris, France
- Tentative

6th Plenary meeting

- Fall 2020
- Montreal, Canada
- Tentative

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INFORMATION TECHNOLOGY STANDARDS
SC 42 – Artificial Intelligence

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

SC 42 program making great progress in its first year

- 10 projects underway
  - 6 international standards and 4 technical reports
  - 3 related to big data, 2 related to foundational AI, 3 related to AI trustworthiness, 1 related to AI use cases and 1 related governance implications of AI
- 4 working groups, 1 study group and 1 ad-hoc group setup to progress the work
- Extensive collaboration underway with internal and external liaisons setup

Part of the ISO, IEC and JTC 1 families

- Access to broad, diverse and numerous committees that range from horizontal to vertical areas
- Setup as a system integration committee to provide guidance to ISO, IEC and JTC 1 committees looking at AI applications

Opportunity for international standards to make an impact on AI market growth and broad technology acceptance

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, UNE in Spain, SIS in Sweden, ASI in Austria etc.

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INFORMATION TECHNOLOGY STANDARDS
SC 42 – Artificial Intelligence

- SC 42
  - Committee website
  - History website
- Press Coverage Related to SC 42
  - IEC e-tech article (17th May 2018). Additional circulations
    - 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
    - ISO retweeted the article (September 2018)
  - ISO news article (18th October 2018)
  - JTC 1 press committee article (30th May 2018)
- Other media coverage
  - Tweet Chat on standards on Artificial Intelligence
    - 25 October at 10 AM Geneva time, Tweet Chat with Chair of SC 42
    - Hashtags: #ISOchat #Standards4AI
  - IEC article on eliminating data bias from machine learning systems (November 13th, 2018)
  - IEC e-tech article on Healthcare needs doctors and machines (December 10th, 2018)
  - 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


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


ISO IEC
WELCOME DELEGATES


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


Korea
Japan


Australia


Denmark
Germany

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SC 42 – Artificial Intelligence