

# ISO/IEC JTC 1 SC 42 Artificial Intelligence – Working Group 4

## Use Case Submission Form

The quality of use case submissions will be evaluated for inclusion in the Working Group’s Technical Report based the application area, relevant AI technologies, credible reference sources (see References section), and the following characteristics:

- Data Focus & Learning: Use cases for AI system which utilizes Machine Learning, and those 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 & 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 to society, environment, etc.
- Architecture: Use cases demonstrating several architectural paradigms for AI systems (e.g., cloud, distributed AI, crowdsourcing, swarm intelligence, etc.)

### 1. General

ID	(leave blank, for internal use)	
Use case name	Automated defect classification on product surfaces	
Application domain	Manufacturing processes	
Deployment model	On premise system	
Status	PoC	
Scope <sup>1</sup>	Image Analytics for water taps in sanitary industries.	
Objective(s) <sup>2</sup>	Image analytics using a combination of feature extraction and classification of defects on shining surfaces in sanitary industries.	
Narrative	Short description (not more than 150 words)	A vision system that inspects and identifies the defects on water taps in sanitary industries. The system uses a combination of features for an automatic defect classification on product surfaces. All defects (15 types are identified) are classified into two major categories, real-defects and pseudo-defects. The pseudo-defects cause no quality problem; while the real-defects are critical as they might malfunction the final products.

<sup>1</sup> The scope defines the intended area of applicability, limits, and audience.

<sup>2</sup> The intention of the system; what is to be accomplished?; who/what will benefit?.

		<p>The AI system uses Support Vector Machine (SVM) classifier along with the combined features to identify the defect types. With the vision system in place, the quality control process is fully automated without any human intervention.</p>		
	Complete description	<p>The proposed vision system has two parts: the hardware part and the software part. The hardware captures the images of product surfaces under a constant illuminating condition. The software is developed to perform image processing tasks and identify defects on product surfaces.</p> <p>The steps of proposed system include image acquisition, preprocessing, segmentation, feature extraction, classification and post-processing. The system presents two software components: Feature Extraction and Classifier Design. These two modules are implemented independently which can be developed in offline platform and can be integrated into vision system and work online.</p> <p>As a first step, the feature extraction is critical and guides the extent to which a classifier can distinguish the defects from one class to another. A combination of features is used like geometry (shape, texture), and statistical features of the segmented images. In the second step, a support vector machine classification model is trained to identify the defect types. The classification results obtained by combining Gabor features, Statistical features, and grayscale features showed comparable performances with human evaluations.</p> <p>Overall, the vision system is modularized with capabilities to self-learn and future extensions.</p>		
Stakeholders <sup>3</sup>	Sanitary Industries			
Stakeholders' assets, values <sup>4</sup>	Competitiveness; Quality Check;			
System's threats & vulnerabilities <sup>5</sup>	Incorrect AI System use (AI system affecting quality control); New Security Threats.			
Key performance indicators (KPIs)	ID	Name	Description	Reference to mentioned use case objectives
	1	Classification Ratio	Real to Pseudo wrong classification	Establishes the quality of identification
AI features	Task(s)	Recognition		

<sup>3</sup> Stakeholder are those that can affect or be affected by the AI system in the scenario; e.g., organizations, customers, 3rd parties, end users, community, environment, negative influencers, bad actors, etc.

<sup>4</sup> 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.

<sup>5</sup> Threats and vulnerabilities can compromise the assets and values above - e.g., different sources of bias, incorrect AI system use, new security threats, challenges to accountability, new privacy threats (hidden patterns), etc.

	Method(s) <sup>6</sup>	Classification; Feature Extraction
	Hardware <sup>7</sup>	IP Camera and Work Station
	Topology <sup>8</sup>	
	Terms and concepts used <sup>9</sup>	Classification, Feature Extraction, Defect Identification
Standardization opportunities/ requirements	1) Quality acceptance criterion from AI systems: What is the acceptable standard for AI output related to quality? How that can be independently validated? 2) Standards for dealing with AI failures: How/Can standards facilitate dealing with AI failures, w.r.t., quality, productivity criteria?	
Challenges and issues	Real time implementation, accurately identify the nature of defects.	
Societal Concerns <sup>10</sup>	Description	Promoting sustainable industries, and investing in scientific research and innovation, are all important ways to facilitate sustainable development.
	SDGs <sup>11</sup> to be achieved	Industry, Innovation, and Infrastructure

<sup>6</sup> AI method(s)/framework(s) used in development.

<sup>7</sup> Hardware system used in development and deployment.

<sup>8</sup> Topology of the deployment network architecture.

<sup>9</sup> Terms and concepts used here should be consistent with those defined by Working Group 1 (AWI 22989 and AWI 23053) or to be recommended for inclusion.

<sup>10</sup> To be inserted.

<sup>11</sup> The Sustainable Development Goals (SDGs), also 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.

URL: <http://www.undp.org/content/undp/en/home/sustainable-development-goals.html>

## References

References						
No.	Type	Reference	Status	Impact on use case	Originator/organization	Link
1	Publication	B. Kuhlenkötter, X. Zhang, C. Krewet, Quality Control in Automated Manufacturing Processes – Combined Features for Image Processing Acta Polytechnica Vol. 46 No. 5/2006.	Published	Use case taken from this reference	Czech Technical University	<a href="https://ojs.cvut.cz/ojs/index.php/ap/article/view/868">https://ojs.cvut.cz/ojs/index.php/ap/article/view/868</a>