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# Introduction

This contribution introduces a new use case for supporting Automated Machine Learning.

### -----------------------Start of change 1-------------------------------------------

## 7.2 Use case #x – Automous Operations using Automated Machine Learning

*Editor’s Note: The section introduces a AI/ML use case that uses IoT data.*

### 7.2.1 Description

Autonomous Operations is the ability of a system to sense the state of its environment through analysing and learning the collected data (e.g., from IoT devices) to find operational problems changing resource demands and adapt the environment dynamically to resolve issues. Thanks to Artificial Intelligence (AI) & Machine Learning (ML) and IoT technologies, Autonomous Operations enable industry companies to intelligently automate various operations that were previously performed manually.

Autonomous driving is a major field of AI and ML. In order for an autonomous vehicle to drive itself, three functions are essential: recognition, judgment, and control. These functions are where AI/ML is required. In the field of driving environment recognition and autonomous operation using cameras, ML (e.g., Deep Learning) has become the most important technology. When ML is applied to the image input through the camera, static environmental information (car lane, traffic signal, product line signal, location of source product, etc.) and dynamic environmental factors (vehicle, pedestrian, other machines status) can all be detected and classified. For example, in the case of autonomous driving, since the surrounding environment and acquired data are constantly changing, it is important to continuously improve the quality of the model through new data after developing the model for the first time.

AutoML is a process that automates the time-consuming and repetitive task of developing machine learning models. In particular, AutoML is used to effectively develop high-quality models while minimizing developer intervention in the process of algorithm selection and parameter tuning in the data preprocessing process.

Various conditions are required to continuously collect new data, label it, and learn it to develop a better quality model in AutoML. For example, machine learning may be performed when more than a certain amount of labelled data is collected, or machine learning may be performed periodically (e.g., once a day) to generate a new model.

Therefore, in the case of the IoT platform, an automated learning function can be provided in fields such as autonomous driving by supporting the collection of training data, labelling data, and classifying conditions for performing AutoML.

In the use case below, autonomous machine learning for autonomous driving is introduced as an example, and IoT platform can provide the following functions:

* Manage collected data set for training
* Support criteria when to perform ML and build a model

### 7.2.2 Source

### None

### 7.2.3 Actors

* Autonomous vehicle: a vehicle capable of autonomous driving and equipped with sensors and camera
* AI-enabled IoT platform: An IoT platform stores data from the autonomous vehicle, classifies data for training, and perform ML to build a model under certain conditions

### 7.2.4 Pre-conditions

* The autonomous vehicle is registered to IoT platform and continuously store its new measurements from embedded sensors and camera.
* The AI-enabled IoT platform holds a set of good quality training data for the autonomous vehicle.

### 7.2.5 Triggers

* If the IoT platform is configured to build a model at midnight every Sunday, the time triggers the process for automated ML.

### 7.2.6 Normal Flow

Figure 7.2.9-1 illusrates the high-level flows of the automated ML for autonomous driving use case, which consists of the following steps:

* Step 1: Initial training dataset is prepared from autonomous driving vehicle.
* Step 2: AI/ML application builds the initial model, Model #1.
* Step 3: Under configured AutoML condition (e.g., every week, the amount of dataset), AI/ML application build Model #2.

### 7.2.7 Alternative Flow

None

### 7.2.8 Post-conditions

The AI-enabled IoT platform has data set for continuous training of the delivery AI/ML model.

### 7.2.9 High Level Illustration



Figure 7.2.9-1 Conceptual diagram of automated ML for autonomous driving

### 7.2.10 Potential Requirements

1. The oneM2M System shall be able to distinguish the data set that will be trained and has already been trained.
2. The oneM2M System shall be able to provide automated machine learning under certain conditions, e.g., building a model every week or when the number of datasets reaches 100.

### -----------------------End of change 1-------------------------------------------