



BSI Standards Publication

Information technology — Artificial intelligence (AI) — Use cases

National foreword

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

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Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

This document provides a collection of use cases of artificial intelligence (AI) applications in a variety of domains.

In total, 132 AI use cases were submitted by experts between July 2018 and the end of November 2019. In this document, the term “use cases” means “collection of submitted use cases”.

The rationale for this document is as follows:

- illustrating the applicability of the AI standardization work across a variety of application domains;
- input to and reference for AI standardization work;
- sharing the collected use cases in support of AI standardization work with external organizations and internal entities to foster collaboration;
- reach out to new stakeholders interested in AI applicability;
- establishment of liaison organizations to collect requirements for AI via use cases;
- by investigating use cases, it is possible to find the new technical requirements (standardized demand) from the market, accelerating the transformation of science and technology achievements.

While a bottom-up approach was used to collect use cases, a top-down approach is used in this document to identify AI applications, and their deployment models, and their application domains., which is shown in [Clause 5](#).

The first step taken to collect use cases was to identify application domains of AI systems (described in [Clause 5](#)) and to provide a use case template (described in [6.4](#) and [Annex B](#)). Contributors were requested to submit use cases using the provided template.

For improving the quality of use cases, a guidance was provided for contributors. The guidance included identified acceptable sources (described in [6.3](#)) and AI characteristics (described in [6.4](#)) for preparing use cases.

In this document, [subclause 6.5](#) includes basic statistics of use cases. [Subclause 6.6](#) and [Annex C](#) describe the findings from use case analysis.

The use cases were grouped and categorized according to the identified application domains. In this document, use cases are summarized and grouped according to the application domains in [Clause 7](#). Readers of this document can find use cases of specific application domains and their original submissions at <https://standards.iso.org/iso-iec/tr/24030/ed-1/en>.

AI is an emerging field with use cases and solutions with a wide range of maturity and success. The descriptions are given for the convenience of users of this document and does not constitute an endorsement by ISO.

Information technology — Artificial intelligence (AI) — Use cases

1 Scope

This document provides a collection of representative use cases of AI applications in a variety of domains.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 artificial intelligence AI

<system> capability to acquire, process, create and apply knowledge, held in the form of a model, to conduct one or more given tasks

3.2 artificial intelligence AI

<engineering discipline> discipline of developing and studying *artificial intelligence* (3.1)

3.3 quality

conformance to specified requirements

[SOURCE: ISO 13628-2:2006, 3.33]

3.4 machine learning

process using computational techniques to enable systems to learn from data or experience

3.5 deep learning

approach to creating rich hierarchical representations through the training of neural networks with many hidden layers

3.6 service

performance of activities, work, or duties

Note 1 to entry: A service is self-contained, coherent, discrete, and can be composed of other services.

Note 2 to entry: A service is generally an intangible product.

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.50]

3.7 classification

task of assigning collected data to target categories or classes.

Note 1 to entry: Machine learning (ML) models can be designed/created either for binary classification, where they can learn to predict one of two different categories/classes; or for multiclass classification, where ML models learn to predict one of many different categories/classes.

Note 2 to entry: An example of classification is to predict if a photograph of an animal is a cat or a dog or even a different species. Classification employs supervised learning. Classification can employ supervised, semi-supervised, or unsupervised learning.

3.8 application

software or a program that is specific to the solution of an application problem

[SOURCE: ISO/IEC 11801:2002, 3.1.2]

3.9 neural network

network of primitive processing elements connected by weighted links with adjustable weights, in which each element produces a value by applying a nonlinear function to its input values, and transmits it to other elements or presents it as an output value

Note 1 to entry: Whereas some neural networks are intended to simulate the functioning of neurons in the nervous system, most neural networks are used in artificial intelligence as realizations of the connectionist model.

Note 2 to entry: Examples of nonlinear functions are a threshold function, a sigmoid function, and a polynomial function.

[SOURCE: ISO/IEC 2382: 2015, 2120625]

3.10 task

set of activities undertaken in order to achieve a specific goal

Note 1 to entry: These activities can be physical, perceptual and/or cognitive.

Note 2 to entry: While goals are independent of the means used to achieve them, tasks describe particular means of achieving goals.

Note 3 to entry: Examples of tasks include classification, regression, ranking, clustering and dimensionality reduction.

[SOURCE: ISO 9241-11:2018, 3.1.11, modified — Note 3 to entry has been added.]

3.11 parameter

<machine learning> variable of the model that affects its output any characteristic that can help in defining or classifying a particular system

3.12 artificial intelligence system AI system

engineered information processing system featuring artificial intelligence

Note 1 to entry: AI systems are designed to operate with varying levels of autonomy.

3.13**training data**

samples for training used to fit a machine learning model

3.14**cloud service**

one or more capabilities offered through cloud computing invoked using a defined interface

[SOURCE: ISO/IEC 17788:2014, 3.2.8]

3.15**cloud computing**

paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand

Note 1 to entry: Examples of resources include servers, operating systems, networks, software, applications, and storage equipment.

[SOURCE: ISO/IEC 17788:2014, 3.2.5]

3.16**automation**

characteristic of a system where work is performed that might previously have been done by a living being and that is governed by rules determined outside of the system

Note 1 to entry: Such systems are subject to external control and oversight.

Note 2 to entry: Automation implies the (revocable) delegation to a machine of a specific and defined set of “skills”, operations, processes, or procedures.

3.17**bias**

systematic difference between true (or accepted) value and measured value

[SOURCE: ISO 14488:2007, 3.1]

3.18**data set**

identifiable collection of data available for access or download in one or more formats

[SOURCE: ISO/IEC 20546:2019, 3.1.11]

3.19**natural language processing**

<system> information processing based upon natural-language understanding

3.20**natural language processing**

<engineering discipline> field of study within computer science and linguistics concerning automated processing, in whole or in part, of natural language

3.21**retraining**

updating a trained model by training with different training data

3.22**computer vision**

capability of a functional unit to acquire, process, and interpret visual data

Note 1 to entry: Computer vision involves the use of visual sensors to create an electronic or digital image of a visual scene.

Note 2 to entry: Not to be confused with machine vision.

Note 3 to entry: computer vision; artificial vision: terms and definition standardized by ISO/IEC [ISO/IEC 2382-28:1995].

Note 4 to entry: 28.01.19 (2382)

[SOURCE: ISO/IEC 2382:2015, 2123787]

3.23

trained model

result of model training

3.24

robot

automation system with actuators that performs intended tasks in the physical world, by means of sensing its environment and a software control system

Note 1 to entry: A robot includes a control system and interface of a control system.

Note 2 to entry: The classification of robot into industrial robot or service robot is done according to its intended application.

Note 3 to entry: In order to properly perform its tasks, a robot makes use of different kinds of sensors to confirm its current state and perceive the elements composing the environment in which it operates.

[SOURCE: ISO 18646-2:2019, 3.1, modified — Note 3 to entry has been added]

3.25

big data

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 1 to entry: Big data is commonly used in many different ways, for example as the name of the scalable technology used to handle big data extensive datasets.

[SOURCE: ISO/IEC 20546:2019, 3.1.2]

3.26

end user

individual person who ultimately benefits from the outcomes of the system

Note 1 to entry: The end user may be a regular operator of the software product or a casual user such as a member of the public.

[SOURCE: ISO/IEC 25000:2014, 4.7]

3.27

data analysis

systematic investigation of the data and their flow in a real or planned system

[SOURCE: ISO/IEC 2382:2015, 2122686]

3.28

pattern recognition

identification, by a functional unit, of physical or abstract patterns, and of structures and configurations

Note 1 to entry: This is an improved version of the definition in ISO/IEC 2382-12:1988.

Note 2 to entry: Pattern recognition: term and definition standardized by ISO/IEC 2382-28:1995.

Note 3 to entry: 28.01.13 (2382)

[SOURCE: ISO/IEC 2382:2015, 2123781]

3.29**anomaly detection**

task of identifying data samples that do not conform to an expected pattern distribution, especially within data sets that appear to be homogeneous.

Note 1 to entry: Anomaly detection is mostly used for outlier detection, for example, fraud detection, detecting suspicious activities, etc. It may, therefore, also be called 'outlier detection'.

Note 2 to entry: With anomaly detection, the input data is all of one class and the ML model predicts if a data point is typical for a given distribution or not.

Note 3 to entry: Anomaly detection typically employs unsupervised learning.

3.30**stakeholder**

person or organization that can affect, be affected by, or perceive themselves to be affected by a decision or activity

[SOURCE: ISO 35001:2019, 3.2]

3.31**model**

physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, process or data

[SOURCE: ISO/IEC 18023-1:2006, 3.1.11, modified — In the definition, "or data" has been added.]

3.32**knowledge**

<artificial intelligence> information about objects, events, concepts or rules, their relationships and properties, organized for goal-oriented systematic use.

Note 1 to entry: Information can exist in numeric or symbolic form.

Note 2 to entry: Information is data that has been contextualized, so that it is interpretable. Data is created through abstraction or measurement from the world.

4 Abbreviated terms

ANN	artificial neural networks	LSTM	long short-term memory networks
API	application programming interface	MAE	mean absolute error
AR	augmented reality	ML	machine learning
AUC	area under the curve	MRI	magnetic resonance imaging
BDEC	big data and extreme-scale computing	NLP	natural language processing
BNN	binarized neural network	NLU	natural language understanding
CG	computer graphics	OLAP	online analytical processing
CNN	convolutional neural network	PoC	proof of concept
CPU	central processing unit	PSNR	peak signal-to-noise ratio
CT	computed tomography	QA	quality assurance
CV	computer vision	RAM	random access memory

DL	deep learning	RGB	red green blue
DNN	deep neural network	RMSE	root mean square error
E2E	end to end	RNN	recurrent neural networks
FPGA	field-programmable gate array	SaaS	software as a service
GAN	generative adversarial nets	SDGs	sustainable development goals
GB	giga byte	SID	infant death syndrome
GDPR	general data protection regulation	SIS	swarm intelligence system
GPS	global positioning system	SMS	short message service
GPU	graphics processing unit	SQL	structured query language
HDD	hard disk drive	SSIM	structural similarity
HPC	high performance computing	SVM	support vector machine
ICT	information and communication technology	TB	tera byte
IoT	internet of things	UCVA	uncorrected visual acuity
IP	internet protocol	UI	user interface
KPI	key performance indicator	UT	ultrasonic testing
KYC	know your customer	UTO	unattended train operation
LIDAR	laser imaging detection and ranging	V2V	virtual to virtual

5 Applications

5.1 General

This clause identifies AI applications from the perspectives of their application domains and deployment models.

5.2 Application domains

Twenty-four application domains from References [5] and [6] were considered as target domains for the use cases:

- agriculture;
- construction;
- defence;
- digital marketing;
- education;
- home/service robotics;
- ICT;
- knowledge management;
- legal;
- logistics;
- media and entertainment;
- mobility;
- public sector;
- retail;
- security;

- energy;
- fintech;
- healthcare;
- low-resource communities;
- maintenance and support;
- manufacturing;
- social infrastructure;
- transportation;
- work and life.

5.3 Deployment models

This document considers the use of AI applications^[5] and lists the following possible deployment models of AI applications.

- cloud services;
- cyber-physical systems;
- embedded systems;
- hybrid;
- on-premise systems;
- social networks.

5.4 Examples of AI applications

Examples of AI applications are listed in [Table 1](#). These application examples were derived from the Reference [\[5\]](#). Each example in [Table 1](#) has an application domain, deployment model and short description.

The applications in [Table 1](#) are the result of a top-down approach and can be considered to be indicative for collecting use cases. Not all the applications are necessarily addressed by the collected use cases.

Table 1 — Examples of AI applications

Application domain	Application	Deployment model	Short description
Agriculture	Agricultural automation	Cloud services	Monitor and manage field conditions.
		On-premise systems	Accumulate weed or insect patterns and eliminate them.
Agriculture	Craftsmanship skill transfer	Cloud services	Learn about the best practices from craftsmen and provide feedback to others.
		On-premise systems	Not applicable
Agriculture	Cultivation management	On-premise systems	Monitor the field condition and manage the irrigation condition.
Construction	Construction planning	Cloud services	Learn about the best practices and apply them to future planning.
Construction	Robot construction	Cloud services	Provide autonomous construction robots to construction sites.
		On-premise systems	
Defence	Cyber security	Cloud services	Monitor cyber transactions against important defence assets and find out attack patterns and prevent their intrusion.
Defence	Electronic warfare	Cloud services	Autonomous pilot with cloud support to enable electronic warfare
		Embedded systems	
		On-premise systems	
Digital marketing	Online campaign performance optimization	Cloud services	For example, Google, Amazon, Facebook, Apple (GAFA).

Table 1 (continued)

Application domain	Application	Deployment model	Short description
Education	Adaptive learning	On-premise systems	Provide personalized learning materials via a learning model to achieve efficient learning results.
Education	Scoring	On-premise systems	Provide the most effective feedback to learners via the cognitive learning model to achieve the most effective learning results.
Fintech	Asset management	Cloud services	Accumulate and learn about the best practices and apply them to realize customer satisfaction.
Fintech	Fraud identification	Cloud services	Identify fraud transactions and warn managers.
Fintech	Loan screening	Cloud services	Learn about customers' backgrounds to find out abnormal loan patterns.
Fintech	Security assurance against cyber attacks	Cloud services	Learn and detect known fraud patterns or discover unknown fraud patterns.
Fintech	Stock exchange and trading	Cloud services	Accumulate the best practices and enable 24/7 trading.
Healthcare	Diagnosis support	Cloud services	Learn about normal condition.
		On-premise systems	Find out abnormal condition compared with normal condition.
Healthcare	Medical platform	Cloud services	Accumulate and disseminate learning patterns and assistants as an integrated medical support system.
		Embedded systems	
		Hybrid	
		On-premise systems	
Healthcare	New drug development	Cloud services	Curation: Find out the correlation among submitted papers.
			Molecular pattern: Find out the effective coordination of target molecule.
Healthcare	Surgical automation	Cloud services	Accumulate disease patterns and healthy patterns.
		Embedded systems	Not applicable
Healthcare	Surgical automation	On-premise systems	Support identification of disease patterns on the premises.
Legal	Early case assessment	Cloud services	AI support of work that preps had been doing.
Legal	Judicial recommendation	Cloud services	Judge support by using previous judicial judgment cases.
Logistics	Logistics in the base	Cloud services	Coordinate the best logistic move in the local procurement base warehouse.
		On-premise systems	
Logistics	Procurement logistics	Cloud services	Analyse the procurement context and propose the best procurement actions.
		On-premise systems	
Logistics	Sales logistics	Cloud services	Analyse and learn about the best practices of sales logistics and provide the most effective routes to move sales.
		On-premise systems	

Table 1 (continued)

Application domain	Application	Deployment model	Short description
Manufacturing	Development design	Cloud services	Accumulate design patterns to help designers.
		Hybrid	Not applicable
		On-premise systems	Check design patterns under real constraints on the premises.
Manufacturing	Product quality inspection	On-premise systems	Inspect products by image recognition.
Manufacturing	Production process	Cloud services	Accumulate production quality actuation patterns and estimate quality performance.
		Hybrid	Not applicable
Manufacturing	Production process	On-premise systems	Accumulate production throughput-related parameters and estimate the output throughput.
Mobility	Automatic cruise control	Cloud services	Update cruise control software dynamically. Accumulate road condition data and disseminate them to autonomous agents. Mainly enabled on wheelchairs, ships, and autonomous robots.
		Embedded systems	Enable autonomous driving without any help from connected devices. Mainly enabled on wheelchairs, ships, and autonomous robots.
Mobility	Automatic cruise control	On-premise systems	Not applicable
Mobility	Autonomous driving	Cloud services	Update cruise control software dynamically. Accumulate road condition data and disseminate them to autonomous agents. Mainly realized on cars.
		Embedded systems	Enable autonomous driving without any help from connected devices. Mainly realized on cars.
		On-premise systems,	Not applicable
Mobility	City-wide traffic control	Cyber-physical systems	Optimize city-wide traffic flow by inspecting real-time traffic images and controlling traffic signals.
Mobility	Dynamic map for autonomous cruise control	Cloud services	Create, maintain, and disseminate map information with semantic tags with real-time communication with mobile agents such as cars, wheelchairs, robots, and human beings.
		Hybrid	Not applicable
		On-premise systems	Accumulate actual road situation data and recognize objects that are not on the shared map.

Table 1 (continued)

Application domain	Application	Deployment model	Short description
Mobility	Robot taxi	Cloud services	Pick-up arrangement system controls robot taxis effectively.
		Embedded systems	Autonomously drive on the road with dynamic control of steering, acceleration, and braking.
		On-premise systems	Autonomously drive on the road using a road map.
Public sector	Online service support	Cloud services	Provide residents with support for online services.
		Social networks	
Public sector	Public service matching	Cloud services	Optimize matching between residents and public services.
		On-premise systems	
Retail	Autonomous driving store	On-premise systems	Provide autonomous driving sales robots.
Retail	Register-less store	On-premise systems	Monitor all customer movements to realize cash register-less retail shops.
Security	Cyber security	Cloud services	Monitor transactions in cyber space and find out attacks through finding abnormal transaction patterns.
Security	Personal information management	Cloud services	Monitor operations for GDPR conformance assurance.
Security	Video surveillance and crime risk prediction	Cloud services	Monitor behavioural patterns in urban areas, predict crime risk, and find out criminal patterns.
Social infrastructure	Abnormality or malfunction prediction	Cloud services	Accumulate normal signal patterns to learn normal signals.
		Hybrid	Not applicable
		On-premise systems	Find out abnormal signal patterns on the premises.
Social infrastructure	Equipment operation	Cloud services	Accumulate operational parameters and learn normal operations.
		On-premise systems	Monitor operations and find out abnormal operation patterns.
Social infrastructure	Improvement of operational efficiency	Cloud services	Learn about the correlation among significant parameters and realize the most efficient operations. Traffic control, electricity supply control, etc.
Social infrastructure	Landslide, flood prediction	Cloud services	Monitor weather and ground conditions in real time and predict disasters such as landslides, floods, etc.
		On-premise systems	
Social infrastructure	Power demand forecasting	Cloud services	Learn about demand patterns with other significant parameters and forecast future demand
Work and life	Smart home appliances	Embedded systems	Equip robot vacuums, refrigerators, and air conditioners with sophisticated control.
Work and life	Smart personal agent	Social networks	Smart agents assist individual users.

6 Use cases

6.1 General

This document is based on 132 use cases available at <https://standards.iso.org/iso-iec/tr/24030/ed-1/en>. Some use cases use trademark names such as company names, product names or service names. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the trademark names.

[Subclause 6.4](#) describes a template that is used for collecting use cases, and [Annex B](#) shows a blank template. [Subclauses 6.2](#) and [6.3](#) provide a list of acceptable sources and guidance for submitting use cases. Some basic statistics of the use cases are shown in [6.5](#). Societal concerns relating to the use cases are described in [6.6](#).

6.2 Acceptable sources of use cases

For improving the quality of use case descriptions, acceptable sources are:

- peer-reviewed scientific/technical publications on AI applications^[1];
- patent documents describing AI solutions^{[2][3]};
- technical reports and presentations by renowned AI experts^[4];
- high-quality company whitepapers and presentations;
- publicly accessible sources in sufficient detail;
- press releases and brochures.

This list is not exhaustive. Other credible sources can be acceptable as well.

6.3 Guidance for submitting use cases

For preparing use cases that cover both the most important application areas and the most relevant AI technologies, use case contributors can consider the following AI characteristics as useful selection guidance.

- Data focus and learning: Use cases for AI systems that utilize machine learning, or that use a fixed a-priori knowledge base.
- Level of autonomy: Use cases demonstrating several degrees (dependent, autonomous, human/critic in the loop, etc.) of AI system autonomy.
- Verifiability and transparency: Use cases demonstrating several types and levels of verifiability and transparency, including approaches for explainable AI, accountability, etc.
- Impact: Use cases demonstrating the impact of AI systems on society, the environment, etc.
- Architecture: Use cases demonstrating several architectural paradigms for AI systems (cloud, distributed AI, crowdsourcing, swarm intelligence).

6.4 Properties

6.4.1 General information on use case

General information on the use case includes the following items.

- Use case name: Use case name provided by the use case contributor.
- Application domain: Refers to [5.2](#).

- Deployment model: Refers to [5.3](#).
- Status: The status of the use case; includes prototype, proof of concept (PoC), and in operation.
- Scope of use case: The scope of the use case defines the intended area of applicability, limits, and audience.
- Objective(s): The intention of the system; what is to be accomplished; who/what would benefit.
- Narrative: Descriptions (short and complete) of the use case.
- Stakeholders: Stakeholders are those that can affect or be affected by the AI system in the scenario; e.g. organizations, customers, third parties, end users, the community, the environment, negative influencers, bad actors, etc.
- Stakeholders' assets, values: Stakeholders' assets and values that are at stake with potential risk of being compromised by the AI system deployment — e.g. competitiveness, reputation, trustworthiness, fair treatment, safety, privacy, stability, etc.
- System's threats and vulnerabilities: Threats and vulnerabilities can compromise the assets and values mentioned above – e.g. different sources of bias, incorrect AI system use, new security threats, challenges to accountability, new privacy threats (hidden patterns), etc.
- Key performance indicators (KPIs): Descriptions of KPIs for evaluating the performance or usefulness of the AI system. Descriptions include the KPI's name, description of the KPI, and reference to mentioned use case objectives.
- Features of use case: Descriptions of features of the use case for AI consideration. Descriptions include the following items.
 - 1) Task(s): The main task of the use case. A pull-down list includes the following terms: recognition, natural language processing, knowledge processing and discovery, inference, planning, prediction, optimization, interactivity, recommendation and other.
 - 2) Method(s): AI method(s)/framework(s) used in development.
 - 3) Platform: Platform (includes hardware system) used in development and deployment.
 - 4) Topology: Topology of the deployment network architecture.
 - 5) Terms and concepts used: Terms and concepts used here are desired to be consistent with existing ISO definitions.
- Standardization opportunities/requirements: Descriptions of standardization opportunities/requirements that are derived from the use case.
- Challenges and issues: Descriptions of challenges and issues of the use case.
- Societal concerns:
 - 1) Description: Description of societal concerns related to the use case;
 - 2) SDGs to be achieved: the Sustainable Development Goals (SDGs), otherwise known as the Global Goals, are a collection of 17 global goals set by the United Nations General Assembly. SDGs are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity.

6.4.2 References of use case

Reference information related to the use case includes the following items.

- Type: Document type of the reference (e.g. standards, paper, patent, press release).

- Reference: Title of the reference.
- Status: The status of the referenced document.
- Impact on use case: Where does the document influence the use case?
- Originator/organization: Who published the document?
- Link: If available, a public link can be provided.

6.5 Basic statistics

6.5.1 Use cases by application domain

[Figure 1](#) describes the percentage of use cases by application domain. Some use cases that are identified by multi-domains are counted multiple times in [Figure 1](#). [Figure 1](#) does not include the following application domains because no use cases were submitted:

- construction;
- defence;
- low-resource communities.

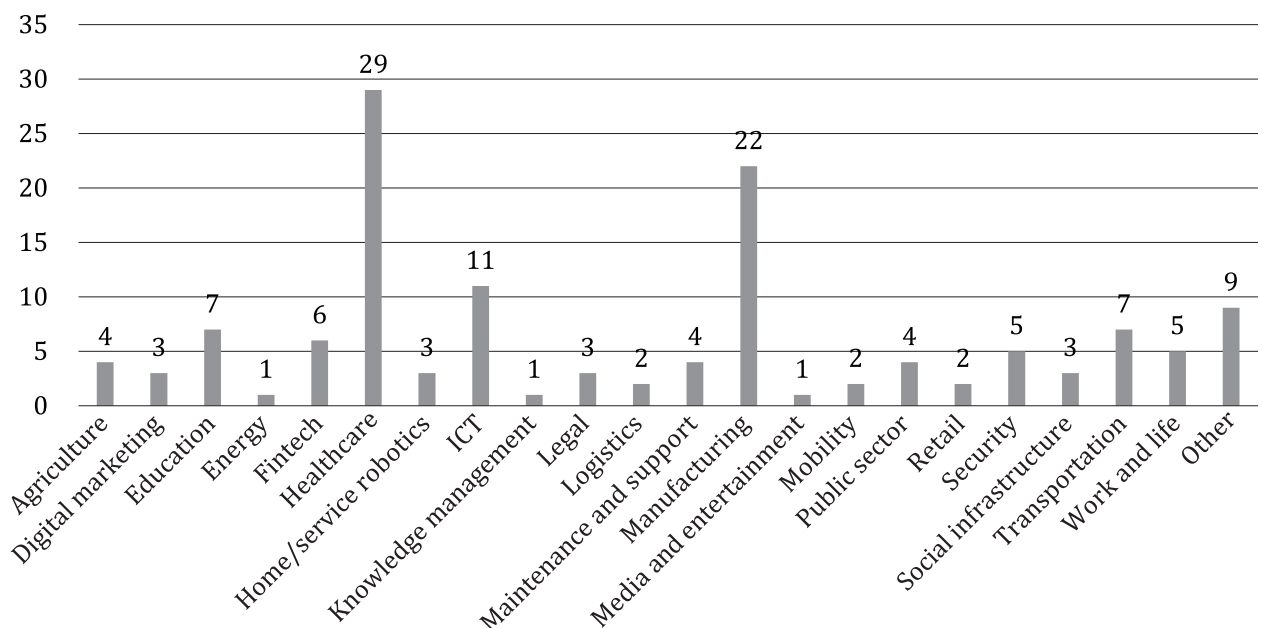


Figure 1 — Distribution of use cases by application domain

6.5.2 Use cases by status

Distribution of use cases by status is shown in [Figure 2](#).

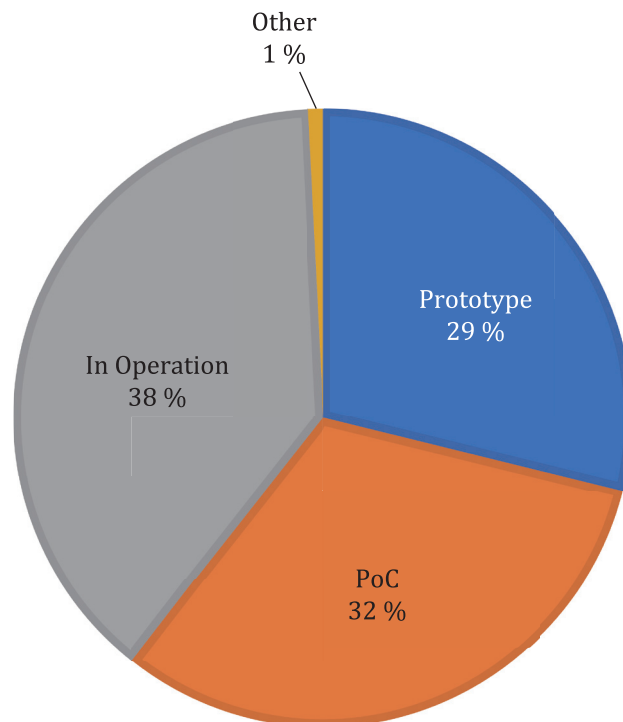


Figure 2 — Distribution of use cases by status

6.5.3 Use cases by task

Distribution of use cases by task is shown in [Figure 3](#). Some use cases that include multi-tasks are counted multiple times in [Figure 3](#).

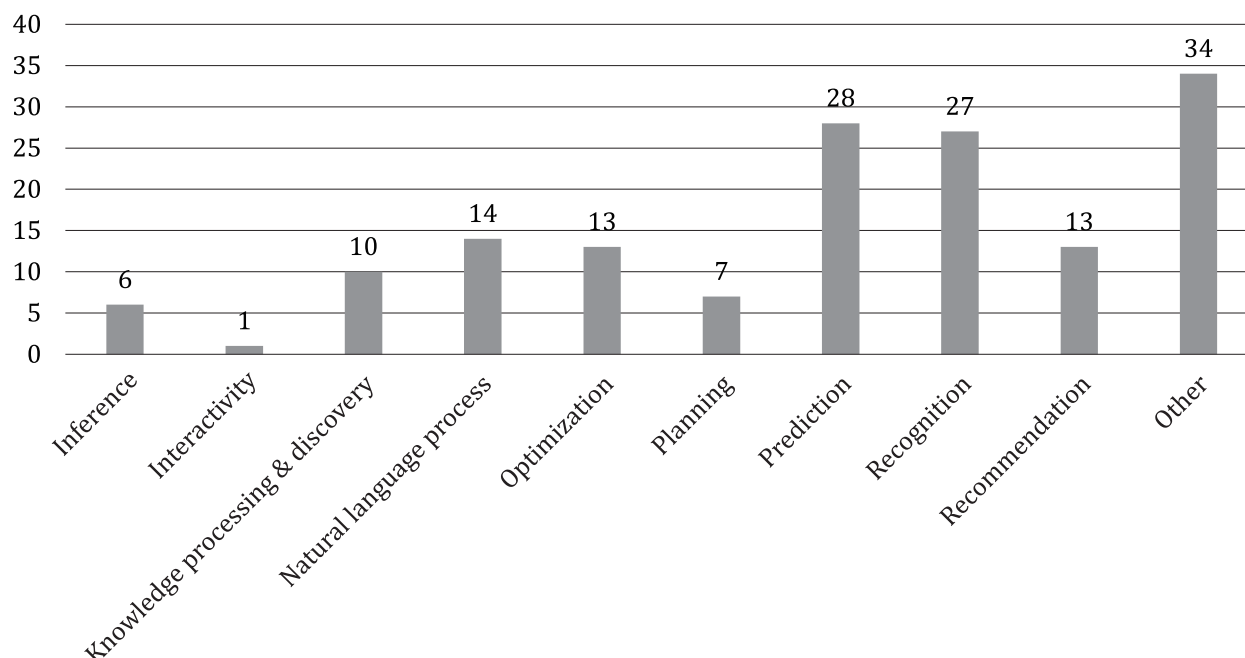


Figure 3 — Distribution of use cases by task

6.6 Societal concerns

6.6.1 General

Societal concerns taking the context, scope, nature and risks of AI technology into consideration come into play when an organization is choosing an AI technology or making recommendations that can affect the outcome in a socially and/or ethically undesirable way. In the absence of such considerations, the technology itself can perform flawlessly from a technical perspective, but with possible social, business or ethical costs. This document focuses on the impact analysis of use cases to consider the societal concerns of using AI systems.

6.6.2 Impact analysis

AI systems can be compared based on the potential impact of failure or unexpected behaviour. AI systems fall on a spectrum of risk, determined by the severity of the potential impact of a failure or unexpected behaviour. Relevant aspects for assessing the level of risk include:

- 1) the type of action space the system is operating in (e.g. recommendations vs direct action in an environment);
- 2) the presence/absence of external supervision;
- 3) the type of external supervision (automated or manual);
- 4) the ethical relevance of the task and/or domain;
- 5) the level of transparency of decisions or processing steps;
- 6) the degree of system autonomy^[7];
- 7) the fundamental rights relevance of the task and/or application domain^[8] (e.g. healthcare, transport, public sector and other application domains directly affect the safety of citizens' lives and property);
- 8) the robustness and accuracy of the system^[8] (whether the system behaves reliably as intended).

For example, a system that only gives recommendations and cannot act on its own, in a domain that has no ethical relevance, and has no autonomy, would be considered low risk. Conversely, we would consider a system to be highly critical if its actions have direct impact on human lives, it operates autonomously and without external supervision, and its decision-making is opaque.

[Annex A](#) is a list of impact analysis items that are used for case studies. Submitted case studies cover numerous topics, from manufacturing and healthcare to mobility and transportation. Few of the use cases include a description of any societal concerns. The details in the use cases are varied, making it difficult to fully analyse the application and its implications. The benefits are also rarely defined. There is a disproportionate number of cases in manufacturing and mobility. The initially submitted use cases are more detailed and complete than later ones. Few of the case studies identify stakeholders. Note that there are a few "use cases" that are not an application of an AI system, but provide possible insights that can be leveraged in AI standardization work. These "use cases" cannot be analysed for societal impacts.

Societal impacts are generally not well defined in the use cases submitted. Vulnerable users are not generally identified. The explainability of the technology or use case is not present. The potential biases and equity issues are not presented. Data and privacy issues are not presented. Potential interactions and feedbacks that can have adverse impacts are not presented.

6.7 Use case analysis for standardization opportunities and requirements

An in-depth analysis of use case 51 was conducted to extract possible useful directions for future AI standards and standardization. The details of this analysis are presented in [Annex C](#).

7 Use cases summaries

7.1 General

Table 2 shows summary information for each of the 132 use cases, including name, application domain(s), deployment model(s), and status. Subclauses 7.2 to 7.22 provide details on each use case, listed by application domain.

AI is an emerging field, with use cases and solutions that have a wide range of maturity and success. Use case descriptions written by practitioners in their respective fields can include inappropriate wordings. The descriptions are given for the convenience of users of this document and do not constitute an endorsement by ISO. Submitted use cases are not edited in this document. Hyperlinks in the use cases were understood to be active at the time of submission. Not all fields were populated by the use case submitters. Therefore, some fields are blank.

Table 2 — List of use cases

Category	Subclause	Use case name	Application domain	Deployment model	Status
Agriculture	7.2.1	AI to understand adulteration in commonly used food items	Agriculture	Cloud services	PoC
	7.2.2	bioBotGuard	Agriculture	Cloud services	PoC
	7.2.3	Ecosystems management from causal relation inference from observational data	Agriculture, knowledge management, ICT	Cloud services, on-premise systems, embedded systems, hybrid	PoC
	7.2.4	Real-time segmentation and prediction of plant growth dynamics using low-power embedded systems equipped with AI	Agriculture	Embedded systems	In operation
Digital marketing	7.3.1	Improving conversion rates and return on investment (RoI) with AI technologies	Digital marketing	On-premise systems	In operation
	7.3.2	Logo and trademark detection	Digital marketing	Hybrid	PoC
	7.3.3	Flavorlens	Digital marketing	Cloud services	Prototype
Education	7.4.1	VTrain recommendation engine	Education	On-premise systems	In operation
	7.4.2	RAVE	Education	Hybrid	PoC
	7.4.3	IFLYTEK intelligent marking system	Education	On-premise systems	In operation
	7.4.4	Intelligent educational robot	Education	On-premise systems	In operation
	7.4.5	AI solution to intelligence campus	Education	Cloud services	In operation
	7.4.6	AI adaptive learning platform for personalized learning	Education	Cloud services	In operation
	7.4.7	AI adaptive learning mobile app	Education	Hybrid	In operation
Energy	7.5.1	AI-dispatcher (operator) of large-scale distributed energy system infrastructure	Energy	On-premise systems	PoC

Table 2 (continued)

Category	Subclause	Use case name	Application domain	Deployment model	Status
Fintech	7.6.1	Detection of frauds based on collusions	Fintech	On-premise systems	In operation
	7.6.2	Credit scoring using KYC data	Fintech	On-premise systems	PoC
	7.6.3	Virtual bank assistant	Fintech	Cloud services	In operation
	7.6.4	Forecasting prices of commodities	Fintech	On-premise systems	In operation
	7.6.5	Finance advising and asset management with AI	Fintech	Cloud services	In operation
	7.6.6	Loan in 7 minutes	Banking and financial services	On-premise systems	In operation
Healthcare	7.7.1	Explainable artificial intelligence for genomic medicine	Healthcare	Cloud services	Prototype
	7.7.2	Revolutionizing clinical decision-making using artificial intelligence	Healthcare	On-premise systems	PoC
	7.7.3	Computer-aided diagnosis in medical imaging based on machine learning	Healthcare	On-premise systems	PoC
	7.7.4	AI solution to predict post-operative visual acuity for LASIK surgeries	Healthcare	Cloud services	In operation
	7.7.5	Chromosome segmentation and deep classification	Healthcare	Hybrid	PoC
	7.7.6	AI solution for quality control of electronic medical records (EMR) in real time	Healthcare	Cloud services	In operation
	7.7.7	Dialogue-based social care services for people with mental illness, dementia and the elderly living alone	Healthcare	Hybrid	Prototype
	7.7.8	Pre-screening of cavity and oral diseases based on 2D digital images	Healthcare	Hybrid	Prototype
	7.7.9	Real-time patient support and medical information service applying spoken dialogue system	Healthcare	Hybrid	Prototype
	7.7.10	Integrated recommendation solution for prosthodontic treatments	Healthcare	Hybrid	Prototype
	7.7.11	Sudden infant death syndrome (SIDS)	Healthcare	Cloud services	Prototype
	7.7.12	Discharge summary classifier	Healthcare	On-premise systems	In operation
	7.7.13	Generation of clinical pathways	Healthcare	On-premise systems	In operation
	7.7.14	Hospital management tools	Healthcare	On-premise systems	In operation

Table 2 (continued)

Category	Subclause	Use case name	Application domain	Deployment model	Status
Healthcare	7.7.15	Predicting relapse of a dialysis patient during treatment	Healthcare	Cloud services	In operation
	7.7.16	Instant triaging of wounds	Healthcare	Cloud services	In operation
	7.7.17	Accelerated acquisition of magnetic resonance images	Healthcare	Hybrid	Prototype
	7.7.18	AI based text to speech services with personal voices for people with speech impairments	Healthcare	On-premise systems	Prototype
	7.7.19	AI platform for chest CT-scan analysis (Early stage lung cancer detection)	Healthcare	Cloud services	In operation
	7.7.20	AI-based design of pharmacologically relevant targets with target properties	Healthcare	On-premise systems	Prototype
	7.7.21	AI-based mapping of optical to multi-electrode catheter recordings for atrial fibrillation treatment	Healthcare	Embedded systems	PoC
	7.7.22	AI solution for end-to-end processing of cell microscopy images	Healthcare	Embedded systems	PoC
	7.7.23	Generation of computer tomography scans from magnetic resonance images	Healthcare	Embedded systems	PoC
	7.7.24	Improving the knowledge base of prescriptions for drug and non-drug therapy and its use as a tool in support of medical professionals	Healthcare	Cloud services	Prototype
	7.7.25	Neural network formation of 3D-model orthopedic insoles	Healthcare	Client and server systems	In operation
	7.7.26	Search for undiagnosed patients	Healthcare	Social networks	In operation
	7.7.27	Support system for optimization and personalization of drug therapy	Healthcare	On premise system	PoC
	7.7.28	Syntelly — computer-aided organic synthesis	Drug design, digital pharma	System for the prediction of the properties of pharmaceutically relevant molecules	Prototype
	7.7.29	WebioMed clinical decision support system	Healthcare	Cloud services	In operation
Home/service robotics	7.8.1	Robot consciousness	Home/service robotics	Embedded systems	PoC
	7.8.2	Social humanoid technology capable of multi-modal context recognition and expression	Home/service robotics	Embedded systems	Prototype
	7.8.3	Application of strong artificial intelligence	Hi-tech labour market	Artificial agents	In operation

Table 2 (continued)

Category	Subclause	Use case name	Application domain	Deployment model	Status
ICT	7.9.1	Autonomous network and automation level definition	ICT	Cyber-physical systems	PoC
	7.9.2	Autonomous network scenarios	ICT	Cyber-physical systems	PoC
	7.9.3	A judging support system for gymnastics using 3D sensing	ICT	On-premise systems	PoC
	7.9.4	Active antenna array satellite	ICT	Cyber-physical systems	Prototype
	7.9.5	Carrier interference detection and removal for satellite communication	ICT	On-premise systems	PoC
	7.9.6	Ontologies for smart buildings	ICT	Hybrid	Prototype
	7.9.7	Product failure prediction for critical IT infrastructure	ICT	On-premise systems	In operation
	7.9.8	Data compression with AI techniques	ICT	On-premise systems	Prototype
	7.9.9	Optimization of software configurations with AI techniques	ICT	On-premise systems	Prototype
	7.9.10	Better human-computer interaction with advanced language models	ICT	Hybrid	Prototype
Legal	7.10.1	Tax rules updates and classification	Legal	On-premise systems	PoC
	7.10.2	AI contract management	Legal	On-premise systems	In operation
	7.10.3	Semantic analysis of legal documents	Legal	On-premise systems	Prototype
Logistics	7.11.1	Improving productivity for warehouse operation	Logistics	On-premise systems	PoC
	7.11.2	AI based dynamic routing SaaS	Logistics	Cloud services	In operation
Maintenance and support	7.12.1	Anomaly detection in sensor data using deep learning techniques	Maintenance and support	Hybrid	PoC
	7.12.2	Jet engine predictive maintenance service	Maintenance and support	Cloud services	Prototype
	7.12.3	Detection of fraudulent medical claims	Maintenance and support	On-premise systems	In operation
	7.12.4	AI virtual assistant for customer support and service	Maintenance and support	Embedded systems	In operation

Table 2 (continued)

Category	Subclause	Use case name	Application domain	Deployment model	Status
Manufacturing	7.13.1	AI solution to calculate amount of contained material from mass spectrometry measurement data	Manufacturing	Embedded systems	PoC
	7.13.2	AI solution to quickly identify defects during quality assurance process on wind turbine blades	Manufacturing	On-premise systems	In operation
	7.13.3	Solution to detect signs of failures in wind power generation system	Manufacturing	On-premise systems	PoB
	7.13.4	Generative design of mechanical parts	Manufacturing	On-premise systems	In operation
	7.13.5	Information extraction from hand-marked industrial inspection sheets	Manufacturing	Cloud services	PoC
	7.13.6	Automated defect classification on product surfaces	Manufacturing	On-premise systems	PoC
	7.13.7	Robotic task automation: Insertion	Manufacturing	Hybrid	PoC
	7.13.8	Powering remote drilling command centre	Manufacturing	Cloud services	In operation
	7.13.9	Leveraging AI to enhance adhesive quality	Manufacturing	On-premise systems	In operation
	7.13.10	Machine learning-driven approach to identify weak spots in the manufacturing of circuit breakers.	Manufacturing	On-premise systems	Prototype
	7.13.11	Machine learning-driven analysis of batch process operation data to identify causes of poor batch performance	Manufacturing	On-premise systems	Prototype
	7.13.12	Empowering autonomous flow meter control - reducing time taken for “proving of meters”	Manufacturing	Cloud services	In operation
	7.13.13	Adaptable factory	Manufacturing	Hybrid	PoC
	7.13.14	Order-controlled production	Manufacturing	Cloud Services	Prototype
	7.13.15	Value-based service	Manufacturing	Hybrid	PoC
	7.13.16	Improvement of productivity of semiconductor manufacturing	Manufacturing	On-premise systems	In operation
	7.13.17	AI decryption of magnetograms	Manufacturing, gas and oil	Client and server systems	In operation
	7.13.18	Analysing and predicting acid treatment effectiveness on bottom hole zone	Manufacturing, gas and oil	Client and server systems	In operation
	7.13.19	Automatic classification tool for full size core	Manufacturing, gas and oil	Client and server systems	In operation
	7.13.20	Intelligent technology to control manual operations via video — “Norma”	Manufacturing	On-premise systems	Prototype
	7.13.21	Optimization of ferroalloy consumption for a steel production company	Manufacturing	Embedded systems	PoC
	7.13.22	Device control using embedded AI with cloud computing	Manufacturing	Learning in both cloud and embedded	In operation

Table 2 (continued)

Category	Subclause	Use case name	Application domain	Deployment model	Status
Media and entertainment	7.14.1	Predictive analytics for the behaviour and psycho-emotional conditions of eSports players using heterogeneous data and artificial intelligence	eSports	Cyber-physical systems	Prototype
Mobility	7.15.1	Autonomous apron truck	Mobility	Embedded systems	PoC
	7.15.2	AI solution to help mobile phones to have better picture effect	Mobility	Hybrid	In operation
Public sector	7.16.1	AI ideally matches children to day-care centres	Public sector	On-premise systems	In operation
	7.16.2	AI sign language interpretation system for people with hearing impairment	Public sector	Embedded systems	Prototype
	7.16.3	AI situation explanation service for people with visual impairments	Public sector	Hybrid	Prototype
	7.16.4	Predictive maintenance of public housing lifts	Public sector	Embedded systems	PoC
Retail	7.17.1	Emotion-sensitive AI customer service	Retail	On-premise systems	In operation
	7.17.2	Deep learning-based user intent recognition	Retail	On-premise systems	In operation
Security	7.18.1	Behavioural and sentiment analytics	Security	On-premise systems	PoC
	7.18.2	AI (swarm intelligence) solution for attack detection in IoT environment	Security	Hybrid	Prototype
	7.18.3	Use of robotic solution for traffic policing and control	Security	On-premise systems	PoC
	7.18.4	Robotic solution for replacing human labour in hazardous conditions	Security	On-premise systems	PoC
	7.18.5	Non-intrusive detection of malware	Security	Cloud services	In operation
Social infrastructure	7.19.1	Deep learning technology combined with topological data analysis successfully estimates degree of internal damage to bridge infrastructure	Social infrastructure	Cloud services	PoC
	7.19.2	Water crystal mapping	Social infrastructure	Cloud services	Prototype
	7.19.3	System for real-time earthquake simulation with data assimilation	Social infrastructure	On-premise systems	Prototype

Table 2 (continued)

Category	Subclause	Use case name	Application domain	Deployment model	Status
Transportation	7.20.1	AI components for vehicle platooning on public roads	Transportation	Self-driving vehicles	Prototype
	7.20.2	Self-driving aircraft towing vehicle	Transportation	Self-driving vehicles	Prototype
	7.20.3	Unstaffed protective vehicle for road works on motorways	Transportation	Self-driving vehicles	Prototype
	7.20.4	Enhancing traffic management efficiency and infraction detection accuracy with AI technologies	Transportation	Hybrid	In operation
	7.20.5	AI solution for traffic signal optimization based on multi-source data fusion	Transportation	Cloud services	In operation
	7.20.6	Automated travel pattern recognition using mobile network data for applications to mobility as a service	Transportation	Activity- based modelling for new mobility services	PoC
	7.20.7	Autonomous trains (Unattended train operation (UTO))	Transportation	Self-driving vehicles	prototype
Work and life	7.21.1	Robotic prehension of objects	Work and life	Embedded systems	PoC
	7.21.2	Robotic vision – scene awareness	Work and life	Embedded systems	PoC
	7.21.3	Recommendation algorithm for improving member experience and discoverability of resorts in the booking portal of a hotel chain	Work and life	Cloud services	In operation
	7.21.4	Cooking recipes without border (CRWB) recommendation benchmark	Work and life	Cloud services	Prototype
	7.21.5	Improving the quality of online interaction	Work and life	Cloud services	In operation

Table 2 (continued)

Category	Subclause	Use case name	Application domain	Deployment model	Status
Others	7.22.1	AI solution to automatically identify false positives from a specific check for “untranslated target segments” by an automated quality assurance tool	This would be relevant for content across all domains	Cloud services	PoC
	7.22.2	AI solution for car damage classification	Insurance	Cloud services	PoC
	7.22.3	Causality-based thermal prediction for data centre	Data centre	On-premise systems	Prototype
	7.22.4	Machine learning tools in support of transformer diagnostics	Performance evaluation and diagnostics	Prototype	Prototype
	7.22.5	Video on demand publishing intelligence platform	TMT industry, technology department	On-premise systems	In operation
	7.22.6	Predictive testing	TMT industry – application development	On-premise systems	PoC
	7.22.7	Predictive data quality	Data management	Hybrid	PoC
	7.22.8	Expansion of AI training dataset and contents using artificial intelligence techniques	IT, AI, future services	Server systems	Prototype
	7.22.9	Open spatial dataset for developing AI algorithms based on remote sensing (satellite, drone, aerial imagery) data	Earth science, digital cartography	On-premise systems	In operation

7.2 Agriculture

7.2.1 AI to understand adulteration in commonly used food items (use case 19)

7.2.1.1 Scope of use case

Understand the patterns in hyperspectral/near infrared (NIR) or visual imaging specifically for adulteration in milk, bananas and mangoes.

7.2.1.2 Objective

To devise a simple, cost effective tool to identify adulteration in food items at point of purchase.

7.2.1.3 Narrative (short description)

Food adulteration is one of the big challenges of modern society. Adulterated milk is a hazard for children, and many ailments including cancer and kidney failure are due to consumption of adulterated food. Hyperspectral technology was evaluated to find out adulteration in food items.

7.2.1.4 Challenges and issues

Large scale data collection, miniaturization of frugal NIR/hyperspectral sensor.

7.2.1.5 Societal concerns

If the AI system is rolled out and taken to be reliable, then it is expected to be able to perform in all cases and scenarios. Incorrect classification can lead to false accusations.

SDGs to be achieved: Good health and well-being for people

7.2.2 bioBotGuard (use case 54)

7.2.2.1 Scope of use case

Use visual recognition to identify and help fight parasites attacking organic farms.

7.2.2.2 Objective

The use case shows how AI is contributing to modernization of the agriculture industry.

7.2.2.3 Narrative (short description)

BioBotGuard defines itself as an initiative of precision farming as a service. From an IT perspective, it uses drones with GPS and high-resolution cameras to monitor crops. The images are then processed by computer vision API in order to spot diseases and harmful insect attacks, building a georeferenced risk map of the crop. This can be used to send operational drones to provide treatment (or antagonist insects) only when and where it is necessary.

7.2.2.4 Challenges and issues

Acquire field as well as crop images at different distances and normalize image recognition and pattern detection.

7.2.2.5 Societal concerns

None identified

7.2.3 Ecosystems management from causal relation inference from observational data (use case 96)

7.2.3.1 Scope of use case

Infer important latent variables to control a whole ecosystem using a database including human observation and sensor data.

7.2.3.2 Objective

To provide some suggestions for managing ecosystems and repeatedly improve management with the introduction of possibly latent variables and new data.

7.2.3.3 Narrative (short description)

We can find diverse relations between climate, animals and plants that infer an ecologically consistent structure.

To determine the factors that support a species' niche, it is necessary to diversify the polyculture in ecological optimum, which is a complex entanglement that depends on environmental conditions, associated biodiversity, farming options, etc.

In the Synecoculture project, polyculture with ecological optimum requires a huge amount of information on biodiversity, interactions, and vegetation succession parameters. This information is generally sparse and possibly biased, open-ended, etc., because it relies on human observation. Still, this information can bring useful understanding and intriguing insight on management if powerful algorithmic analysis is combined with appropriate human evaluation.

7.2.3.4 Challenges and issues

None identified

7.2.3.5 Societal concerns

SDGs to be achieved: No poverty; Zero hunger; Good health and well-being; Clean water and sanitation; Decent work and economic growth; Industry, innovation and infrastructure; Reduce inequalities; Responsible consumption and production; Climate action; Life on land; Partnerships for the goals.

7.2.4 Real-time segmentation and prediction of plant growth dynamics using low-power embedded systems equipped with AI (use case 126)

7.2.4.1 Scope of use case

The project is devoted to the development of a low-power embedded system and AI algorithm for real-time plant segmentation and prediction of its growth. The proposed distributed system is aimed for use in greenhouses and remote areas, where edge-computing autonomous systems are in demand. A branch of this project also aims to develop the payload for drones for the segmentation of harmful plants in real-time.

7.2.4.2 Objective

Prediction of harvest, biomass/leaf area dynamics, leaf index, parameters describing the quality of produced food, consumption of resources from sequences of images of plant growth (including multispectral), data from sensors that describe environmental conditions and artificial growing system parameters representing the state of the growing system.

7.2.4.3 Narrative (short description)

Research efforts towards low-power sensing devices with fully functional AI on board are still fragmented. In our project, we present an embedded system enriched with AI that ensures the continuous analysis and in-situ prediction of the plant leaf growth dynamics and other important growth parameters. The embedded solutions grounded on a low-power embedded sensing system with a graphics processing unit (GPU) are able to run the neural networks-based AI on board. Advantages of the proposed system include portability and ease of deployment. The proposed approach guarantees the system autonomous operation for 180 d using a standard Li-ion battery. We rely on state-of-the-art mobile graphic chips for smart analysis and control of autonomous devices. The data was used for training and testing the recurrent neural network, convolutional neural network algorithms, and the segmentation algorithms. All this allows for high performance in-situ optimization of plant growth dynamics and resource consumption.

7.2.4.4 Challenges and issues

- The plant growth data significantly depends on multiple factors, including used solutions, illumination characteristics (for greenhouses), weather and seasonal conditions (for outdoors).
- The architecture of the neural network is expected to have both high accuracy and high framerate, but a low amount of layers and trained parameters for further inference on low-power embedded systems. These controversial factors are expected to be met since embedded systems have limited processing capabilities.
- High diversity of data types and no standardization of data obtained by farmers.

7.2.4.5 Societal concerns

- Good health and well-being for people