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	Enhancing traffic management efficiency and infraction detection accuracy with AI technologies	
Application domain	Transportation	
Deployment model	Hybrid or other (please specify) Cloud services and on-premise systems	
Status	In operation	
Scope[1]	Utilizing AI technologies in traffic monitoring and management	
Objective(s)[2]	To increase the accuracy and efficiency of infraction detection, traffic monitoring and flow analysis, while minimizing the human effort and the overall solution cost.	
Narrative	Short description (not more than 150 words)	Big data enabled AI technologies are applied to monitoring and managing the traffic in a large municipality in China. Multi-sourced data (traffic flow, vehicle data, pedestrian movement, etc.) is monitored, from which illegal operation of vehicles, unexpected incidents, surge of traffic etc. are detected and analysed with machine learning (ML) methods. ML tasks (including training and deployment) are carried out on a platform supporting the integration of various ML frameworks, models and algorithms. The platform is based on heterogeneous computing resources. The efficiency and accuracy of infraction detection, and the effectiveness of traffic

[1] The scope defines the intended area of applicability, limits, and audience.
[2] The intention of the system; what is to be accomplished?; who/what will benefit?.

		management are significantly improved, with much reduced human effort and overall solution cost.
	Complete description	With the population and the number of vehicles growing in large cities, managing the heavy traffic in urban areas has become a challenging yet essential task for the municipality. Addressing this issue has become particularly urgent for big cities in China, where millions of people live and commute every day. In this use case, big data based AI technologies are applied to monitoring and managing the heavy traffic in a metropolitan in south China. Previously, significant human resources were involved in the vehicle and road monitoring, and large investment was made to the computing infrastructure specific to certain functionalities. To increase the efficiency of urban transportation, reduce the traffic jam and air pollution, as well as minimize the human effort, machine learning techniques (e.g. deep learning) are applied to image and video analysis, such as traffic flow analysis, infraction detection and incident detection. Example applications include but not limited to 1) detection of traffic rule violation, e.g. over-speeding, wrong driving lanes or parking. AI-enabled detection produces much faster and more accurate result, and helps in enforcing the traffic regulation. 2) traffic light optimization. Based on the modelling and analysis of multi-sourced traffic information (both real-time and historical data), traffic lights are dynamically configured to divert the flow, increase the passing speed of cars and reduce the traffic jam in major junctions. The use of AI has obtained remarkable results: The infraction detection efficiency gets 10X increase, and the detection accuracy is greater than 95%. The urban area traffic jam is much alleviated, with vehicles' passing speed through major junctions increases by 9%-25%.
Stakeholders[3]	Urban citizens (drivers and pedestrians), government, car companies, traffic administrative bureaus, logistics companies, etc.	
Stakeholders' assets, values[4]	Transportation efficiency, controlability and predictability of commute time, pedestrian and vehicle safety, air quality, etc.	
System's threats & vulnerabilities[5]	Low quality pictures, insufficient processing capability	

[3] 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.

[4] 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.

[5] 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.

Key performance indicators (KPIs)	ID	Name	Description	Reference to mentioned use case objectives
		accuracy	The accuracy of infraction and incident detection from traffic pictures/videos	To increase the accuracy of traffic monitoring and inspection
		split	Proportion of images requiring human inspection. The less the split, the higher the efficiency.	To minimize the human effort in inspection
		resource utilization ratio	Achievable resource utilization ratio in the hardware infrastructure (the higher the utilization ratio, the lower amount the required resource)	To reduce the infrastructure investment and overall solution cost
AI features	Task(s)	Recognition		
	Method(s)[6]	Machine learning, Deep learning		
	Hardware[7]	Heterogeneous computing platform (CPU plus heterogeneous accelerators such as GPU, FPGA etc.)		
	Topology[8]			
	Terms and concepts used[9]	Heterogeneous resource pooling, on-demand resource scheduling		
Standardization opportunities/ requirements	• Requirement of computing infrastructure to empower AI applications in the transportation domain, e.g. the integration of acceleration units (GPU, FPGA, etc.), dynamic scheduling and on-demand allocation of heterogeneous resources • Support of mainstream ML frameworks, and the algorithms and models from different vendors, to prevent vendor lock-in			
Challenges and issues	• Constant improvement in hardware architecture to increase the performance and efficiency of running ML/DL tasks • Consistent interfaces between applications, ML engines and heterogeneous resource pools • Support of new models and emerging algorithms for growing functionalities			

[6] AI method(s)/framework(s) used in development.

[7] Hardware system used in development and deployment.

[8] Topology of the deployment network architecture.

[9] 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.

Societal Concerns[10]	Description	AI's application in urban transportation significantly improves the quality of life for urban citizens, reduces the time wasted in heavy traffic and the air pollution from vehicles.
	SDGs[11] to be achieved	Sustainable cities and communities

[10] To be inserted.

[11] 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

Data (optional)

Data characteristics	
Description	Traffic data (vehicle, road, and pedestrian data)
Source[12]	Traffic camera
Type[13]	Image, video
Volume (size)	~100TB/day
Velocity[14]	Stream and batch
Variety[15]	Traffic flows, vehicle information, pedestrian information, etc.
Variability (rate of change)[16]	Subject to random surge (rush hour, accident, etc.)
Quality[17]	Vary (depending on the weather condition, environment etc.)

[12] Origin of data, which could be from customers, instruments, IoT, web, surveys, commercial activity, simulations, etc.

[13] Structured/unstructured text, images, voices, gene sequences, numbers, composite: time-series, graph-structures, etc.

[14] The rate of flow at which the data is created, stored, analysed, or visualized. Could be in real time.

[15] Domains and types of data employed including formats, logical models, timescales, and semantics. Could be from multiple databases.

[16] Changes in data rate, format/structure, semantics, and/or quality.

[17] Completeness and accuracy of the data with respect to semantic content as well as syntax of the data (such as presence of missing fields or incorrect values).

Process scenario (optional)

Scenario conditions					
No.	Scenario name	Scenario description	Triggering event	Pre-condition[18]	Post-condition[19]
1	Training	Train a model (e.g. neural network) with training samples	Sample raw dataset is ready		
2	Evaluation	Evaluate whether the model is properly trained for the detection	Completion of training/retraining		Meeting KPI requirements (e.g. accuracy, split) of the particular case
3	Execution	Deploy the model for infraction detection and traffic analysis	Traffic image/video data is applied.	The model has been evaluated as properly trained.	
4	Retraining	Retrain a model with training samples	Changes in dataset pattern is expected, or new requirement on detection.		

[18] Describes which condition(s) should have been met before this scenario happens.

[19] Describes which condition(s) should prevail after this scenario happens. The post-condition may also define "success" or "failure" conditions

Training (optional)

Scenario name	Training				
Step No.	Event[20]	Name of process/Activity[21]	Primary actor	Description of process/activity	Requirement

Specification of training data	

[20] The event that triggers the step. This might be completion of the previous event.
[21] Action verbs should be used when naming activity.

Evaluation (optional)

Scenario name	Evaluation				
Step No.	Event[22]	Name of process/Activity[23]	Primary actor	Description of process/activity	Requirement

Input of evaluation	
Output of evaluation	

[22] The event that triggers the step. This might be completion of the previous event.
[23] Action verbs should be used when naming activity.

Execution (optional)

Scenario name	Execution				
Step No.	Event[24]	Name of process/Activity[25]	Primary actor	Description of process/activity	Requirement

Input of Execution	
Output of Execution	

[24] The event that triggers the step. This might be completion of the previous event.
[25] Action verbs should be used when naming activity.

Retraining (optional)

Scenario name	Retraining				
Step No.	Event[26]	Name of process/Activity[27]	Primary actor	Description of process/activity	Requirement

Specification of retraining data	

[26] The event that triggers the step. This might be completion of the previous event.
[27] Action verbs should be used when naming activity.

References

References						
No.	Type	Reference	Status	Impact on use case	Originator/organization	Link
1	Journal		Published online		Huawei Technologies Co.,Ltd.	https://www.huaweicloud.com/journal/detail_09.html

Acceptable Reference Sources of Use Cases

— Peer-reviewed scientific/technical publications on AI applications (e.g. [1]).
— Patent documents describing AI solutions (e.g. [2], [3]).
— Technical reports or presentations by renowned AI experts (e.g. [4])
— High quality company whitepapers and presentations
— Publicly accessible sources with sufficient detail

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

Examples of credible sources:

— [1] B. Du Boulay. "Artificial Intelligence as an Effective Classroom Assistant". IEEE Intelligent Systems, V 31, p.76–81. 2016.
— [2] S. Hong. "Artificial intelligence audio apparatus and operation method thereof". N US 9,948,764, Available at: https://patents.google.com/patent/US20150120618A1/en. 2018.
— [3] M.R. Sumner, B.J. Newendorp and R.M. Orr. "Structured dictation using intelligent automated assistants". N US 9,865,280, 2018.

— [4] J. Hendler, S. Ellis, K. McGuire, N. Negedley, A. Weinstock, M. Klawonn and D. Burns. "WATSON@RPI, Technical Project Review".
URL: https://www.slideshare.net/jahendler/watson-summer-review82013final. 2013.