Artificial Intelligence

SC 42 Outreach Deck, rev 20.0, December 2020

Overview of the AI Standards Program and Novel Ecosystem Approach

Wael William Diab, Chair SC 42 (Artificial Intelligence)
Acknowledgement

Heather Benko (SC 42 Committee Manager)
Jose Alcorta, Andy Dryden (ISO TPMs)
ISO Communications Team (Clare, Vivienne, Liz, Catherine, Barnaby)
IEC Communications Team (Antoinette, Gabriella, Mike)
SC 42 Officers
Summary Slides for High Level Brief Presentation
Introduction and Overview of SC 42

Part of the IEC and ISO Family

- Committee on AI standardization under the joint initiative on Information Technology (JTC 1)
- IEC and ISO produce international standards and with participation by country – one country one vote
- Collaboration with long established sister ISO and IEC committees covering broad rage of app domains
- Works with JTC 1 committees producing horizontal stds in key areas such as security, cloud, IoT, governance

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

Growing Program of Work and Stakeholders

- Projects: 21 active projects of which 11 new projects added to the work program in the last year
- Participation: 47 nations (31P/16O) with annual growth. New regions represented. 250+ delegates at plenaries
- SC 42 “customers” consuming our standards and participants are increasingly diverse e.g. from data scientists to regulators to application domain experts to social scientists

Extensive collaborations (internal and external) – over 30 liaisons including Cat A e.g. recently with OECD, EC
Structure of SC 42

WG 1 Foundational standards
WG 2 Data
WG 3 Trustworthiness
WG 4 Use cases and applications
WG 5 Computational approaches and computational characteristics of AI systems
SC 42 – SC 40 JWG 1 Governance implications of AI
AHG 1 Dissemination and outreach
Bridging the Gap – An Ecosystem Approach

Example of Non-Technical Trends and Requirements

SC 42 – Artificial Intelligence

Assimilating Requirements for Context of Use of AI, Big Data and Analytics

Horizontal and Foundational Projects

Enabling and Accelerating Wide Adoption while Addressing Concerns

Deliverables

- Foundational Concepts
- Data Stds
- Reference Architectures
- Use Cases
- Frameworks
- Guidance
- Interoperability

Ecosystem Deliverables & Implementations

- Application Standards
  - Domain specific standards that build on SC 42 horizontal deliverables
- Open Source Projects
  - OS projects including AI algorithms leveraging SC 42 ecosystem deliverables
- Proprietary Solutions
  - Proprietary solutions leveraging SC 42 deliverables for requirements and guidance

Implementations Across Diverse Application Domains

E.g. AI-enabled Smart Manufacturing, Health Care, Financial Systems, Consumer Devices, ITS etc.
Key Topics: Data – AI, Big Data, Analytics

Overview

- Data ecosystem, characteristics, properties and quality essential to AI, Big Data and analytics work
- Big Data deals with extensive datasets by considering characteristics, such as volume, variety, velocity, variability, which allows scalable technology to efficiently store, manipulate, manage and analyze these datasets
- AI systems acquire, process and apply knowledge, which relies on data, its properties and quality
- Analytics derives insights from data, which requires data acquisition, collection, validation and processing

History, motivation and current issues

- History
  - BD work initiated as JTC 1/WG 9 in 2015 and moved to SC 42 in 2018 creating SC 42/WG 2 (Big Data)
  - WG 2 expanded to data in context of AI, BD and analytics April 2020 focusing SC 42’s data work in one WG
- Foundational Big Data work completed and published: ISO/IEC 20546 and ISO/IEC BDRA 20547 series
- Areas of current work
  - IS on process management framework for Big Data analytics
  - New multipart series AI – data quality for analytics and ML identified
- Areas of current study and project proposals under development
  - Data quality for analytics and ML series – part 2: Data quality measures (ISO/IEC 5259-2) – NP Balloting
  - Data ecosystem study areas include AI Data AHG, Data Quality AHG and road-mapping
COMMON AI-RELATED ETHICAL AND SOCIETAL ISSUES*

PRIVACY

ALGORITHMIC BIASES

INADVERTENT ALGORITHMIC CONSEQUENCES

JOB DISPLACEMENT

THE SINGULARITY

*Source: Accenture (Liongosari)
Key Topics: Societal Concerns and Ethics

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, app 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 etc.

- SC 42 collaborating with other work programs e.g. PAI, OECD 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

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 130 use cases including contributions from liaisons. Passed CD ballot. comment resolution
- Will consider the ethical and societal concerns within the context of use cases

New areas of work

- Best practices / horizontal macro app guidance – Guidelines for AI applications
- AI lifecycle for software developers – AI system life cycle processes

New study areas

- AI Service Ecosystem assigned to WG 4
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 has taken initial steps towards developing a MSS:

- New project (ISO/IEC 42001) approved and assigned to SC 42/WG 1 for work.
Update Slides for Incremental Updates
Structure of SC 42

WG 1 Foundational standards
WG 2 Data
WG 3 Trustworthiness
WG 4 Use cases and applications
WG 5 Computational approaches and computational characteristics of AI systems
SC 42 – SC 40 JWG 1 Governance implications of AI
AHG 1 Dissemination and outreach
Introduction and Overview of SC 42

Part of the IEC and ISO Family

- Committee on AI standardization under the joint initiative on Information Technology (JTC 1)
- IEC and ISO produce international standards and with participation by country – one country one vote
- Collaboration with long established sister ISO and IEC committees covering broad rage of app domains
- Works with JTC 1 committees producing horizontal stds in key areas such as security, cloud, IoT, governance

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

Growing Program of Work and Stakeholders

- Projects: 21 active projects of which 11 new projects added to the work program in the last year
- Participation: 47 nations (31P/16O) with annual growth. New regions represented
  - >250 delegates at virtual plenaries, ~150+ at physical plenaries
- SC 42 “customers” consuming our standards and participants are increasingly diverse
  - e.g. from data scientists to regulators to application domain experts to social scientists
Key Highlights and Growth

Publications

- **Big Data Foundational work published**
  - 5 projects including BDRA (ISO/IEC 20546, 20547-1, -2, -3, and -5)

- **First AI trustworthiness** project published: ISO/IEC 24028

- ISO/IEC 24030 **AI use cases** (>130) completed balloting and in publication prep

Successive strong annual growth despite COVID headwinds

Extensive outreach activities, media/comms coverage and collaborations (internal and external)

- Over 30 liaisons including new Cat A liaisons with OECD, EC

- New internal collaboration with **IEC TC 65/SC 65A** on AI and Functional Safety and **JTC 1/SC 7** on SQuaRE’

Robust progress on existing work coverage

- Foundational projects, risk management and governance implications of AI completed CD ballots

Growth in the diversity of the work program and ecosystem coverage

- Scope of Big Data (WG 2) expanded to included data in the context of AI, Big Data and Analytics
Key Highlights and Growth

Growth in the diversity of the work program and ecosystem coverage

- New projects initiated in the following additional areas of the ecosystem
  - **AI MSS** (ISO/IEC 42001)
  - **Data quality** for analytics and ML series (ISO/IEC 5259)
  - AI system **lifecycle** (ISO/IEC 5338)
  - **SQuaRE** enhancements for AI systems (ISO/IEC 25059)
  - Algorithmic **assessment of classification** performance (ISO/IEC 4213)
  - AI System **Lifecycle** (ISO/IEC 5338)
  - **Functional safety** and AI systems (ISO/IEC 5469)
  - **Guidelines for AI applications** (ISO/IEC 5339)
  - **Knowledge engineering** (ISO/IEC 5392)

- New project proposals under development
  - Data quality for analytics and ML series – part 2: **Data quality measures** (ISO/IEC 5259-2) – NP Balloting
  - Objectives and methods for **explainability** of ML models and AI systems – NP Balloting

- Healthy pipeline of new ideas for additional projects and roadmap planning at the SC and WG levels
Bridging the Gap – An Ecosystem Approach

Example of Non-Technical Trends and Requirements

Application Domain Requirements

Regulatory and Policy Requirements

Emerging Societal Requirements

Business Requirements / KPIs

SC 42 Ecosystem Perspective

Assimilating Requirements for Context of Use of AI, Big Data and Analytics

Horizontal and Foundational Projects

Enabling and Accelerating Wide Adoption while Addressing Concerns

SC 42 Deliverables

Foundational Concepts

Data Stds

Reference Architectures

Use Cases

Frameworks

Guidance

Interoperability

Ecosystem Deliverables

Application Standards

Domain specific standards that build on SC 42 horizontal deliverables

Open Source Projects

OS projects including AI algorithms leveraging SC 42 ecosystem deliverables

Proprietary Solutions

Proprietary solutions leveraging SC 42 deliverables for requirements and guidance

Implementations Across Diverse Application Domains

E.g. AI-enabled Smart Manufacturing, Health Care, Financial Systems, Consumer Devices, ITS etc.
Key Topics: Data – AI, Big Data, Analytics

Overview

- **Data ecosystem, characteristics, properties and quality** essential to **AI, Big Data and analytics** work
- **Big Data** deals with **extensive datasets** by considering **characteristics**, such as volume, variety, velocity, variability, which allows scalable technology to efficiently store, manipulate, manage and analyze these datasets
- **AI** systems acquire, process and apply **knowledge**, which relies on **data**, its **properties** and **quality**
- **Analytics** derives **insights** from data, which requires **data** acquisition, collection, validation and processing

History, motivation and current issues

- History: **BD work initiated as JTC 1/WG 9 in 2015 and moved to SC 42 in 2018 creating SC 42/WG 2 (Big Data).** WG 2 **expanded** to data in context of AI, BD and analytics April 2020 focusing SC 42’s data work in one WG
- Foundational Big Data work completed and published: ISO/IEC 20546 and ISO/IEC BDRA 20547 series
- Areas of current work
  - **IS on process management framework for Big Data analytics**
  - New multipart series **AI – data quality for analytics and ML** identified
- Data ecosystem study areas include **AI Data AHG, Data Quality AHG** and road-mapping
COMMON AI-RELATED ETHICAL AND SOCIETAL ISSUES*

PRIVACY

ALGORITHMIC BIASES

INADVERTENT ALGORITHMIC CONSEQUENCES

JOB DISPLACEMENT

THE SINGULARITY

*Source: Accenture (Liongosari)
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, app 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 etc.

- SC 42 collaborating with other work programs e.g. PAI, OECD 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

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 130 use cases** including contributions from liaisons. Passed CD ballot. comment resolution
  - Will consider the ethical and societal concerns within the context of use cases

New areas of work

- Best practices / horizontal macro app guidance – **Guidelines for AI applications**
- AI lifecycle for software developers – **AI system life cycle processes**

New study areas

- **AI Service Ecosystem** assigned to WG 4
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 has taken initial steps towards developing a MSS:

- New project (ISO/IEC 42001) assigned to SC 42/WG 1.
Full Slide Deck for Detailed Presentation or Posting
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

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

Data Science and the Data Ecosystem
- Big Data ecosystem, AI related data and analytics
- includes BD reference architecture, data quality, AI data aspects

Changing how we live, work and play...
AI Use Cases, Applicability and Growth

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

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, data ecosystem
- Broad standardization approach that includes and goes beyond traditional interoperability
Structure of SC 42

WG 1 Foundational standards
WG 2 Data
WG 3 Trustworthiness
WG 4 Use cases and applications

WG 5 Computational approaches and computational characteristics of AI systems
SC 42 – SC 40 JWG 1 Governance implications of AI
AHG 1 Dissemination and outreach
Introduction and Overview of SC 42

Part of the IEC and ISO Family
- Committee on AI standardization under the joint initiative on Information Technology (JTC 1)
- IEC and ISO produce international standards and with participation by country – one country one vote
- Collaboration with long established sister ISO and IEC committees covering broad rage of app domains
- Works with JTC 1 committees producing horizontal stds in key areas such as security, cloud, IoT, governance

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

Growing Program of Work and Stakeholders
- Projects: 21 active projects of which 11 new projects added to the work program in the last year
- Participation: 47 nations (31P/16O) with annual growth. New regions represented
  - >250 delegates at virtual plenaries, ~150+ at physical plenaries
- SC 42 “customers” consuming our standards and participants are increasingly diverse
  - e.g. from data scientists to regulators to application domain experts to social scientists
Key Highlights and Growth

Publications

- **Big Data Foundational work published**
  - 5 projects including BDRA (ISO/IEC 20546, 20547-1, -2, -3, and -5)
- First **AI trustworthiness** project published: ISO/IEC 24028
- ISO/IEC 24030 **AI use cases** (>130) completed balloting and in publication prep

Successive strong annual growth despite COVID headwinds

Extensive outreach activities, media/comms coverage and collaborations (internal and external)

- Over 30 liaisons including new Cat A liaisons with OECD, EC
- New internal collaboration with **IEC TC 65/SC 65A** on AI and Functional Safety and **JTC 1/SC 7** on SQuaRE’

Robust progress on existing work coverage

- Foundational projects, risk management and governance implications of AI completed CD ballots

Growth in the diversity of the work program and ecosystem coverage

- Scope of Big Data (WG 2) expanded to included data in the context of AI, Big Data and Analytics
Key Highlights and Growth

Growth in the diversity of the work program and ecosystem coverage

- New projects initiated in the following additional areas of the ecosystem
  - **AI MSS** (ISO/IEC 42001)
  - **Data quality** for analytics and ML series (ISO/IEC 5259)
  - AI system **lifecycle** (ISO/IEC 5338)
  - **SQuaRE** enhancements for AI systems (ISO/IEC 25059)
  - Algorithmic **assessment of classification** performance (ISO/IEC 4213)
  - AI System **Lifecycle** (ISO/IEC 5338)
  - **Functional safety** and AI systems (ISO/IEC 5469)
  - **Guidelines for AI applications** (ISO/IEC 5339)
  - **Knowledge engineering** (ISO/IEC 5392)

- New project proposals under development
  - Data quality for analytics and ML series – part 2: **Data quality measures** (ISO/IEC 5259-2) – NP Balloting
  - Objectives and methods for **explainability** of ML models and AI systems – NP Balloting

- Healthy pipeline of new ideas for additional projects and roadmap planning at the SC and WG levels
The Need for an Ecosystem Perspective

Historically, IT systems and their governing standards were based on well understood environments

- Early approaches focused on performance for a specific problem definition
- As IT became ubiquitous, considerations such as cost, sustainability, security and privacy played an increasingly important role in defining requirements

Digital transformation of industries has changed the landscape for IT standardization. For instance:

- Emerging non-technical requirements such as ethical and societal considerations and the ability to design trustworthy systems are key aspects
- Stakeholder diversity has increased considerably (eg. regulatory, social scientists etc.)
- Early engagement by the various stakeholders has become the norm
- The use cases for IT have dramatically increased
- Understanding uses, proving business cases and developing standards are now concurrent
- The “data ecosystem” is as important as hardware, software and operational technologies
SC 42 and the Holistic AI Ecosystem

A new approach to standardization is needed that

- Takes into account the context of use of the technology by looking at both technology capability and non-technical requirements such as business requirements, regulatory and policy requirements, application domain needs, and ethical and societal concerns

- Translating the above into technical requirements

- Building foundational standards that allow communities to build upon such as terminology, use cases, application guidance and reference architectures

- Linking technology innovation communities such as proprietary implementations, research, SDOs and open source communities

The result not only accelerates technology adoption but it also takes into account its context of use and builds an ecosystem

AI and Big Data are perfect examples of this type of technology, it’s use and IT’s evolution

SC 42 has adopted this holistic ecosystem approach providing the glue between requirements and technical requirements through the horizontal deliverables the committee develops
Bridging the Gap – An Ecosystem Approach

Example of Non-Technical Trends and Requirements

SC 42 Ecosystem Perspective

SC 42

Deliverables

Ecosystem Deliverables & Implementations

Application Domain Requirements

Regulatory and Policy Requirements

Emerging Societal Requirements

Business Requirements / KPIs

Assimilating Requirements for Context of Use of AI, Big Data and Analytics

Horizontal and Foundational Projects

Enabling and Accelerating Wide Adoption while Addressing Concerns

Foundational Concepts

Data Stds

Reference Architectures

Use Cases

Frameworks

Guidance

Interoperability

Application Standards

Domain specific standards that build on SC 42 horizontal deliverables

Open Source Projects

OS projects including AI algorithms leveraging SC 42 ecosystem deliverables

Proprietary Solutions

Proprietary solutions leveraging SC 42 deliverables for requirements and guidance

Implementations Across Diverse Application Domains

E.g. AI-enabled Smart Manufacturing, Health Care, Financial Systems, Consumer Devices, ITS etc.
Key Topics: Foundational Standards

Overview

- Introduces an overview of the topic, terminology, key concepts and framework
- Describes the AI Machine Learning ecosystem

Motivation and current issues

- From a technology perspective, gives a description of the area and systems
- From a cross-stakeholder point of view (e.g. regulator, implementer, architect etc.) introduces common language
- Provides building blocks for some of the other deliverables within SC 42
- 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: Data – AI, Big Data, Analytics

Overview

- **Data ecosystem, characteristics, properties and quality** essential to AI, Big Data and analytics work
- **Big Data** deals with extensive datasets by considering characteristics, such as volume, variety, velocity, variability, which allows scalable technology to efficiently store, manipulate, manage and analyze these datasets
- **AI** systems acquire, process and apply knowledge, which relies on data, its properties and quality
- **Analytics** derives insights from data, which requires data acquisition, collection, validation and processing

History, motivation and current issues

- History
  - BD work initiated as JTC 1/WG 9 in 2015 and moved to SC 42 in 2018 creating SC 42/WG 2 (Big Data)
  - WG 2 expanded to data in context of AI, BD and analytics April 2020 focusing SC 42’s data work in one WG
  - Foundational Big Data work completed and published: ISO/IEC 20546 and ISO/IEC BDRA 20547 series
- Areas of current work
  - IS on process management framework for Big Data analytics
  - New multipart series AI – data quality for analytics and ML identified
- Areas of current study and project proposals under development
  - Data quality for analytics and ML series – part 2: Data quality measures (ISO/IEC 5259-2) – NP Balloting
  - Data ecosystem study areas include AI Data AHG, Data Quality AHG and road-mapping
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
- IS on formal methodologies for the assessment of neural networks
- IS on risk management framework for AI based on ISO 31000
- IS on Systems and SW Quality Requirements and Evaluation (SQuaRE) – Quality Model for AI systems
- TR on Functional Safety and AI Systems

Areas of continued study and road-mapping for new work and to expand existing work

- Approaches to establish trust in AI systems through transparency, verifiability, explainability, controllability, etc.
  - Objectives and methods for explainability of ML models and AI systems – NP Balloting
- 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, availability, security, privacy, etc.
- Requirements and acceptance criteria
COMMON AI-RELATED ETHICAL AND SOCIETAL ISSUES*

*Source: Accenture (Liongosari)
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 etc.

- SC 42 collaborating with other work programs e.g. PAI, OECD 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

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 130 use cases including contributions from liaisons. Passed CD ballot. comment resolution
- Will consider the ethical and societal concerns within the context of use cases

New areas of work
- Best practices / horizontal macro app guidance – Guidelines for AI applications
- AI lifecycle for software developers – AI system life cycle processes

New study areas
- AI Service Ecosystem assigned to WG 4
Key Topics: Computational Methods

Overview

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

Motivation and current issues

- Overview project: **Overview of the state of the art of computational approaches for AI systems**, 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
  - TS on **Assessment of classification performance for machine learning models and algorithms**

- Knowledge engineering framework
  - New project on “**reference architecture of knowledge engineering**”
Key Topics: Governance Implications of AI

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 standard on the governance implications of AI.
Key Topic: Management Systems Standard

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 has taken initial steps towards developing a MSS

- New project (ISO/IEC 42001) assigned to SC 42/WG 1
Key Topic: AI Systems Engineering

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
  - (d) extension of a **data quality model for AI**

- Creation of **SC 42 advisory 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*

AG 2 completed its work at the 6th plenary and was disbanded. Output, in part, resulted in ideas for new projects
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 (> 30) 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
  - >30 internal and external liaisons covering a variety of application domains (e.g. ISO TC 204, IEC TC 65)

Motivation and current issues

- Both IT and application side require AI/BD expertise to explore and develop standards in emerging domains
- JWG with SC 40 on governance. Collaboration with IEC TC 65/SC 65A on AI and Functional Safety
- 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
- Feedback provided through ISO/IEC to the European Commission on Multi-Stakeholder Rolling Plan
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, Big Data and related analytics are key technologies enabling the digital transformation

SC 42 has a rapidly growing work program

- Strong growth and execution on work program. 6 published projects and 21 active projects in 6 working groups
- Robust study program for anticipated new work addressing AI ecosystem and 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 your national body
  - e.g. ANSI in USA, DIN in Germany, SAC in China, NSAI in Ireland, SIS in Sweden, BIS in India etc.
Annex A

Additional Links and Information
Additional Links and Information

- **SC 42**
  - Committee website
  - History website

- Press Coverage Related to SC 42 Overview and Program of Work
  - ISO news article on Getting Big on Data (Nov 5th 2020)
  - IEC e-tech article on International standards committee for AI ecosystem expands into new areas (Sep 15th 2020)
  - IEC e-tech article on IEC and ISO publish TR which provides overview of big data framework and reference architecture (Aug 24th 2020)
  - IEC e-tech article on Achieving trustworthy AI with standards (June 8th 2020)
  - ISO news SC 42 virtual plenary as an example of standards innovation during COVID-19 (May 15th, 2020)
  - IEC news announcing the key outcomes of the 5th plenary and added focus on data ecosystem (May 7th, 2020)
  - IEC e-tech article on SC 42’s holistic ecosystem approach to AI standardization (Feb 2020)
  - IEC e-tech article on New IEC and ISO Standard will enable big data adoption across industry sectors (Feb 15th 2020)
  - IEC e-tech article on IEC and ISO AI committee (SC 42) expands programme of work (Jan 2020)
  - IEC news AI standards help accelerate digitalization of smart manufacturing (December 2019)
  - ISO focus Nov/Dec 2019 magazine on AI and the SC 42 program of work (November 2019)
    - ISO focus landing page for edition including links to download PDF (above in English) in various languages and individual articles
  - IEC news announcing the key outcomes of the 4th plenary (Nov 11th, 2019)
Additional Links and Information

- **Press Coverage Related to SC 42 Overview and Program of Work**
  - IEC e-tech article on Establishing trustworthiness is vital in our human-machine world (July 15th 2019)
  - IEC e-tech article on Artificial intelligence and big data: a paradigm shift in healthcare (May 15th 2019)
  - 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)

- **Press Coverage Related to SC 42 Formation**
  - 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

- Press Coverage Related to SC 42 Participation at Key Industry and International Events

  - IEC Medium Publications
    - [IEC blog](#) on Webinar on regulations and artificial intelligence technologies (Dec 10th 2020)
    - [IEC blog](#) on AI standards on the agenda at IOT Solutions World Congress (Dec 8th 2020)
    - [IEC blog](#) on IEC and ISO present AI standardization work during event by European Commission (Oct 28th 2020)
    - [IEC blog](#) on Trustworthiness is key to services and products using AI and IoT technologies (Mar 3rd, 2020)
    - [IEC blog](#) on AI standards on the agenda at IOT Solutions World Congress (Nov 21st 2019)
    - [IEC blog](#) on AI and IoT industry leaders to consider a digital trust framework at Berlin forum (May 15th 2019)

  - 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)

  - JTC 1 Info
    - [JTC 1 info article](#) on IEC and ISO present on the AI Ecosystem Standardization Program at the European Commission Workshop (Oct 16th 2020)

  - Industrial Internet Consortium (IIC)
    - [IIC blog](#) on from IEC on Standards for AI on the Agenda at IoT Solutions World Congress

  - IoT Solutions World Congress (IoT SWC)
    - [IoT SWC promotion](#) of the IEC blog on AI standards on the agenda at IOT Solutions World Congress
Additional Links and Information

- **Other media coverage**
  - **Twitter**
    - ISO [@isostandards](https://twitter.com/isostandards)
      - Tweet Chat on standards on Artificial Intelligence with Chair of SC 42 (25th October). Hashtags: #ISOchat #Standards4AI
    - IEC [@IECStandards](https://twitter.com/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 New IEC and ISO Standard will enable big data adoption across industry sectors (Mar 30th, 2020)
    - IEC blog on Important questions around AI technologies in smart manufacturing (Jan 8th, 2020)
    - IEC blog on New IEC and ISO Standard will enable big data adoption across industry sectors (Mar 30th, 2020)
    - IEC blog on Trustworthiness is key to services and products using AI and IoT technologies (Mar 3rd, 2020)
    - IEC blog on How standards help people trust AI (Jan 15th, 2020)
    - IEC blog on Important questions around AI technologies in smart manufacturing (Jan 8th, 2020)
Additional Links and Information

- Other media coverage
  - IEC Medium Publications
    - [IEC blog](#) on Establishing trustworthiness is vital in our human-machine world (Sep 9th 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)
    - [IEC e-tech](#) article on Standards development organizations play key role in enabling remote daily life
Additional Links and Information

- **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 SC 42 Chair, SC 42/WG 3 Connvenor and ISO/IEC 24368 Editor on AI Ethics (Nov 2019)
    - [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
Annex B

Detailed Breakdown of SC 42/WGs, Liaisons and Work Program
This document surveys topics related to trustworthiness in AI systems, including the following:

— approaches to establish trust in AI systems through transparency, explainability, controllability, etc.;

— engineering pitfalls and typical associated threats and risks to AI systems, along with possible mitigation techniques and methods; and

— approaches to assess and achieve availability, resiliency, reliability, accuracy, safety, security and privacy of AI systems.

The specification of levels of trustworthiness for AI systems is out of the scope of this document.

- Publication date: 2020-03

The ISO/IEC 20547 series is intended to provide users with a standardized approach to developing and implementing big data architectures and provide references for approaches.

This document describes the reference architecture in terms of User and Functional views.

The reference architecture presented in this document provides an architecture framework for describing the big data components, processes, and systems to establish a common language for the various stakeholders named as big data reference architecture (BDRA).

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

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.
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 Passed. Comment resolution
  - Editor: Milan Patel (United Kingdom)
  - Status: CD Ballot Passed. Comment resolution

SC 42/WG 2 Big data

- Terms of reference: Standardization in the area of Big Data
- Convenor: Wo Chang (United States)
  - Editor: David Boyd (United States)
  - Status: DTR Ballot Passed. Comment resolution complete. Pre-publication
- 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: Noleen Campbell (Ireland)
- ISO/IEC 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 TR 24029-1: Artificial Intelligence (AI) -- Assessment of the robustness of neural networks
  - Editor: Arnault Ioualalen (France)
  - Status: DTR Ballot passed. Comment resolution
  - Editor: Arnault Ioualalen (France)
  - Status: Working Draft
- ISO/IEC 23894 -- Information technology -- Artificial intelligence -- Risk management
  - Editor: Peter Deussen (Germany)
  - Status: CD Ballot
- ISO/IEC TR 24368: Information technology -- Artificial Intelligence (AI) -- Overview of Ethical and Societal Concerns
  - Editor: Mikael Hjalmarson (Sweden)
  - Status: Working draft
- ISO/IEC TR 5469: Artificial Intelligence (AI) -- Functional Safety
  - Editor: Takashi Egawa (Japan)
  - Status: Working draft
- ISO/IEC 25059 -- Software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- Quality Model for AI-based systems
  - Editor: Adam Leon Smith (United Kingdom)
  - 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 TR 24030: Information technology -- Artificial Intelligence (AI) -- Use cases
  - Editor: Yuchang Cheng (Japan)
  - Status: DTR ballot passed. Comment resolution

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 TR 24372: Information technology -- Artificial Intelligence (AI) -- Overview of computational approaches for AI systems
  - Editor: Wanzhong Ma (China)
  - Status: Working draft
- ISO/IEC TS 4213: Assessment of classification performance for machine learning models
  - Editor: TBD
  - 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: Yonosuke Harada (Japan)
- 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: CD ballot

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 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 Completed AGs on Specific Topics

- AG 1 on AI Management Systems Standard – Convenor: Jim McFie (Canada)
SC 42 Projects, Status and Leadership

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

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

<table>
<thead>
<tr>
<th>Approved Category A External Liaisons</th>
<th>Approved Category A External Liaisons</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC – European Commission</td>
<td>OECD – Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>SC 42 liaison officer</td>
<td>OECD liaison officers</td>
</tr>
<tr>
<td>– Ray Walshe (Ireland)</td>
<td>– Karine Perset</td>
</tr>
<tr>
<td>Big Data Value Association (BDVA)</td>
<td>– Luis Aranda</td>
</tr>
<tr>
<td>SC 42 liaison officers</td>
<td>SC 42 liaison officer</td>
</tr>
<tr>
<td>– Abdellatif Benjelloun Touimi (U.K.)</td>
<td>– Rohit Israni (US)</td>
</tr>
<tr>
<td>– Ray Walshe (Ireland)</td>
<td>BDVA liaison officers</td>
</tr>
<tr>
<td>BDVA liaison officers</td>
<td>– Ana Garcia Robles</td>
</tr>
<tr>
<td>– Ana Garcia Robles</td>
<td>– Abdellatif Benjelloun Touimi</td>
</tr>
<tr>
<td>Consumers International</td>
<td>Open Geospatial Consortium (OGC)</td>
</tr>
<tr>
<td>Partnership on AI (PAI)</td>
<td>OGC liaison officers</td>
</tr>
<tr>
<td>SC 42 liaison officer</td>
<td>– George Percivall</td>
</tr>
<tr>
<td>– Tarek Besold (Germany)</td>
<td>– Ingo Simonis</td>
</tr>
<tr>
<td>PAI liaison officers</td>
<td>ITU</td>
</tr>
<tr>
<td>– Terah Lyons, Peter Eckersley</td>
<td>SC 42 liaison officer</td>
</tr>
<tr>
<td>– Steven Adler</td>
<td>– Yoav Evenstein (Israel)</td>
</tr>
<tr>
<td></td>
<td>ITU liaison officers</td>
</tr>
<tr>
<td></td>
<td>– Reinhard Scholl</td>
</tr>
<tr>
<td></td>
<td>– Bilel Jamoussi</td>
</tr>
</tbody>
</table>

SC 42 Liaisons

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 Internal Liaisons to SC 42

- JTC 1/SC 7 – Software and systems engineering
  - Officers: Stuart Reid and Shuji Kinoshita
- JTC 1/SC 29 – Coding of audio, picture, multimedia and hypermedia information
- 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)
- JTC 1 (WG 11) – Smart Cities
  - Officer: Howard Choe
- ISO CASCO

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 20/SC 16 – Unmanned aircraft
- ISO/TC 37 – Language and terminology
- ISO/TC 37/SC 3 – Management of terminology resources
- 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 informatics
- ISO/TC 262 – Risk management
- ISO/TC 269 – Railway applications
- ISO/TC 307 – Blockchain and distributed ledger technologies
  - Officer: Janna Lingenfelder (Germany)
- ISO/TC 309 – Governance of organizations
  - Officer: Michael Kayser
SC 42 Liaisons

Approved Internal Liaisons to SC 42

- IEC SyC AAL
  - Officer: Ulrike Haltrich

- IEC SyC SM
  - Officer: Alexander McMillan

- 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 Bellardi (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

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 CASCO
  - ISO/TC 37 – Language and terminology
    - SC 42 Officer: David Filip (Ireland)
SC 42 Liaisons

Approved Internal Liaisons from SC 42

- 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

7th Plenary meeting
- April, 2021
- Versailles, France
- Confirmed

8th Plenary meeting
- October, 2021
- Moscow, Russia
- Confirmed

9th Plenary meeting
- April, 2022
- Salerno, Italy
- Confirmed

10th Plenary meeting
- October, 2022
- Sydney, Australia
- Confirmed

11th Plenary meeting
- April, 2023
- Tel Aviv, Israel
- Confirmed

12th Plenary meeting
- October, 2023
- Vienna, Austria
- Confirmed

13th Plenary meeting
- April, 2024
- Seoul, South Korea
- Tentative
# Past Meetings

<table>
<thead>
<tr>
<th>Plenary Meeting</th>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th Plenary meeting</td>
<td>October 19th – 30th, 2020</td>
<td>Virtual</td>
</tr>
<tr>
<td>5th Plenary meeting</td>
<td>April 6th – 20th, 2020</td>
<td>Virtual</td>
</tr>
<tr>
<td>4th Plenary meeting</td>
<td>October 7th – 11th, 2019</td>
<td>Tokyo, Japan</td>
</tr>
<tr>
<td>3rd Plenary meeting</td>
<td>April 8th – 12th, 2019</td>
<td>Dublin, Ireland</td>
</tr>
<tr>
<td>2nd Plenary meeting</td>
<td>October 18th – 20th, 2018</td>
<td>Sunnyvale, CA, USA</td>
</tr>
<tr>
<td>1st Plenary meeting</td>
<td>April 18th – 20th, 2018</td>
<td>Beijing, China</td>
</tr>
</tbody>
</table>
Annex D

SC 42 Member National Bodies
SC 42 Member National Bodies

The following national bodies are participating members of SC 42 (P-members)

- Australia (SA), Austria (ASI), Belgium (NBN), Canada (SCC), China (SAC), Congo, The Democratic Republic of the (OCC), Denmark (DS), Finland (SFS), France (AFNOR), Germany (DIN), India (BIS), Ireland (NSAI), Israel (SII), Italy (UNI), Japan (JISC), Kenya (KEBS), Korea, Republic of (KATS), Luxembourg (ILNAS), Malta (MCCAA), Netherlands (NEN), Norway (SN), Russian Federation (GOST R), Saudi Arabia (SASO), Singapore (SSC), Spain (UNE), Sweden (SIS), Switzerland (SNV), Uganda (UNBS), United Arab Emirates (ESMA), United Kingdom (BSI), United States (ANSI)

The following national bodies are observing members of SC 42 (O-members)

- Argentina (IRAM), Benin (ANM), Cyprus (CYS), Hong Kong (ITCHKSAR), Hungary (MSZT), Indonesia (BSN), Lithuania (LST), Mexico (DGN), New Zealand (NZSO), Philippines (BPS), Poland (PKN), Portugal (IPQ), Romania (ASRO), South Africa (SABS), Ukraine (DSTU)
Annex E

Big Data Trends
Key Topics: Big Data Background

Overview

- Big Data is extensive datasets — primarily in the data characteristics of volume, variety, velocity, and/or variability — that require a scalable technology for efficient storage, manipulation, management, and analysis. Note: Big data is commonly used in many different ways, for example as the name of the scalable used to handle big data extensive datasets.

- Big Data deals with characteristics that for an application domain cannot be efficiently processed using 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
  - Variety: too diverse

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.
Big Data Analysis and Predictions

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

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.

Tremendous market growth and job creation

Paradigm shift and predictive analytics
Big Data Analysis and Predictions

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

- 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

Bid Data Motivators within ICT Space
Annex F

Overview of JTC 1
Part of the ISO, IEC and JTC 1 Family

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
- 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
Contacts:
Wael William Diab, Chair SC 42 (Artificial Intelligence): wael.diab@gmail.com
Heather Benko, Committee Manager SC 42 (Artificial Intelligence): hbenko@ansi.org