# 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**

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| --- | --- | --- | --- | --- |
| 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]](#footnote-1) | Utilizing AI technologies in traffic monitoring and management | | | |
| Objective(s)[[2]](#footnote-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 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]](#footnote-3) | Urban citizens (drivers and pedestrians), government, car companies, traffic administrative bureaus, logistics companies, etc. | | | |
| Stakeholders’  assets, values[[4]](#footnote-4) | Transportation efficiency, controlability and predictability of commute time, pedestrian and vehicle safety, air quality, etc. | | | |
| System’s threats & vulnerabilities[[5]](#footnote-5) | Low quality pictures, insufficient processing capability | | | |
| 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 |
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| AI features | Task(s) | Recognition | | |
| Method(s)[[6]](#footnote-6) | Machine learning, Deep learning | | |
| Hardware[[7]](#footnote-7) | Heterogeneous computing platform (CPU plus heterogeneous accelerators such as GPU, FPGA etc.) | | |
| Topology[[8]](#footnote-8) |  | | |
| Terms and concepts used[[9]](#footnote-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 | | | |
| Societal  Concerns[[10]](#footnote-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]](#footnote-11) to be achieved | Sustainable cities and communities | | |

**Data (optional)**

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

**Process scenario (optional)**

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| Scenario conditions | | | | | |
| No. | Scenario name | Scenario description | Triggering event | Pre-condition[[18]](#footnote-18) | Post-condition[[19]](#footnote-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. |  |  |
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**Training (optional)**

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| Scenario name | Training | | | | |
| Step No. | Event[[20]](#footnote-20) | Name of process/Activity[[21]](#footnote-21) | Primary actor | Description of process/activity | Requirement |
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| Specification of training data | |  | | | |

**Evaluation (optional)**

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| Scenario name | Evaluation | | | | |
| Step No. | Event[[22]](#footnote-22) | Name of process/Activity[[23]](#footnote-23) | Primary actor | Description of process/activity | Requirement |
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| Input of evaluation | |  | | | |
| Output of evaluation | |  | | | |

**Execution (optional)**

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| Scenario name | Execution | | | | |
| Step No. | Event[[24]](#footnote-24) | Name of process/Activity[[25]](#footnote-25) | Primary actor | Description of process/activity | Requirement |
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| Input of Execution | |  | | | |
| Output of Execution | |  | | | |

**Retraining (optional)**

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| Scenario name | Retraining | | | | |
| Step No. | Event[[26]](#footnote-26) | Name of process/Activity[[27]](#footnote-27) | Primary actor | Description of process/activity | Requirement |
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| Specification of retraining data | |  | | | |

**References**

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| 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 |
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# 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](https://patents.google.com/patent/US20150120618A1/en.%202018).
* [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](https://www.slideshare.net/jahendler/watson-summer-review82013final.%202013).

1. The scope defines the intended area of applicability, limits, and audience. [↑](#footnote-ref-1)
2. The intention of the system; what is to be accomplished?; who/what will benefit?. [↑](#footnote-ref-2)
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. [↑](#footnote-ref-3)
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. [↑](#footnote-ref-4)
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. [↑](#footnote-ref-5)
6. AI method(s)/framework(s) used in development. [↑](#footnote-ref-6)
7. Hardware system used in development and deployment. [↑](#footnote-ref-7)
8. Topology of the deployment network architecture. [↑](#footnote-ref-8)
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. [↑](#footnote-ref-9)
10. To be inserted. [↑](#footnote-ref-10)
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> [↑](#footnote-ref-11)
12. Origin of data, which could be from customers, instruments, IoT, web, surveys, commercial activity, simulations, etc. [↑](#footnote-ref-12)
13. Structured/unstructured text, images, voices, gene sequences, numbers, composite: time-series, graph-structures, etc. [↑](#footnote-ref-13)
14. The rate of flow at which the data is created, stored, analysed, or visualized. Could be in real time. [↑](#footnote-ref-14)
15. Domains and types of data employed including formats, logical models, timescales, and semantics. Could be from multiple databases. [↑](#footnote-ref-15)
16. Changes in data rate, format/structure, semantics, and/or quality. [↑](#footnote-ref-16)
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). [↑](#footnote-ref-17)
18. Describes which condition(s) should have been met before this scenario happens. [↑](#footnote-ref-18)
19. Describes which condition(s) should prevail after this scenario happens. The post-condition may also define "success" or "failure" conditions [↑](#footnote-ref-19)
20. The event that triggers the step. This might be completion of the previous event. [↑](#footnote-ref-20)
21. Action verbs should be used when naming activity. [↑](#footnote-ref-21)
22. The event that triggers the step. This might be completion of the previous event. [↑](#footnote-ref-22)
23. Action verbs should be used when naming activity. [↑](#footnote-ref-23)
24. The event that triggers the step. This might be completion of the previous event. [↑](#footnote-ref-24)
25. Action verbs should be used when naming activity. [↑](#footnote-ref-25)
26. The event that triggers the step. This might be completion of the previous event. [↑](#footnote-ref-26)
27. Action verbs should be used when naming activity. [↑](#footnote-ref-27)