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# Data Attribute Recommendation

# Content

<b>1</b>	<b>What Is Data Attribute Recommendation?</b>	<b>4</b>
<b>2</b>	<b>What's New for Data Attribute Recommendation</b>	<b>7</b>
2.1	2023 What's New for Data Attribute Recommendation (Archive).	9
2.2	2022 What's New for Data Attribute Recommendation (Archive).	15
2.3	2021 What's New for Data Attribute Recommendation (Archive).	19
2.4	2020 What's New for Data Attribute Recommendation (Archive).	22
2.5	2019 What's New for Data Attribute Recommendation (Archive).	27
<b>3</b>	<b>Concepts.</b>	<b>28</b>
<b>4</b>	<b>Service Plans.</b>	<b>32</b>
<b>5</b>	<b>Metering and Pricing.</b>	<b>34</b>
<b>6</b>	<b>Initial Setup.</b>	<b>37</b>
6.1	Enabling the Service in the Cloud Foundry Environment.	38
6.2	Enabling the Service in the Kyma Environment.	38
<b>7</b>	<b>Enable X.509 Authentication.</b>	<b>39</b>
<b>8</b>	<b>Run the Service in a Multitenant Application.</b>	<b>41</b>
<b>9</b>	<b>Tutorials.</b>	<b>42</b>
<b>10</b>	<b>API Reference.</b>	<b>43</b>
10.1	Get Authorization.	43
10.2	Upload Data.	44
	Data Validation.	53
	Dataset Lifecycle.	54
10.3	Train Job and Deploy Model.	55
	Model Templates.	60
	Business Blueprints.	61
	Training Job Lifecycle.	61
	Deployment Lifecycle.	63
10.4	Get Inference Results.	64
10.5	Common Status and Error Codes.	65
<b>11</b>	<b>Consuming the Service via AI API.</b>	<b>67</b>
11.1	Authorization.	68
11.2	AI API - Dataset Upload.	69

11.3	AI API - Model Training and Deployment. . . . .	71
	Scenarios. . . . .	72
	Artifacts. . . . .	73
	Executables. . . . .	76
	Configurations. . . . .	84
	Executions. . . . .	96
	Metrics. . . . .	100
	Deployments. . . . .	103
<b>12</b>	<b>Technical Constraints. . . . .</b>	<b>104</b>
12.1	Free Tier Option and Trial Account Technical Constraints. . . . .	111
<b>13</b>	<b>Security. . . . .</b>	<b>112</b>
13.1	Technical System Landscape. . . . .	112
13.2	Security Aspects of Data, Data Flow and Processes. . . . .	114
13.3	User Administration, Authentication and Authorization. . . . .	115
13.4	Data Protection and Privacy. . . . .	116
13.5	Auditing and Logging Information. . . . .	120
13.6	Front-End Security. . . . .	123
<b>14</b>	<b>Accessibility Features in Data Attribute Recommendation. . . . .</b>	<b>124</b>
<b>15</b>	<b>Monitoring and Troubleshooting. . . . .</b>	<b>125</b>
15.1	FAQ. . . . .	125
15.2	Getting Support. . . . .	128

# 1 What Is Data Attribute Recommendation?

Apply machine learning to predict and classify data records.

Data Attribute Recommendation uses free text, numbers and categories as input to classify entities such as products, stores and users into multiple classes and also to predict the value of missing numerical attributes in your data records. You can use Data Attribute Recommendation, for example, to classify incoming product information and predict the price of commodities based on their description.

With Data Attribute Recommendation you can:

- Automate and speed up data management processes
- Reduce errors and manual efforts in data maintenance
- Increase data consistency and accuracy

## Features

<b>Manage training data</b>	Perform tasks related to the dataset that will be used to train the machine learning model.
<b>Manage machine learning model</b>	Perform tasks related to the machine learning model that will be used to classify entities and predict the missing attributes in your data records.
<b>Classify data records</b>	Classify data records by specifying which deployed machine learning model should be used.
<b>Predict data records</b>	Predict the value of missing numerical attributes in your data records by specifying which deployed machine learning model should be used.
<b>Benefit from multitenancy support</b>	Use this service in tenant-aware (multitenant) applications. Run them on a shared compute unit that can be used by multiple consumers (tenants).

## Environment

This service is available in the following environments:

- Cloud Foundry environment
- Kyma environment

## Multitenancy Support

This service supports multitenancy. It can be used in tenant-aware applications.

For information on multitenancy support, see [Run the Service in a Multitenant Application \[page 41\]](#).

## Applications

Data Attribute Recommendation consists of the following applications:

- **Data Manager:** manages training data, for example, training upload and deletion
- **Model Manager:** manages machine learning models, for example, model creation, deployment and deletion
- **Inference:** classifies entities or predicts the missing attributes in your data records

## Use Cases

Take a look at possible use cases for Data Attribute Recommendation:

- Get suggestions of material class and its characteristics when creating new material requests
- Get international trade commodity code predictions when adding a new product
- Solve master data inconsistencies
- Obtain a price estimation for a product based on its description


## Prerequisites

See [Initial Setup \[page 37\]](#).

## Technical Constraints

For information on technical limits, see [Technical Constraints \[page 104\]](#).

## Regional Availability

Get an overview on the availability of Data Attribute Recommendation according to region, infrastructure provider, and release status in the [Pricing](#) tab of the [SAP Discovery Center](#) .

## Trial Scope

Data Attribute Recommendation is available for trial use. A trial account lets you try out SAP Business Technology Platform (SAP BTP) for free and is open to everyone. Trial accounts are intended for personal

exploration, and not for productive use or team development. They allow restricted use of the platform resources and services.

To activate your trial account, go to [Welcome to SAP BTP Trial](#).

#### Note

See also the following information: [Trial Accounts and Free Tier](#).

In the Cloud Foundry environment, you get a free trial account for Data Attribute Recommendation with the following constraints: [Free Tier Option and Trial Account Technical Constraints \[page 111\]](#).

## 2 What's New for Data Attribute Recommendation

Technical Component	Environment	Title	Description	Action	Life-cycle	Type	Line of Business	Modular Business Process	Product	Latest Revision	Available as of
Data Attribute Recommendation	Cloud Foundry	Sales Order Completion (SOC) Business Blueprint Improvements	<p>The preprocessing of the Sales Order Completion (SOC) business blueprint has been improved.</p> <p>See <a href="#">Upload Data [page 44]</a> and <a href="#">Business Blueprints [page 61]</a>.</p>	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2024-08-05	2024-08-05
Data Attribute Recommendation	Cloud Foundry	Technical Constraints	<p>The maximum length for dataset schema array <i>labels</i> has been increased to 30 items in the <i>labels</i> list.</p> <p>See <a href="#">Technical Constraints [page 104]</a>.</p>	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2024-08-05	2024-08-05
Data Attribute Recommendation	Cloud Foundry	Usability and Stability Improvements	<p>The following usability and stability improvements are now available:</p> <ul style="list-style-type: none"> <li>Some issues with the support of UTF-8 Byte Order Mark (BOM) encoding type have now been resolved.</li> <li>AI API executions that remain in <b>UNKNOWN</b> status for more than 3 hours are now abandoned.</li> <li>AI API deployments that remain in <b>UNKNOWN</b> status for more than 6 hours are now abandoned.</li> </ul>	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2024-06-24	2024-06-24

Technical Component	Environment	Title	Description	Action	Life-cycle	Type	Line of Business	Modular Business Process	Product	Latest Revision	Available as of
Data Attribute Recommendation	Cloud Foundry	Training Configuration	<p>The enableMasking parameter is now also available for the Sales Order Completion executables.</p> <p>See <a href="#">Training Configuration [page 85]</a>.</p>	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2024-04-12	2024-04-12
Data Attribute Recommendation	Cloud Foundry	AI API - New Functionalities	<p>The following new functionalities are now available when consuming the Data Attribute Recommendation service via AI API:</p> <ul style="list-style-type: none"> <li>• <b>Support for dataset schemas with overlapping features and labels:</b> Add common values to the list of features and labels in your dataset schemas. Use the trained model for autocompletion tasks. See <a href="#">AI API - Dataset Upload [page 69]</a>.</li> <li>• <b>Support for masking during model training:</b> Set the training configuration parameter enableMasking to true to make the model learn nontrivial relationships between inputs and outputs (even when the list of features coincides with the list of labels). See <a href="#">Training Configuration [page 85]</a>.</li> </ul>	Info only	General Availability	New	Technology	Not applicable	SAP Business Technology Platform	2024-03-06	2024-03-06



Tech nical Com- po- nent	Envi- ron- men- t	Title	Description	Ac- tion	Life- cy- cle	Type	Line of Busi- ness	Mod- ular Busi- ness Proc- ess	Product	Lat- est Revi- sion	Avail- able as of
Data Attri- bute Reco- mmen- dation	Cloud Foundry	Reuse of Dataset Schemas	We've fixed an issue related to the reuse of dataset schemas.  You can now reuse the same dataset schema with different datasets.	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2024-03-06	2024-03-06

## 2.1 2023 What's New for Data Attribute Recommendation (Archive)

Tech nical Com- po- nent	Envi- ron- men- t	Title	Description	Ac- tion	Life- cy- cle	Type	Line of Busi- ness	Mod- ular Busi- ness Proc- ess	Product	Lat- est Revi- sion	Avail- able as of
Data Attri- bute Reco- mmen- dation	Cloud Foundry	Support to X.509 Au- thentication	The Data Attribute Recommendation service supports now X.509 Authentication.  See <a href="#">Enable X.509 Authentication [page 39]</a> .	Info only	General Availability	New	Technology	Not applicable	SAP Business Technology Platform	2023-11-03	2023-11-03
Data Attri- bute Reco- mmen- dation	Cloud Foundry	Batch Infer- ence and Transfer Learning  Available with Exe- cutable Ver- sion 3.0	The functionalities batch inference and transfer learning are now available with executable version 2.0 and 3.0.  See <a href="#">Batch Inference Configuration [page 93]</a> and <a href="#">Transfer Learning Configuration [page 92]</a> .	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2023-11-03	2023-11-03

Tech nical Com po- nent	Envi- ron- men t	Title	Description	Ac- tion	Life- cy- cle	Type	Line of Busi ness	Mod ular Busi ness Proc ess	Product	Lat- est Revi- sion	Avail able as of
Data Attri bute Reco mme ndati on	Clou d Foun dry	Overall Im- provements	There have been several code and stability improvements.	Info only	Gen- eral Avail abil- ity	Cha nged	Tech nol- ogy	Not ap- pli- ca- ble	SAP Business Technology Platform	2023 -11-0 3	2023 -11-0 3

Tech nical Com- po- nent	Envi- ron- men- t	Title	Description	Ac- tion	Life- cy- cle	Type	Line of Busi- ness	Mod- ular Busi- ness Proc- ess	Product	Lat- est Revi- sion	Avail- able as of
Data Attri- bute Reco- mmen- dation	Cloud Foundry	AI API - New Func- tionalities	<p>The following new functional- ities are now available when consuming the Data Attribute Recommendation service via AI API:</p> <ul style="list-style-type: none"> <li>• <b>Batch inference:</b> Upload one or more files for asyn- chronous processing.</li> <li>• <b>Feature contribution scores:</b> Get an estimate of how much the model de- pends on each feature.</li> <li>• <b>Transfer learning:</b> Train an existing model on a new da- taset.</li> </ul>	Info only	Gen- eral Avail- abil- ity	New	Tech nol- ogy	Not ap- pli- ca- ble	SAP Business Technology Platform	2023 -09- 04	2023 -09- 04

See [Configurations \[page 84\]](#)  
and [Metrics \[page 100\]](#).

#### ⚠ Restriction

These new functionalities  
depend on the executable  
version. See at a glance  
which functionalities are  
available with which ver-  
sions:

	Exe- cuta- ble	Exe- cuta- ble	Exe- cuta- ble
Func- tion- ality	Ver- sion	Ver- sion	Ver- sion
	1.0	2.0	3.0
Batc h In- fer- ence	✗ No	✓ Yes	✗ No

Technical Component		Environment	Title	Description				Action	Life-cycle	Type	Line of Business	Modular Business Process	Product	Latest Revision	Availability
				Functionality	Executable Version 1.0	Executable Version 2.0	Executable Version 3.0								
				Feature	✔ Yes	✔ Yes	✔ Yes								
				Contribution Scores											
				Transfer Learning	✘ No	✔ Yes	✘ No								

Technical Component	Environment	Title	Description	Action	Life-cycle	Type	Line of Business	Modular Business Process	Product	Latest Revision	Available as of
Data Attribute Recommendation	Cloud Foundry	AI API - Improvements	<p>You can now take advantage of the following training configuration improvements to override the default behavior of Data Attribute Recommendation:</p> <ul style="list-style-type: none"> <li>Use the <code>deleteAfterTraining</code> parameter to delete the dataset and schema after model training is done.</li> <li>Use the <code>computeGlobalMetrics</code> parameter to hide global metrics.</li> </ul> <p>See <a href="#">Training Configuration [page 85]</a>.</p> <div> <p><b>⚠ Restriction</b></p> <p>These improvements are available only with executable version 3.0.</p> </div>	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2023-09-04	2023-09-04
Data Attribute Recommendation	Cloud Foundry	Technical Constraints	<p>The label value <code>&lt;arg__top_k&gt;</code> is no longer allowed for the following <code>/data-manager/api/v3/datasetSchemas</code> fields:</p> <ul style="list-style-type: none"> <li>Dataset schema per-feature label</li> <li>Dataset schema per-label label</li> </ul> <p>See <a href="#">Technical Constraints [page 104]</a>.</p>	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2023-09-04	2023-09-04



Technical Component	Environment	Title	Description	Action	Life-cycle	Type	Line of Business	Modular Business Process	Product	Latest Revision	Available as of
Data Attribute Recommendation	Cloud Foundry	Trial Account Response Times	When using a trial account, the response takes more time than usual if you make an inference call more than an hour after you deployed the model, or more than an hour after the previous inference call.  See <a href="#">Free Tier Option and Trial Account Technical Constraints [page 111]</a> .	Info only	General Availability	Challenged	Technology	Not applicable	SAP Business Technology Platform	2023-06-28	2023-06-28
Data Attribute Recommendation	Cloud Foundry	Business Blueprints	The Sales Order Completion (SOC) business blueprint is now available.  See <a href="#">Upload Data [page 44]</a> and <a href="#">Business Blueprints [page 61]</a> .	Info only	General Availability	New	Technology	Not applicable	SAP Business Technology Platform	2023-03-08	2023-03-08
Data Attribute Recommendation	Cloud Foundry	Technical Constraints	The maximum field value length for inference request features has been increased to 1024 characters.  See <a href="#">Technical Constraints [page 104]</a> .	Info only	General Availability	Challenged	Technology	Not applicable	SAP Business Technology Platform	2023-03-08	2023-03-08
Data Attribute Recommendation	Cloud Foundry	Overall Improvements	There have been several code and stability improvements.	Info only	General Availability	Challenged	Technology	Not applicable	SAP Business Technology Platform	2023-03-08	2023-03-08

Tech nical Com- po- nent	Envi- ron- men t	Title	Description	Ac- tion	Life- cy- cle	Type	Line of Busi- ness	Mod- ular Busi- ness Proc- ess	Product	Lat- est Revi- sion	Avail- able as of
Data Attri- bute Reco- mmen- dation	Cloud Foundry	AI API - Path Length Technical Limit for Dataset Up- load	The maximum length for the URL paths <code>{{folderName}}/ {{datasetSchemaFile}}/ {{folderName}}/ {{datasetFile}}</code> is now 900 characters.  See operations Upload Dataset Schema and Upload Dataset in <a href="#">Consuming the Service via AI API [page 67]</a> .	Info only	Gen- eral  Avail- ability	New	Tech nol- ogy	Not ap- pli- ca- ble	SAP Business Technology Platform	2023 -01-1 8	2023 -01-1 8
Data Attri- bute Reco- mmen- dation	Cloud Foundry	AI API - Metrics for Data Valida- tion	You can now get per-label met- rics for data validation when consuming the service via AI API.  See operation Get Metric Details in <a href="#">Consuming the Service via AI API [page 67]</a> .	Info only	Gen- eral  Avail- ability	New	Tech nol- ogy	Not ap- pli- ca- ble	SAP Business Technology Platform	2023 -01-1 8	2023 -01-1 8

## 2.2 2022 What's New for Data Attribute Recommendation (Archive)

Technical Component	Environment	Title	Description	Action	Life-cycle	Type	Line of Business	Modular Business Process	Product	Latest Revision	Availability as of
Data Attribute Recommendation	Cloud Foundry	Technical Constraints	The maximum length for dataset schema array <i>features</i> has been increased to 60 items in the <i>labels</i> list.  See <a href="#">Technical Constraints [page 104]</a> .	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2022-12-23	2022-12-23
Data Attribute Recommendation	Cloud Foundry	Overall Improvements	There have been several code and stability improvements.	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2022-12-23	2022-12-23
Data Attribute Recommendation	Cloud Foundry	SAP AI Core Migration	Data Attribute Recommendation now runs on SAP AI Core. The service no longer uses core functionalities of SAP Leonardo Machine Learning Foundation.  See <a href="#">Security Aspects of Data, Data Flow and Processes [page 114]</a> and <a href="#">Data Protection and Privacy [page 116]</a> .	Info only	General Availability	New	Technology	Not applicable	SAP Business Technology Platform	2022-12-02	2022-12-02
Data Attribute Recommendation	Cloud Foundry	AI API Dataset Upload	You can now use the AI API from SAP AI Core to perform the operations related to dataset upload when consuming Data Attribute Recommendation via AI API.  See <a href="#">Consuming the Service via AI API [page 67]</a> .	Info only	General Availability	New	Technology	Not applicable	SAP Business Technology Platform	2022-12-02	2022-12-02



Technical Component	Environment	Title	Description	Action	Life-cycle	Type	Line of Business	Modular Business Process	Product	Latest Revision	Available as of
Data Attribute Recommendation	Cloud Foundry	Accessibility Features	Documentation on <a href="#">Accessibility Features in Data Attribute Recommendation [page 124]</a> is now available.	Info only	General Availability	New	Technology	Not applicable	SAP Business Technology Platform	2022-10-05	2022-10-05
Data Attribute Recommendation	Cloud Foundry	Tutorials	<p>The following new tutorial groups are now available for Data Attribute Recommendation:</p> <ul style="list-style-type: none"> <li><a href="#">Use Machine Learning and the Invoice Object Recommendation Business Blueprint to Predict Invoice Financial Objects</a> </li> <li><a href="#">Use Machine Learning and the Regression Model Template to Predict Data Records</a> </li> </ul> <p>See <a href="#">Tutorials [page 42]</a>.</p>	Info only	General Availability	New	Technology	Not applicable	SAP Business Technology Platform	2022-05-16	2022-05-16
Data Attribute Recommendation	Cloud Foundry	AI API	<p>You can now use the AI API from SAP AI Core to consume the Data Attribute Recommendation Regression model template and Invoice Object Recommendation business blueprint.</p> <p>See <a href="#">Consuming the Service via AI API [page 67]</a>.</p>	Info only	General Availability	New	Technology	Not applicable	SAP Business Technology Platform	2022-05-02	2022-05-02
Data Attribute Recommendation	Cloud Foundry	Global Accounts	<p>You can now move subaccounts between your global accounts.</p> <p>See <a href="#">Initial Setup [page 37]</a>.</p>	Info only	General Availability	New	Technology	Not applicable	SAP Business Technology Platform	2022-05-02	2022-05-02

Technical Component	Environment	Title	Description	Action	Life-cycle	Type	Line of Business	Modular Business Process	Product	Latest Revision	Available as of
Data Attribute Recommendation	Cloud Foundry	Overall Improvements	There have been several code and stability improvements.	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2022-05-02	2022-05-02
Data Attribute Recommendation	Cloud Foundry	AI API	You can now use the AI API from SAP AI Core to consume Data Attribute Recommendation.  See <a href="#">Consuming the Service via AI API [page 67]</a> .	Info only	General Availability	New	Technology	Not applicable	SAP Business Technology Platform	2022-03-28	2022-03-28
Data Attribute Recommendation	Cloud Foundry	Overall Improvements	There have been several code and stability improvements.	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2022-03-28	2022-03-28
Data Attribute Recommendation	Cloud Foundry	Concepts	New terms related to the Invoice Object Recommendation business blueprint have been added to <a href="#">Concepts [page 28]</a> .	Info only	General Availability	Changed	Technology	Not applicable	SAP Business Technology Platform	2022-03-09	2022-03-09
Data Attribute Recommendation	Cloud Foundry	Business Blueprints	The Invoice Object Recommendation business blueprint is now available.  See <a href="#">Upload Data [page 44]</a> , <a href="#">Train Job and Deploy Model [page 55]</a> and <a href="#">Business Blueprints [page 61]</a> .	Info only	General Availability	New	Technology	Not applicable	SAP Business Technology Platform	2022-02-02	2022-02-02

## 2.3 2021 What's New for Data Attribute Recommendation (Archive)

Technical Component	Capability	Environment	Title	Description	Action	Type	Available as of
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Trial Account	Data Attribute Recommendation is now available in the AWS region US East (VA) on SAP BTP Trial.	Info only	New	2021-10-26
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Model Templates	The Regression model template is now available. See <a href="#">Model Templates [page 60]</a> .	Info only	New	2021-10-04
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	SAP BTP Cockpit Booster	You can now use the <a href="#">Set up account for Data Attribute Recommendation</a> booster to automate the onboarding steps on the SAP BTP cockpit, and quickly consume the service. See <a href="#">Initial Setup [page 37]</a> .	Info only	New	2021-10-04
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	API Reference	The number of simultaneous training jobs (in <b>PENDING</b> and / or <b>RUNNING</b> status) is now limited to 15. See <a href="#">Train Job and Deploy Model [page 55]</a> and <a href="#">Common Status and Error Codes [page 65]</a> .	Info only	Changed	2021-10-04

Technical Component	Capability	Environment	Title	Description	Action	Type	Available as of
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvements	There have been several code and stability improvements.	Info only	Changed	2021-10-04
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Technical Constraints	The maximum length for dataset schema array <i>features</i> has been increased to 40 items in the <i>labels</i> list. See <a href="#">Technical Constraints [page 104]</a> .	Info only	Changed	2021-07-30
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvements	There have been several code and stability improvements.	Info only	Changed	2021-07-30
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Free Service Plan	The Free service plan is now available for Data Attribute Recommendation. See <a href="#">Service Plans [page 32]</a> and <a href="#">Free Tier Option and Trial Account Technical Constraints [page 111]</a> .	Info only	New	2021-07-05

Technical Component	Capability	Environment	Title	Description	Action	Type	Available as of
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Security Guide	Auditing and logging information is now available in the <a href="#">Security [page 112]</a> .	Info only	New	2021-07-05
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvements	There have been several code and stability improvements.	Info only	Changed	2021-06-07
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvements	<ul style="list-style-type: none"> <li>There have been several code and stability improvements.</li> <li>The maximum model name length has been changed to 56 characters. See <a href="#">Technical Constraints [page 104]</a>.</li> </ul>	Info only	Changed	2021-05-31
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Model Templates	The AutoML model template is now available. See <a href="#">Model Templates [page 60]</a> .	Info only	New	2021-04-16

Technical Component	Capability	Environment	Title	Description	Action	Type	Available as of
Data Attribute Recommendation	Extension Suite Development Efficiency	Cloud Foundry	Multitenant Application Dependency Enablement	You can now run Data Attribute Recommendation in a multitenant application using the SAP SaaS Provisioning service. See <a href="#">Run the Service in a Multitenant Application [page 41]</a> .	Info only	New	2021-04-16
Data Attribute Recommendation	Extension Suite Development Efficiency	Cloud Foundry	Overall Improvement	There have been several code and security improvements. The processing of inference requests is now faster.	Info only	Changed	2021-03-04
Data Attribute Recommendation	Extension Suite Development Efficiency	Cloud Foundry	Overall Improvement	There have been several code and stability improvements.	Info only	Changed	2021-01-27

## 2.4 2020 What's New for Data Attribute Recommendation (Archive)

Technical Component	Capability	Environment	Title	Description	Type	Available as of
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvement	There have been several code, stability and security improvements.	Changed	2020-12-03
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Feature Scope Description	The <a href="#">Feature Scope Description for Data Attribute Recommendation</a> has been updated.	Changed	2020-10-30
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Swagger UI	<p>New Swagger UI endpoints are now available for the Data Attribute Recommendation APIs:</p> <ul style="list-style-type: none"> <li>Data Manager API. See <a href="#">Upload Data [page 44]</a>.</li> <li>Model Manager API. See <a href="#">Train Job and Deploy Model [page 55]</a>.</li> <li>Inference API. See <a href="#">Get Inference Results [page 64]</a>.</li> </ul>	New	2020-10-30
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Technical Constraints	<p>The allowed values for the following fields have changed:</p> <ul style="list-style-type: none"> <li>Dataset schema per-feature <a href="#">label</a></li> <li>Dataset schema per-label <a href="#">label</a></li> </ul> <p>See <a href="#">Technical Constraints [page 104]</a>.</p>	Changed	2020-10-30
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvement	There have been several code improvements.	Changed	2020-10-16

Technical Component	Capability	Environment	Title	Description	Type	Available as of
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Inference API	<p>The Swagger UI documentation for inference request and response has been fixed. TopN is not a mandatory field in the Inference API.</p> <p>See <a href="#">Get Inference Results [page 64]</a> to find out how to access comprehensive specification of the Inference API in Swagger UI.</p>	Changed	2020-09-15
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Technical Constraints	<p>The maximum request size for inference request has been increased to 200 KB.</p> <p>See <a href="#">Technical Constraints [page 104]</a>.</p>	Changed	2020-09-15
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	SDK	<p>A <a href="#">Python SDK (Software Development Kit)</a> 🐍 is now available for Data Attribute Recommendation.</p> <p>See the new tutorial group <a href="#">Classify Data Records with the SDK for Data Attribute Recommendation</a> 📖.</p>	New	2020-08-17
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	SAP API Business Hub	<p>Data Attribute Recommendation is now available in the SAP API Business Hub.</p> <p>See <a href="#">Data Attribute Recommendation</a> 📖.</p>	New	2020-08-17
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Trial Account Technical Constraints	<p>The <a href="#">Free Tier Option and Trial Account Technical Constraints [page 111]</a> have been updated.</p>	Changed	2020-08-17



Technical Component	Capability	Environment	Title	Description	Type	Available as of
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvements	There have been several code improvements.	Changed	2020-08-17
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvements	There have been several code improvements. CA-ML-DAR is now the BCP component for Data Attribute Recommendation. See <a href="#">Getting Support [page 128]</a> .	Changed	2020-06-15
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvements	There have been several code and stabilization improvements.	Changed	2020-04-20
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Tutorials	A new tutorial mission is now available for Data Attribute Recommendation.  See <a href="#">Use Machine Learning to Classify Data Records</a> .  See also the <a href="#">Data Attribute Recommendation - Postman Collection and Dataset Example Sample Files</a> repository.	New	2020-04-20
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Service Guide	The <a href="#">Service Guide</a> documentation has been updated with the following new sections: <ul style="list-style-type: none"> <li><a href="#">Metering and Pricing [page 34]</a></li> <li><a href="#">Free Tier Option and Trial Account Technical Constraints [page 111]</a></li> </ul>	New	2020-04-20

Technical Component	Capability	Environment	Title	Description	Type	Available as of
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvements	There have been several code and stabilization improvements. The status <b>VALIDATING</b> is now deletable after timeout. The Swagger UI documentation has been updated.	Changed	2020-03-16
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvements	There have been several code and stabilization improvements. Data Attribute Recommendation can now validate datasets larger than 1GB.	Changed	2020-03-02
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Trial Account	You can now try out Data Attribute Recommendation on SAP Cloud Platform Trial.	New	2020-03-02
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvements	There have been several code and stabilization improvements. The status <b>UPLOADING</b> is now deletable after timeout.	Changed	2020-02-17
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Model Templates	<a href="#">Model Templates [page 60]</a> are now available.	New	2020-02-17

## 2.5 2019 What's New for Data Attribute Recommendation (Archive)


Technical Component	Capability	Environment	Title	Description	Type	Available as of
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	API Reference	<p>The number of simultaneous training jobs (in <b>PENDING</b> and / or <b>RUNNING</b> status) is now limited to 3.</p> <p>See <a href="#">Train Job and Deploy Model [page 55]</a>.</p> <p>See also the new error code 503 (Service Unavailable) in <a href="#">Common Status and Error Codes [page 65]</a>.</p>	Changed	2019-12-02
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	Overall Improvements	<p>There have been several stability and security improvements.</p> <p>UTF-8 Byte Order Mark (BOM) encoding type is now supported and can be used in the dataset CSV files.</p>	Changed	2019-12-02
Data Attribute Recommendation	Extension Suite - Development Efficiency	Cloud Foundry	New Service	<p>A new service that applies machine learning to match and classify data records automatically is now available. Data Attribute Recommendation can be used, for example, to classify incoming product information. See <a href="#">Data Attribute Recommendation documentation</a>.</p>	Announcement	2019-10-22

# 3 Concepts

The following terms are the main concepts of artificial intelligence (AI) and machine learning (ML) in the context of Data Attribute Recommendation:

Concepts

Term	Definition
<b>accuracy</b>	Classification metric. Percentage of correctly predicted <b>records</b> . The higher the better.
<b>batch inference</b>	A process that gives users the option of uploading one or more files for asynchronous processing, instead of making synchronous <b>inference requests</b> . The resulting predictions are collected in a JSON file that can be downloaded. <div><b>⚠ Restriction</b><ul style="list-style-type: none"><li>AutoML <b>scenario</b> isn't currently supported.</li><li>Like <b>transfer learning</b> (see definition in this table), this functionality can only be consumed via API.</li><li>Models trained before <b>batch inference</b> was introduced don't support this functionality.</li></ul></div>
<b>BKPF</b>	Accounting Document Header. It's a standard table in SAP R/3 and SAP ERP systems.
<b>BSEG</b>	Accounting Document Segment. It's a standard table in SAP R/3 and SAP ERP systems.
<b>business blueprint</b>	Each <b>business blueprint</b> implements a <b>machine learning scenario</b> tailored to solve a specific business use case. In contrast to a <b>model template</b> , the data processing rules are enhanced and optimized for the task at hand.
<b>CO-PA dimensions</b>	The table field name in SAP tables for profitability analysis.
<b>cost center</b>	A cost object defined as an organizational unit within a controlling area that represents a defined location of cost incurrence.
<b>dataset</b>	A <b>dataset</b> is a table: the rows represent instances of business objects and the columns represent the values of those instances.
<b>dataset schema</b>	Description of a <b>dataset</b> structure. Each <b>dataset</b> must obey exactly one <b>dataset schema</b> . The <b>dataset schema</b> defines which columns must appear in a <b>dataset</b> . No other column is allowed. Moreover, the <b>dataset schema</b> specifies which columns are used as <b>features</b> and which are used as <b>labels</b> .
<b>deployment or deployed model</b>	Trained <b>machine learning model</b> that's available as an engine for prediction and classification via the corresponding API endpoint.
<b>f1 score</b>	Classification metric. Harmonic mean of <b>precision</b> and <b>recall</b> . The higher the better.

Term	Definition
<b>features</b>	Columns of the <b>dataset</b> , which are used as inputs to the <b>machine learning model</b> .
<b>G/L (general ledger) account</b>	A structure that <b>records</b> value movements in a company code and represents the <b>G/L account</b> items in a chart of accounts. A <b>G/L account</b> has transaction figures that <b>record</b> changes to the account during a posting period. These figures are totals that are used for G/L reporting.
<b>HKONT</b>	The table field name in SAP tables for <b>G/L account</b> .
<b>inference</b>	Process during which a <b>machine learning model</b> receives an input ( <b>features</b> ) and predicts the most probable <b>labels</b> .
<b>inference request</b>	A single call to a <b>machine learning model</b> to perform <b>inference</b> .
<b>KOSTL</b>	The table field name in SAP tables for cost object.
<b>labels</b>	Fields of the <b>dataset</b> that are predicted by the <b>machine learning model</b> .
<b>machine learning</b>	The ability of computers to learn on their own (without being programmed) by using algorithms that process large quantities of data.
<b>machine learning model</b>	A <b>machine learning</b> algorithm that learns patterns from a given set of <b>training data</b> to accomplish a certain task. For Data Attribute Recommendation, this involves classifying entities such as products, stores and users into multiple classes, using free text, numbers, and categories as input.
<b>masking</b>	Technique where the feature values are randomly dropped and substituted with a special token (called <b>masking</b> value) before the model training begins. This approach forces the model to learn under missing information making it more likely to give good predictions when some feature values are missing.
<b>mean absolute error (MAE)</b>	Regression metric. Average absolute difference between the predicted values and the actual values. The lower the better.
<b>mean absolute percentage error (MAPE)</b>	Regression metric. Average of the absolute percentage errors of the predictions. The lower the better.
	<div>  <b>Note</b>  For predictions that are too high there's no upper limit to the percentage error, resulting in values that can exceed 100%. </div>
<b>mean squared error (MSE)</b>	Regression metric. Average squared difference between the predicted values and the actual values. The lower the better.
<b>model template</b>	Each <b>model template</b> consists of a <b>machine learning</b> pipeline, where specific data preprocessing rules and model architectures are defined. The <b>model templates</b> for Data Attribute Recommendation are generic technical components that can be used in a variety of use cases, covering classification and regression <b>scenarios</b> . Different <b>model templates</b> can provide different prediction performance for the same <b>dataset</b> .

Term	Definition
<b>precision</b>	Classification metric. The ability of the <b>machine learning model</b> to assign only the relevant <b>records</b> to the correct attributes. The higher the better.
<b>recall</b>	Classification metric. The ability of the <b>machine learning model</b> to find all the <b>records</b> belonging to the correct attributes. The higher the better.
<b>record</b>	A single instance that has a set of <b>features</b> . Depending on the business case, a <b>record</b> can mean, for example, a single product or a single sales order.
<b>tenant</b>	Technical entity that represents a customer as an organization on SAP Business Technology Platform.
<b>training data</b>	Business data used to train a <b>machine learning model</b> . For Data Attribute Recommendation, the <b>training data</b> is the master data and it's composed of a <b>dataset schema</b> and a <b>dataset</b> .
<b>training job</b>	A procedure whereby the <b>machine learning model</b> learns to match patterns from <b>training data</b> .
<b>transfer learning</b>	<p>A technique that gives users the option of training an existing model on a new <b>dataset</b> instead of training a new model from scratch. This approach is an effective way of retaining and leveraging previously learned knowledge and keeps models updated while minimizing training time.</p> <div> <p><b>⚠ Restriction</b></p> <ul style="list-style-type: none"> <li>The <b>dataset schema</b> of the new <b>dataset</b> must match the schema used for training the starting model. There's currently no support for modifications to <b>features</b> or <b>labels</b>.</li> <li>The same <b>scenario</b> must be used for <b>transfer learning</b> as was used originally to train the existing model. For example, if the starting model was obtained via a hierarchical training <b>executable</b>, <b>transfer learning</b> is only possible if the hierarchical <b>transfer learning executable</b> is chosen.</li> <li>There's currently no support for AutoML and Regression <b>scenarios</b>.</li> <li>This functionality is only available if the service is consumed via AI API, and the <b>dataset</b> is uploaded as described in <a href="#">AI API - Dataset Upload [page 69]</a>.</li> <li>Models trained before <b>transfer learning</b> was introduced don't support the functionality. In such cases, you must retrain your models to enable <b>transfer learning</b>.</li> </ul> </div>
<b>undeployed model</b>	Trained <b>machine learning model</b> that hasn't been chosen for productive usage and, therefore, doesn't generate costs.
<b>executable</b>	<p>An <b>executable</b> is a template that is instantiated for a purpose, such as training a model or creating a <b>deployment</b>.</p> <p>User-defined <b>labels</b> can be applied to an <b>executable</b> and are listed with the executable's details.</p> <ul style="list-style-type: none"> <li>If a non-deployable <b>executable</b> is instantiated, it results in an <b>execution</b>. <b>Executions</b> can produce output <b>artifacts</b>.</li> <li>If a deployable <b>executable</b> is instantiated, it results in a <b>deployment</b>. <b>Deployments</b> generate URLs that can be used for <b>inference</b>.</li> </ul>
<b>artifact</b>	A reference to data or a file that is produced or consumed by an <b>execution</b> or <b>deployment</b> .

Term	Definition
<b>execution</b>	<p>An <b>execution</b> is an instance of a non-deployable <b>executable</b>. <b>Executions</b> are used to train a model or to run other types of workflow.</p> <p>An <b>execution</b> runs only once and produces an output <b>artifact</b>. If a training instance is executed, the output <b>artifacts</b> produced are models.</p> <p>There's typically a large amount of metadata associated with an <b>execution</b>. The metadata is stored as metrics (and associated <b>labels</b>), tags, and custom info. Multiple metrics, tags, and custom info can be passed with a single <b>execution</b>.</p> <p>Once the metric, tag and custom info are saved, they can be queried with an <code>&lt;execution ID&gt;</code>.</p> <p>Every metric, tag, and custom info must be associated with an <b>execution</b>.</p>
<b>scenario</b>	A <b>scenario</b> is a group of related <b>executables</b> for a use case within the user's <b>tenant</b> . A <b>scenario</b> can have multiple versions that further correspond to the different versions of <b>executables</b> .
<b>configuration</b>	A collection of parameters, <b>artifact</b> references, and <b>executables</b> that is used to run an <b>execution</b> or <b>deployment</b> . A <b>configuration</b> is required to instantiate an <b>execution</b> . <b>Executables</b> and <b>configurations</b> have a 1:n relationship (that is, one <b>executable</b> can have many <b>configurations</b> ).
<b>global metrics</b>	Aggregated performance of the model across all <b>labels</b> . In this case, the model output is considered correct if the predictions across all <b>labels</b> match the corresponding ground truth.
<b>per-label metrics</b>	Detailed model performance for each label independently.
<b>feature contribution scores</b>	<p>Estimate of how much the model depends on each feature.</p> <p>All scores are values between 0 and 1, which sum up to 1. Therefore, the scores should be judged relative to each other. The higher the contribution score, the more important the feature is. If all <b>features</b> were equally important, their score would be <math>1 / n</math>, where <math>n</math> is the number of <b>features</b> in the corresponding <b>dataset schema</b>.</p>

See also [AI & ML Glossary](#).

## 4 Service Plans

Learn more about the different types of service plans for Data Attribute Recommendation.


Data Attribute Recommendation provides different types of service plans. The type you choose determines pricing, conditions of use, resources, available services, and hosts.

It depends on your use case whether you choose a free or a paid service plan. If you plan to use your global account in productive mode, you must purchase a paid enterprise account. It's important that you're aware of the differences when you're planning and setting up your account model. See [Initial Setup \[page 37\]](#).

There are three service plans available:

- Free (for enterprise accounts)
- Standard (for enterprise accounts)
- Standard (for trial accounts)

For more details about the service plans, see the following table:

Service Plan	Details	Account Type
Free	<ul style="list-style-type: none"><li>• Service plan intended for development and try-out purposes.</li><li>• You can get 2000 record predictions.</li></ul> <p>See <a href="#">Free Tier Option and Trial Account Technical Constraints [page 111]</a> and the tutorial <a href="#">Get an Account on SAP BTP to Try Out Free Tier Service Plans</a> .</p>	Enterprise
Standard	<ul style="list-style-type: none"><li>• Data Attribute Recommendation default service plan.</li><li>• Service plan intended for productive usage.</li><li>• Running free models included: 5. The first 5 models can be used without extra model-costs.</li><li>• Deployed model hours charge + Inference requests in blocks of 1000 records.</li></ul> <p>See <a href="#">Metering and Pricing [page 34]</a> and <a href="#">Technical Constraints [page 104]</a>.</p>	Enterprise



Service Plan	Details	Account Type
Standard	<ul style="list-style-type: none"> <li>Service plan intended for personal exploration. Access is open to everyone after registration.</li> <li>You can get 2000 record predictions.</li> </ul> <p>See <a href="#">Free Tier Option and Trial Account Technical Constraints [page 111]</a>.</p>	Trial

### → Remember

- If you first activated the Free service plan, you can update the same service instance to switch to Standard for enterprise accounts.
- If you've already activated Standard for enterprise accounts, you won't be able to activate the Free service plan in your subaccount. Although the Free service plan is available, you won't be able to activate it.
- If the Free service plan is still available but unsubscribed, it can be resubscribed.
- If Standard for enterprise accounts is active but unsubscribed, you can only subscribe to it again, not the Free service plan.
- If you've subscribed to Standard for enterprise accounts in a subaccount and want to use the Free service plan in the same account, you can unsubscribe from the Standard service plan and use the Free service plan after 14 days of offboarding, but all your data would be lost.
- Both metadata and transaction data, including trained models, are transferred to Standard for enterprise accounts when you switch from Free to Standard.
- If you don't want Free and Standard data to be combined together, you can split them by subscribing to the service plans in separate subaccounts.

## 5 Metering and Pricing

### → Tip

The metering and pricing details listed here are relevant only to users of the **Standard** service plan for enterprise accounts. See [Service Plans \[page 32\]](#).

### Usage Metric

Data Attribute Recommendation is metered based on a predefined usage metric consisting of records and models:

- **Records:** unique objects processed by the cloud service each month.
- **Models:** trained machine learning models that are available as an engine for prediction and classification via the corresponding API endpoint.

### Block Size

1 block = 1,000 records or 1 model per hour. The final price is a sum of records and models consumed.

### Basic Service

#### ⚠ Caution

The price rates listed below might be outdated. Find updated price rates in the [Pricing](#) tab of the SAP Discovery Center.

Data Attribute Recommendation allows users to train and deploy customizable models. The first 5 models can be used without extra model-costs. Only inference requests are charged.

Metric	Tiers	Block Price per Month
Blocks of 1,000 records	Minimum consumption: 5 blocks	EUR 64.00
	5 to 100 blocks	
	101 to 250 blocks	EUR 32.00
	251 to 500 blocks	EUR 19.00

Metric	Tiers	Block Price per Month
	501 to 750 blocks	EUR 13.00
	More than 751 blocks	EUR 10.00

## Example

Cost for 7 blocks =  $7 * \text{EUR } 64.00 = \text{EUR } 448.00$ .

Cost for 110 blocks =  $110 * \text{EUR } 32.00 = \text{EUR } 3,520$ .

Cost for 310 blocks =  $310 * \text{EUR } 19.00 = \text{EUR } 5,890$ .

Cost for 510 blocks =  $510 * \text{EUR } 13.00 = \text{EUR } 6,630$ .

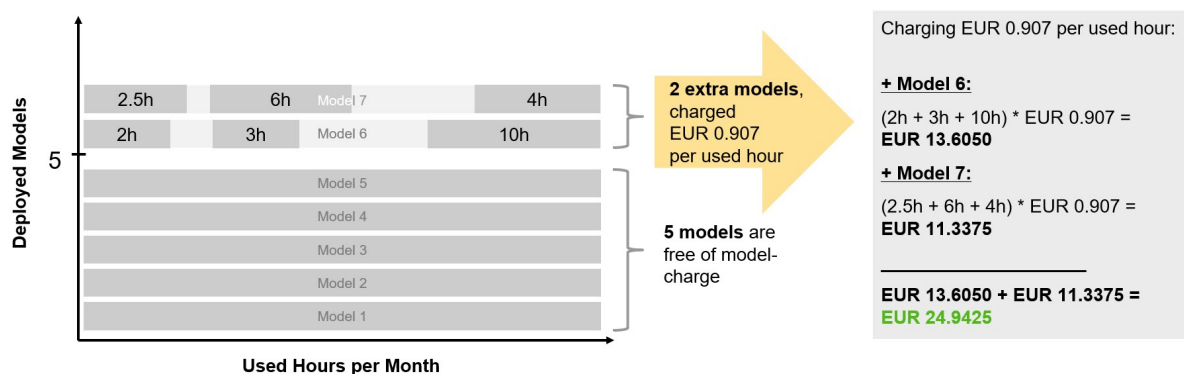
Cost for 810 blocks =  $810 * \text{EUR } 10.00 = \text{EUR } 8,100$ .

## Extended Service

Additional models are charged EUR 0.907 per used hour.

If at some point of time the client had more than 5 models deployed, then the additional model hours are charged.

## Example



Total Charge = Deployed model hours charge + Inference requests in blocks of 1,000 records.

105 Blocks are used (unit price/month = EUR 32.00) =  $105 * \text{EUR } 32 = \text{EUR } 3,360$ .

In total:  $\text{EUR } 24.94 + \text{EUR } 3,360 = \text{EUR } 3,384.94$ .

### → Tip

Use the [pricing estimator tool](#).

## Related Information

[SAP Discovery Center](#) 

[SAP Business Technology Platform Service Description Guide](#) 

# 6 Initial Setup

Get started with Data Attribute Recommendation using the standard procedures for SAP BTP Cloud Foundry environment or Kyma environment.

## → Tip

See [Tutorials \[page 42\]](#) to find out how to use a trial account or the free tier option for Data Attribute Recommendation to try out the service.

## Prerequisites

You have set up your global account and at least one subaccount on SAP BTP. For an overview of the required steps, see [Getting Started in the Cloud Foundry Environment](#) or [Getting Started in the Kyma Environment](#).

## 📘 Note

Data Attribute Recommendation allows you to move subaccounts between your global accounts. For more information, see [Relationship Between Global Accounts, Subaccounts, and Directories \[Feature Set B\]](#).

## Related Information

[Enabling the Service in the Cloud Foundry Environment \[page 38\]](#)


[Enabling the Service in the Kyma Environment \[page 38\]](#)

## 6.1 Enabling the Service in the Cloud Foundry Environment

Enable Data Attribute Recommendation using the standard procedures for SAP BTP Cloud Foundry environment.

### Context

#### → Tip

You can also use the booster [Set up account for Data Attribute Recommendation](#) to automate the steps described below on the SAP BTP cockpit. See [Boosters](#) and the tutorial [Use Free Tier to Set Up Account for Data Attribute Recommendation and Get Service Key](#) .

### Procedure

1. Create a service instance in the Cloud Foundry environment. See [Creating Service Instances](#).
2. You can then bind the service instance to your application, or you can create a service key to communicate directly with the service instance. See [Binding Service Instances to Applications](#) and [Creating Service Keys](#).

## 6.2 Enabling the Service in the Kyma Environment

Enable Data Attribute Recommendation using the standard procedures for SAP BTP Kyma environment.

### Procedure

1. Create a service instance in the Kyma environment.
2. You can then bind the service instance to your application, or you can create a service key to communicate directly with the service instance. See [Using SAP BTP Services in the Kyma Environment](#).

## 7 Enable X.509 Authentication

Find out how to enable your service instance for authentication with an X.509 client certificate.

The Data Attribute Recommendation service supports X.509 authentication with the certificates managed either by the SAP Authorization and Trust Management service or self-managed. The authentication with an X.509 client certificate is enabled for every service instance by default.

### Create Service Key or Service Binding Additional Parameters

To use X.509 secrets, you need to set additional parameters when you create your service key or service binding. We support the following two scenarios:

- The SAP Authorization and Trust Management service generates certificates for you. In this case, the parameters you need to set when you create your service key or service binding are the following in JSON format:

```
{
  "xsuaa": {
    "credential-type": "x509",
    "x509": {
      "key-length": 2048,
      "validity": 8,
      "validity-type": "DAYS"
    }
  }
}
```

For a detailed description of the parameters, see [Parameters for X.509 Certificates Managed by SAP Authorization and Trust Management Service](#).

- You already have your own public key infrastructure (PKI), with certificates issued from one of the trusted Certificate Authorities (CAs). In this case, the parameters you need to set when you create your service key or service binding are the following in JSON format::

```
{
  "xsuaa": {
    "credential-type": "x509",
    "x509": {
      "certificate": "-----BEGIN CERTIFICATE-----...-----END
CERTIFICATE-----",
      "ensure-uniqueness": false,
      "certificate-pinning": true,
      "hide-certificate": true
    }
  }
}
```


For a detailed description of the parameters, see [Parameters for Self-Managed X.509 Certificates](#). See also [Trusted Certificate Authentication](#).

## Get an Authorization Token with X.509 Certificate

To get an authorization token using an X.509 certificate, use “certurl”. In the scenario of already generated certificates, also use “key” and “certificate” from the service key.

### Example of a request using `curl`:

```
curl --cert <path to certificate.pem> --key <path to key.pem> --request POST <value of "uaa.certurl">/oauth/token -d 'grant_type=client_credentials&client_id=<Value of "uaa.clientid">'
```

See also the blog post: [X.509 certificate-based authentication\(mTLS\) – Generating X.509 certificates of BTP managed services](#) .

## Restrict your Service Instance to X.509 Certificate Authentication Only (Optional)

To restrict your instance to support **only** X.509 certificate authentication and don't allow any service keys that use different authentication methods, in the **New Instance or Subscription** wizard, enter in **Parameters** the following instance parameters in JSON format:

```
{
  "xs-security": {
    "xsappname": "<app-name>",
    "oauth2-configuration": {
      "credential-types": [
        "x509"
      ]
    }
  }
}
```

### Note

In the sample code, "<app-name>" is a name of your choice.



## 8 Run the Service in a Multitenant Application

Find out how to run Data Attribute Recommendation in a multitenant application.

In the Cloud Foundry environment, you can develop and run multitenant applications, and share them with multiple consumers simultaneously on SAP BTP.






Data Attribute Recommendation supports this scenario and can be declared as a dependency of a multitenant application. This means that Data Attribute Recommendation gets provisioned automatically for every consumer that subscribes to the multitenant application. Different consumers are independently provisioned and data from these consumers is isolated inside Data Attribute Recommendation.

### → Tip

See [Develop the Multitenant Application](#) for more details on how to declare Data Attribute Recommendation as a dependency of a multitenant application using the SAP SaaS Provisioning service.

## 9 Tutorials

Follow our tutorials to get familiar with the Data Attribute Recommendation APIs and functionalities.

Tutorial Group or Mission	Description
<a href="#">Use Machine Learning to Classify Data Records</a> 	Use Data Attribute Recommendation to classify entities such as products, stores and users into multiple classes, using free text, numbers and categories.
<a href="#">Classify Data Records with the SDK for Data Attribute Recommendation</a> 	Set up and use the SDK (Software Development Kit) for Data Attribute Recommendation to classify entities such as products, stores and users into multiple classes, using free text, numbers and categories.
<a href="#">Use Machine Learning and the Invoice Object Recommendation Business Blueprint to Predict Invoice Financial Objects</a> 	Use Data Attribute Recommendation to process invoices without a purchase order reference attached with the Invoice Object Recommendation business blueprint.
<a href="#">Use Machine Learning and the Regression Model Template to Predict Data Records</a> 	Use Data Attribute Recommendation to predict data records with the Regression model template.
<a href="#">Use Machine Learning and the Sales Order Completion (SOC) Business Blueprint to Predict Missing Sales Order Fields</a> 	Use Data Attribute Recommendation to process sales orders with the Sales Order Completion (SOC) business blueprint.

### Related Information

[Tutorial Navigator](#)

# 10 API Reference

Explore the native Data Attribute Recommendation APIs.

Get an overview on how to perform the following tasks:

- [Get Authorization \[page 43\]](#)
- [Upload Data \[page 44\]](#)
- [Train Job and Deploy Model \[page 55\]](#)
- [Get Inference Results \[page 64\]](#)

→ Tip

See also [Consuming the Service via AI API \[page 67\]](#).

## Related Information

[Common Status and Error Codes \[page 65\]](#)

[Technical Constraints \[page 104\]](#)

## 10.1 Get Authorization

Before processing any requests, Data Attribute Recommendation checks if you have the right authorization. Every request has to contain an "Authorization" header value, which is a JSON Web Token (JWT).

### Context

To call Data Attribute Recommendation APIs, use Postman or any other application for interaction with the RESTful services over HTTPS. Find Postman installation and related documentation at <https://www.getpostman.com/> 📖. See also for your reference the following JSON files from the [Data Attribute Recommendation - Postman Collection and Dataset Example Sample Files](#) 📖 repository:

- *Data\_Attribute\_Recommendation\_Tutorial\_Postman\_Collection.json*
- *Data\_Attribute\_Recommendation\_Tutorial\_Postman\_Collection\_Environment.json*

## Procedure

1. To receive a JWT, create a service key for Data Attribute Recommendation, as described in [Creating Service Keys](#).

### Note

The token is valid for 12 hours. After that, you need to generate a new one.

2. Enter the following values from your service key in the Postman environment:

Service Key	Postman Environment
"url" (inside the "uaa" section of the service key)	"authentication_endpoint"
"clientid" (inside the "uaa" section of the service key)	"clientid"
"clientsecret" (inside the "uaa" section of the service key)	"clientsecret"
"url" (outside the "uaa" section of the service key)	"hostname"

3. Import to Postman the JSON file for the Postman environment (containing the values listed in the table above) and send a `GET` ([Get Authorization](#)) request to Data Attribute Recommendation.

## Related Information

[Initial Setup \[page 37\]](#)

## 10.2 Upload Data

For the definition of **dataset**, **dataset schema** and **training data** in the Data Attribute Recommendation context, see [Concepts \[page 28\]](#).

## Data Manager API

Use the hostname from the “url” value of the service key and the paths listed below to perform the following HTTP methods:

HTTP Method	Path	Description
GET	/data-manager/api/v3/doc	See comprehensive specification of the Data Manager API in YAML format
GET	/data-manager/doc/ui	See comprehensive specification of the Data Manager API in Swagger UI
GET	/data-manager/api/v3/ datasetSchemas	See the list of dataset schemas

HTTP Method	Path	Description
POST	<code>/data-manager/api/v3/datasetSchemas</code>	<p>Create new dataset schema</p> <div> <p><b>Note</b></p> <p>The dataset schema is represented by features, labels and name. One features object consists of label and type and one labels object consists of label and type.</p> </div> <div> <p><b>→ Tip</b></p> <p>To create a new dataset schema provide a name to it. Specify which columns of the dataset are features and labels. Each column specification consists of label and type. The label should match the name of the column in the dataset. The type can be one of the following:</p> <ul style="list-style-type: none"> <li>CATEGORY</li> <li>NUMBER</li> <li>TEXT</li> </ul> </div> <p>When using the <b>AutoML</b> model template, create a single-label, multi-class classification dataset schema. This model template does not support multi-label dataset schemas.</p> <p>When using the <b>Regression</b> model template, create a single-label, regression dataset schema where the label type is "NUMBER". This model template does not support multi-label dataset schemas.</p> <p>For the <b>Hierarchical</b> model template, each item inside the labels field of a dataset schema defines one level in the hierarchy you want to predict. The order of the items determines the arrangement of these levels: the very first item corresponds to the highest level in the hierarchy and the very last item represents the deepest level in the hierarchy. The dataset schema from the code sample below defines the follow-</p>

HTTP Method	Path	Description
		ing hierarchy levels: "F1_readable" → "F2_readable" → "F3_readable".

#### Sample Code

```
{
  "features": [
    {
      "label": "description",
      "type": "TEXT"
    },
    {
      "label": "manufacturer",
      "type": "CATEGORY"
    },
    {
      "label": "price",
      "type": "NUMBER"
    }
  ],
  "id": "fbb37bd1-d43e-419d-aa62-c4a643dea117",
  "labels": [
    {
      "label": "F1_readable",
      "type": "CATEGORY"
    },
    {
      "label": "F2_readable",
      "type": "CATEGORY"
    },
    {
      "label": "F3_readable",
      "type": "CATEGORY"
    }
  ],
  "name": "my-dataset-schema"
}
```

See [Model Templates \[page 60\]](#).

HTTP Method	Path	Description
		<p>When using <a href="#">Business Blueprints [page 61]</a>, add the relevant <code>businessBlueprintFields</code> to the dataset schema.</p> <p>For the <b>Invoice Object Recommendation</b> business blueprint, you need to add features: BUKRS, BELNR, LIFNR, BUDAT, GJAHR, BUZEI, and WRBTR, and the <code>businessBlueprintFields</code>: BSCHL, SHKZG, STBLG, and BUZID to the dataset schema. Adding labels is optional.</p>
		<div> <div>Sample Code</div> <pre> {   "features": [     {       "label":       "BUKRS",       "type":       "CATEGORY"     },     {       "label":       "BELNR",       "type":       "CATEGORY"     },     {       "label":       "GJAHR",       "type":       "NUMBER"     },     {       "label":       "BUZEI",       "type":       "NUMBER"     },     {       "label":       "KOART",       "type":       "CATEGORY"     },     {       "label":       "WRBTR",       "type":       "NUMBER"     }   ] }</pre> </div>



HTTP Method	Path	Description
		<pre> "label": "LIFNR", "type": "CATEGORY" }, "label": "BLART", "type": "CATEGORY" }, "label": "BUDAT", "type": "CATEGORY" }, "label": "MWSKZ", "type": "CATEGORY" }, "label": "labels": [ { "label": "HKONT", "type": "CATEGORY" }, "label": "KOSTL", "type": "CATEGORY" }, ], "businessBlueprintFields": [ { "label": "BSCHL", "type": "CATEGORY" }, "label": "SHKZG", "type": "CATEGORY" }, "label": "STBLG", "type": "CATEGORY" }, "label": "BUZID", </pre>

HTTP Method	Path	Description
		<pre> "category": {   "type": "CATEGORY" }, "name": "ior-dataset-schema" } </pre> <p>For the <b>Sales Order Completion (SOC)</b> business blueprint, you need to add the <code>businessBlueprintFields</code>: <code>SALESDOCUMENT</code> and <code>SALESDOCUMENTITEM</code> to the dataset schema. Adding features and labels is optional.</p> <p><b>Sample Code</b></p> <pre> {   "features": [     {       "label": "SALESORDERTYPE",       "type": "CATEGORY"     },     {       "label": "SALESORGANIZATION",       "type": "CATEGORY"     },     {       "label": "DISTRIBUTIONCHANNEL",       "type": "CATEGORY"     },     {       "label": "ORGANIZATIONDIVISION",       "type": "CATEGORY"     },     {       "label": "MATERIAL",       "type": "CATEGORY"     }   ],   "labels": [ </pre>

HTTP Method	Path	Description
		<pre> "label": "SALESGROUP", "type": "CATEGORY" }, "label": "SALESOFFICE", "type": "CATEGORY" }, "businessBlueprintFields": [ { "label": "SALESDOCUMENT", "type": "CATEGORY" }, { "label": "SALESDOCUMENTITEM", "type": "CATEGORY" } ], "name": "soc-dataset-schema" } </pre>
GET	/data-manager/api/v3/datasetSchemas/{dataset_schema_id}	<p>See dataset schema by its ID</p> <p>→ Tip</p> <p>Here you need to provide the ID of a previously created dataset schema.</p>
DELETE	/data-manager/api/v3/datasetSchemas/{dataset_schema_id}	<p>Delete dataset schema by its ID</p> <p>→ Tip</p> <p>Here you need to provide the ID of a previously created dataset schema.</p>
POST	/data-manager/api/v3/datasets	Create a new dataset.
GET	/data-manager/api/v3/datasets	See the list of datasets

HTTP Method	Path	Description
POST	<code>/data-manager/api/v3/datasets/{dataset_id}/data</code>	<p>Upload data (CSV file) to the dataset by its ID. Data upload triggers validation process.</p> <div> <p>→ Tip</p> <p>Here you need to provide the ID of a dataset previously created and that has no data yet.</p> <p>For more information on the training data configuration, see <a href="#">Data Validation [page 53]</a>.</p> <p>ⓘ Note</p> <p>When using the <b>Invoice Object Recommendation</b> business blueprint, you need to add the <code>businessBlueprintFields</code> from the dataset schema to the dataset CSV file to prevent data validation from failing.</p> </div>
GET	<code>/data-manager/api/v3/datasets/{dataset_id}</code>	<p>See dataset by its ID</p> <div> <p>→ Tip</p> <p>Here you need to provide the ID of a previously created dataset.</p> </div>
DELETE	<code>/data-manager/api/v3/datasets/{dataset_id}</code>	<p>Delete dataset by its ID</p> <div> <p>→ Tip</p> <p>Here you need to provide the ID of a previously created dataset.</p> </div>

## Related Information

[Data Validation \[page 53\]](#)

[Dataset Lifecycle \[page 54\]](#)

## 10.2.1 Data Validation

Data validation is a set of steps that Data Attribute Recommendation performs to verify if the dataset uploaded by the client application is compliant with the provided dataset schema, and how many records can be effectively used for training. This also allows the client application to get some feedback on the usability and quality of the provided dataset.

### Context

The data validation process is performed by SAP once the dataset status changes from **UPLOADING** to **VALIDATING**. To ensure the process is successful, observe the uploaded dataset prerequisites listed below.

### Prerequisites

- Dataset schema and dataset have been successfully uploaded
- Dataset status is **VALIDATING**
- Dataset is in CSV file format (possibly compressed with gzip) containing a header that should match the feature and label names provided in the dataset schema
- Dataset CSV file uses only commas (,) as separators
- Dataset CSV file only contains UTF-8 encoding. Any other encoding type is not supported by Data Attribute Recommendation

At the end of the data validation process, the possible dataset status are the following:

- **SUCCEEDED**
- **INVALID\_DATA**
- **VALIDATION\_FAILED**

#### Note

The validation process can take some minutes to complete depending on the size of the uploaded dataset.

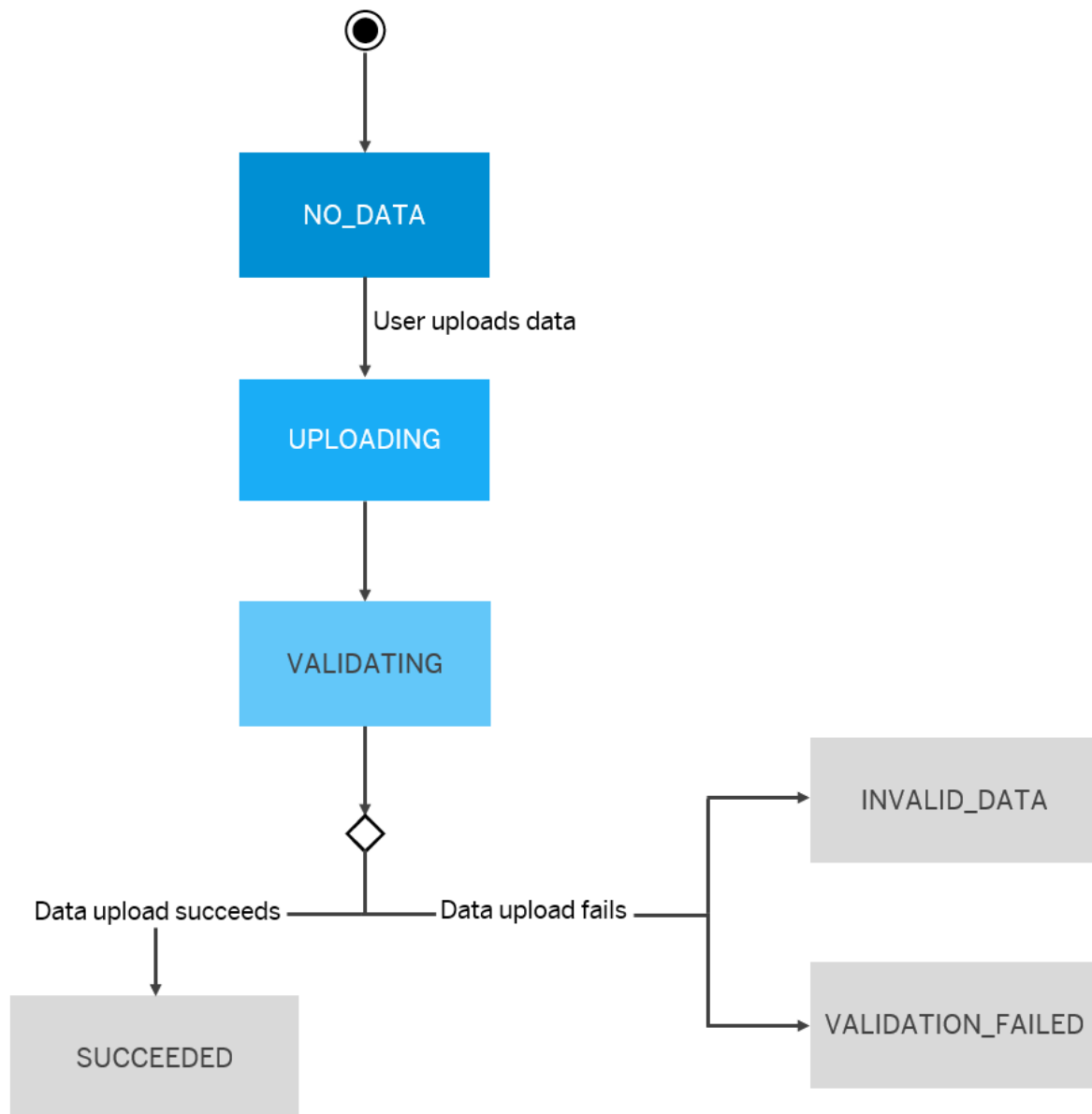
### Related Information

[Dataset Lifecycle \[page 54\]](#)

## 10.2.2 Dataset Lifecycle

Data Attribute Recommendation defines a lifecycle for datasets to enable you to classify data records or predict the value of missing numerical attributes. This section provides you with descriptions of the different possible statuses of datasets for Data Attribute Recommendation.

Status	Description
<b>NO_DATA</b>	The dataset schema and dataset have not been uploaded yet. Upload a CSV file to start the process.
<b>UPLOADING</b>	The dataset schema and dataset are uploading.
<b>VALIDATING</b>	After the dataset schema and dataset are uploaded, the status changes from <b>UP-LOADING</b> to <b>VALIDATING</b> . The dataset validation is in process, wait until the status changes again to either <b>SUCCEEDED</b> , <b>INVALID_DATA</b> or <b>VALIDATION_FAILED</b> to continue the process.
<b>SUCCEEDED</b>	The dataset validation process was successful (no fatal error was found). You can now start to train the machine learning model.
<b>INVALID_DATA</b>	During the dataset validation process, fundamental problems were identified (for example, the file is not in CSV file format or it does not contain a header). Fix the listed issues and upload a new dataset, this will trigger data validation once again.
<b>VALIDATION_FAILED</b>	The dataset validation process was not possible due to application issues. Create a new dataset and upload data again.



## 10.3 Train Job and Deploy Model

For the definition of **training job**, **machine learning model** and **deployment** in the Data Attribute Recommendation context, see [Concepts \[page 28\]](#).

## Model Manager API

Use the hostname from the “url” value of the service key and the paths listed below to perform the following HTTP methods:

HTTP Method	Path	Description
GET	/model-manager/api/v3/doc	See comprehensive specification of the Model Manager API in YAML format
GET	/model-manager/doc/ui	See comprehensive specification of the Model Manager API in Swagger UI
GET	/model-manager/api/v3/modelTemplates	See the list of <a href="#">Model Templates [page 60]</a>
GET	/model-manager/api/v3/modelTemplates/{model_template_id}	See a model template by its ID <div>→ Tip Here you need to provide the ID of one of the available model templates.</div>
GET	/model-manager/api/v3/businessBlueprints	See the list of <a href="#">Business Blueprints [page 61]</a>
GET	/model-manager/api/v3/businessBlueprints/{business_blueprint_id}	See a business blueprint by its ID <div>→ Tip Here you need to provide the ID of one of the available business blueprints.</div>
GET	/model-manager/api/v3/jobs	See the list of training jobs



HTTP Method	Path	Description
POST	/model-manager/api/v3/jobs	<p>Create a new training job</p> <div> <p><b>Note</b></p> <p>The number of simultaneous training jobs (in <b>PENDING</b> and / or <b>RUNNING</b> status) is limited to 15. See <a href="#">Training Job Lifecycle [page 61]</a>.</p> </div> <p>Enter the <code>model_template_id</code> or the <code>business_blueprint_id</code> in the <i>Body</i> of the request. You cannot use both <a href="#">Model Templates [page 60]</a> and <a href="#">Business Blueprints [page 61]</a> in the same request.</p> <div> <pre>{   "datasetId":     "{{dataset_id}}",   "modelTemplateId":     "{{model_template_id}}",   "modelName":     "{{model_name}}" }</pre> <pre>{   "datasetId":     "{{dataset_id}}",   "businessBlueprintId":     "{{business_blueprint_id}}",   "modelName":     "{{model_name}}" }</pre> </div>
GET	/model-manager/api/v3/jobs/{job_id}	<p>See training job by its ID</p> <div> <p><b>→ Tip</b></p> <p>Here you need to provide the ID of a previously created job.</p> </div>
DELETE	/model-manager/api/v3/jobs/{job_id}	<p>Delete training job by its ID</p> <div> <p><b>→ Tip</b></p> <p>Here you need to provide the ID of a previously created job.</p> </div>

HTTP Method	Path	Description
GET	/model-manager/api/v3/models	See the list of models
GET	/model-manager/api/v3/models/{model_name}	<p>See training statistics by model name</p> <div> <p>→ Tip</p> <p>Here you need to provide the name of a previously created model.</p> <pre>{ "modelName": "my-model-name" }</pre> </div> <p><b>Response Example:</b> classification metrics (when a classification model template is selected)</p> <pre>{   "validationResult": {     "accuracy": 0.9810261009503216,     "f1Score": 0.9794542101212391,     "precision": 0.9779722507388351,     "recall": 0.981026100910936   } }</pre> <p><b>Response Example:</b> regression metrics (when the regression model template is selected)</p> <pre>{   "validationResult": {     "meanAbsoluteError": 16.34337203216552,     "meanAbsolutePercentageError": 12.93408453707585,     "meanSquaredError": 796.23282547694   } }</pre>

HTTP Method	Path	Description
DELETE	/model-manager/api/v3/models/{model_name}	Delete model by its name <div> → Tip <p>Here you need to provide the name of a previously created model.</p> <pre>{ "modelName" : "my-model-name" }</pre> </div>
GET	/model-manager/api/v3/deployments	See the list of deployments
POST	/model-manager/api/v3/deployments	Deploy a model by its name <div> → Tip <p>Here you need to provide the name of a previously created model.</p> <pre>{ "modelName" : "my-model-name" }</pre> </div>
GET	/model-manager/api/v3/deployments/{deployment_id}	See deployment by its ID <div> → Tip <p>Here you need to provide the ID of a previously deployed model.</p> </div>
DELETE	/model-manager/api/v3/deployments/{deployment_id}	Undeploy a model <div> → Tip <p>Here you need to provide the ID of the deployment previously created.</p> </div>



## Related Information

[Training Job Lifecycle \[page 61\]](#)


[Deployment Lifecycle \[page 63\]](#)

## 10.3.1 Model Templates

Each model template consists of a machine learning pipeline, where specific data preprocessing rules and model architectures are defined. The model templates for Data Attribute Recommendation are generic technical components that can be used in a variety of use cases, covering classification and regression scenarios. See below the available classification and regression model templates.



Name	ID	Description
AutoML	188df8b2-795a-48c1-8297-37f37b25ea00	<p>A set of generic and traditional machine learning models for single-label, multi-class classification tasks. This template automatically starts several experiments and searches for the best data preparation and machine learning algorithms for a given dataset within the defined algorithm space. Use this model template for small to medium sized classification tasks.</p> <p>See also the blog post <a href="#">How does AutoML work in Data Attribute Recommendation</a> .</p>
Generic	223abe0f-3b52-446f-9273-f3ca39619d2c	<p>Generic neural network for multi-label, multi-class classification. The number of inputs and outputs is derived from the dataset schema. This model template is recommended for a generic multiclass prediction use case.</p>
Hierarchical	d7810207-ca31-4d4d-9b5a-841a644fd81f	<p>Generic neural network for hierarchical classification. The number of inputs and outputs is derived from the dataset schema. This model template is recommended for the prediction of multiple classes that form a hierarchy (a product hierarchy, for example).</p>
Regression	bdbcd699-4419-40a5-abb8-e7ad43dde49b	<p>Generic neural network for regression that seeks to minimize the mean squared error (MSE). This model template does not support multi-label dataset schemas. Use single-label dataset schemas only.</p> <p>See also the blog post <a href="#">Solving regression use-cases with Data Attribute Recommendation</a> .</p>

### Note

Different model templates may provide different prediction quality for the same dataset and use case. If you are not sure, which model template is the best for your use case, you can [Ask a Question](#) in the [SAP Community](#)  using the tag [Data Attribute Recommendation](#). You can also train several models and compare the expected accuracy among them.

## 10.3.2 Business Blueprints

Each business blueprint implements a machine learning scenario tailored to solve a specific business use case, detailed in the table below in the description column. In contrast to a model template, the data processing rules are enhanced and optimized for the task at hand. See below the available business blueprints.

Name	ID	Description
Invoice Object Recommendation (IOR)	4788254b-0bad-4757-a67f-92d5b55f322d	<p>Business blueprint for Invoice Object Recommendation (IOR). Use this business blueprint to assign G/L (general ledger) accounts, cost objects and profitability analysis (CO-PA) dimension values to incoming invoices without a purchase order reference.</p> <p>See also the following blog posts:</p> <ul style="list-style-type: none"><li>• <a href="#">Announcement: Invoice Object Recommendation Becomes Part of Data Attribute Recommendation (Part 1)</a> </li><li>• <a href="#">Announcement: Invoice Object Recommendation becomes part of Data Attribute Recommendation – Technical Details (Part 2)</a> </li></ul>
Sales Order Completion (SOC)	9d15125d-2b7b-4136-8872-1ddd337cf36f	<p>Business blueprint for Sales Order Completion (SOC). Use this business blueprint in the context of the sales order process to predict missing fields that are needed for completion. With a dedicated preprocessing, the business blueprint takes care of imbalanced datasets as well as model training split based on the sales order object.</p>

## Related Information

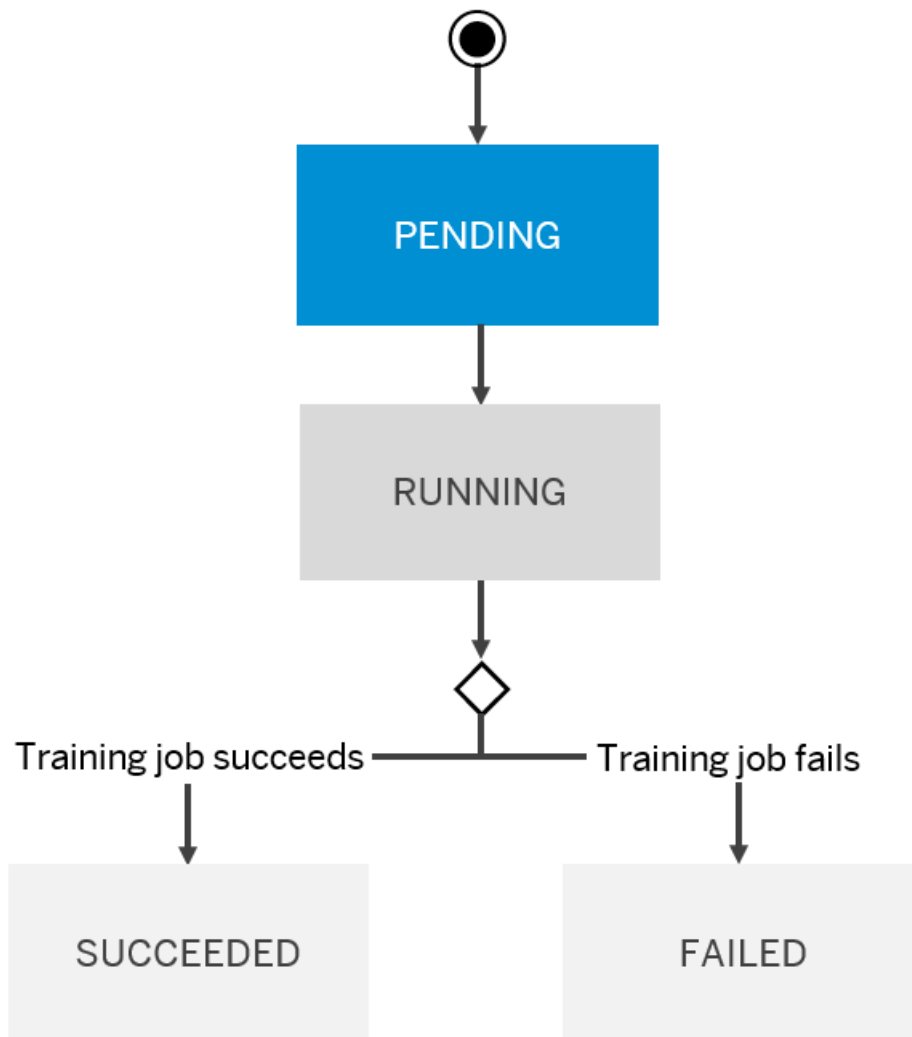
[Tutorials \[page 42\]](#)

## 10.3.3 Training Job Lifecycle

Data Attribute Recommendation defines a lifecycle for training jobs to enable you to classify data records or predict the value of missing numerical attributes. This section provides you with descriptions of the different possible statuses of training jobs for Data Attribute Recommendation.

Status	Description
PENDING	The training job has been enqueued for processing, but training has not started yet.
RUNNING	The model is being trained and you can follow the training progress.

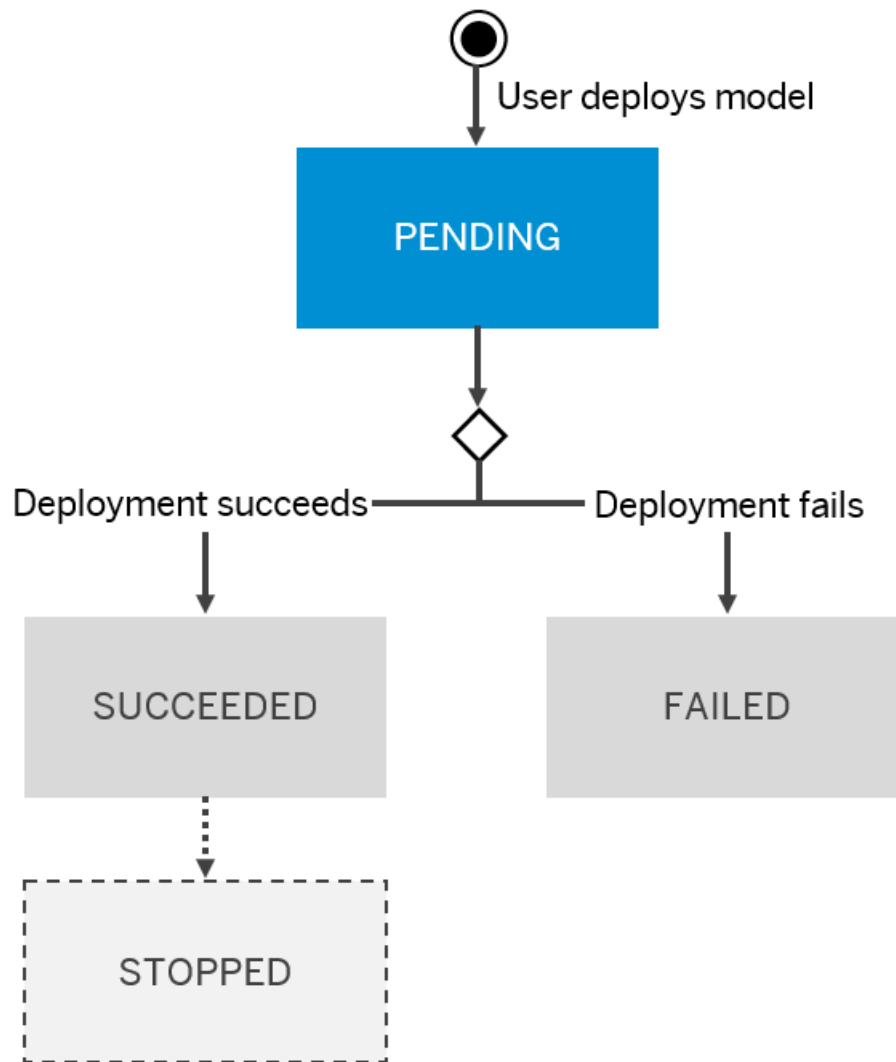
Status	Description
SUCCEEDED	The model has been successfully trained and is now ready to be deployed.
FAILED	An error occurred during training or the training process was cancelled mid-way. Delete existing job and create a new one to trigger the training process again.



## 10.3.4 Deployment Lifecycle

Data Attribute Recommendation defines a lifecycle for deployments to enable you to classify data records or predict the value of missing numerical attributes. This section provides you with descriptions of the different possible statuses of deployments for Data Attribute Recommendation.

Status	Description
<b>PENDING</b>	This is an intermediate status when the model is being deployed (currently being loaded).
<b>SUCCEEDED</b>	The model has been successfully deployed and can be used for inference.
<b>FAILED</b>	Model deployment has failed. Delete the existing deployment and create a new one to trigger the model deployment process again.
<b>STOPPED</b>	This is a possible status from the Bring Your Own Model (BYOM) service. Data Attribute Recommendation service does not support transitions to this status.



## 10.4 Get Inference Results

For the definition of **inference** in the Data Attribute Recommendation context, see [Concepts \[page 28\]](#).



## Inference API

Use the hostname from the “url” value of the service key and the paths listed below to perform the following HTTP methods:

HTTP Method	Path	Description
GET	/inference/api/v3/doc	See comprehensive specification of the Inference API in YAML format
GET	/inference/doc/ui	See comprehensive specification of the Inference API in Swagger UI
POST	/inference/api/v3/models/ {model_name}/versions/1	Send an inference request to a machine learning model by its name

→ Tip

Here you need to provide the name of a model previously created, trained and deployed.

## 10.5 Common Status and Error Codes

Code	Message	Reason
200	OK	Request was successful.
202	Accepted	Request was accepted.
204	Successfully deleted	Request was deleted.
400	Bad request	Process could not be submitted or completed; possibly due to parameter error, bad request syntax or invalid request message framing.
401	Not authorized	No token, bad or invalid token.
404	Not found	URL used is incorrect.

Code	Message	Reason
409	Conflict	Request cannot be processed due to a conflict in the current status of the resource, for example a dataset that was already uploaded.
500	Internal server error	Process could not be submitted or completed; possibly due to an internal error.
503	Service Unavailable	Process could not be submitted or completed due to exceeded number of simultaneous training jobs. The number of simultaneous training jobs (in <b>PENDING</b> and / or <b>RUNNING</b> status) is limited to 15. See <a href="#">Training Job Lifecycle [page 61]</a> .

# 11 Consuming the Service via AI API

Find out how to consume Data Attribute Recommendation using the AI API from SAP AI Core.

## Prerequisites

You have a service instance and service key for Data Attribute Recommendation. See tutorial [Use Free Tier to Set Up Account for Data Attribute Recommendation and Get Service Key](#).

### → Tip

The booster [Set up account for Data Attribute Recommendation](#) is available both for the free tier option, and the standard service plan.

See in [AI API - Dataset Upload \[page 69\]](#) and [AI API - Model Training and Deployment \[page 71\]](#) the main operations you can call to consume Data Attribute Recommendation via AI API. For more information, see [AI API Concepts](#) and [About the AI API](#).

### ⓘ Note

- The operations related to inference are handled by the Inference API from the Data Attribute Recommendation service. See [Get Inference Results \[page 64\]](#).
- The operations related to dataset upload, model training and deployment are handled by the AI API.
- When consuming the service via AI API, data validation is performed immediately before model training starts.

### ⚠ Restriction

The AI API dataset upload operations (`{{url}}/model-manager/v2/lm/files`) can be made available for tenants created from 2022-12-02. For that, create an incident providing the tenant details under the BCP component for the Data Attribute Recommendation service (CA-ML-DAR). See [Getting Support \[page 128\]](#).

### ⚠ Caution

Do not delete jobs, models, and deployments created via AI API using the Data Attribute Recommendation service APIs.

You can use Postman, curl or any other REST client to make calls to the AI API and Data Attribute Recommendation APIs. If you choose Postman, get ahead by using the [Data Attribute Recommendation and AI API Postman Environment and Collection](#) JSON files.

## Related Information

[Authorization \[page 68\]](#)

[AI API - Dataset Upload \[page 69\]](#)

[AI API - Model Training and Deployment \[page 71\]](#)

## 11.1 Authorization

Before processing any requests, Data Attribute Recommendation checks if you have the right authorization. Every request has to contain an "Authorization" header value, which is a JSON Web Token (JWT).

Operation	HTTP Method	URL	Additional information
Get XSUAA OAuth Token	GET	<code>{{authUrl}}/oauth/token?grant_type=client_credentials</code>	<p>Before sending this request, edit Postman environment to add the values from your Data Attribute Recommendation service key in the following environment variables:</p> <ul style="list-style-type: none"><li>• <code>authUrl</code>: to be filled from the <code>uaa.url</code> section of the service key</li><li>• <code>clientId</code>: to be filled from the <code>uaa.clientId</code> section of the service key</li><li>• <code>clientSecret</code>: to be filled from the <code>uaa.clientSecret</code> section of the service key</li><li>• <code>url</code>: to be filled from the <code>url</code> section of the service key</li></ul>

→ Tip

The `{{accessToken}}` is valid for 12 hours. After that, you need to generate a new one. To do so, send this request once again.

When sending the next request after this one, *Upload Dataset Schema*, for example, set *Type* to **Bearer Token** on the *Authorization* tab and enter `{{accessToken}}` in *Token*. Always repeat this step after creating a new `{{accessToken}}`.

## Related Information

[Initial Setup \[page 37\]](#)

## 11.2 AI API - Dataset Upload

Operation	HTTP Method	URL	Additional information
Upload Dataset Schema	PUT	<code>{{url}}/model-manager/v2/lm/files/{{folderName}}/{{datasetSchemaFile}}</code>	<p>For file and folder names use <b>only</b> alphanumeric characters, underscores “_” and hyphens “-”. No spaces are allowed.</p> <p>Don't use more than 900 characters in the URL path <code>{{folderName}}/{{datasetSchemaFile}}</code>.</p> <div> <p>→ Remember</p> <p>Set the header "Content-Type" to "application/octet-stream" before sending this request.</p> </div> <p>To use the trained model for autocomplete tasks, you can add common values to the list of features and labels in your dataset schemas, as you can see in the following example:</p> <pre> {   "features": [     {       "label": "description",       "type": "TEXT"     },     {       "label": "manufacturer",       "type": "CATEGORY"     },     {       "label": "price",       "type": "NUMBER"     }   ],   "labels": [     {       "label": "manufacturer",       "type": "CATEGORY"     }   ],   "name": "my-dataset-schema-with-overlaps" } </pre> <p>Here, the value "manufacturer" is both a feature and a label. It can be, for example, an input and an output of the model. For classical classification and regression scenarios this is usually not the case, but this kind of dataset schemas enables use cases where you can use the resulting machine learning model for autocomplete tasks. For example, with a complete overlap of features and labels, you can fill in the value of one field (any field of your choice) and ask the model to predict the rest.</p> <p>If the value of "manufacturer" is provided as input, the task of the model is trivial. Because of that you should use such dataset schemas <b>only</b> if you set the training con-</p>

Operation	HTTP Method	URL	Additional information
			figuration parameter enableMasking to true. For more information, see <a href="#">Training Configuration [page 85]</a> .
Delete Dataset Schema	DELETE	<pre> {{url}} /model- manager /v2/lm/ files/ {{folderName}} / {{datasetSchemaFile}} </pre>	
Upload Dataset	PUT	<pre> {{url}} /model- manager /v2/lm/ files/ {{folderName}} / {{datasetFile}} </pre>	<p>You can upload dataset CSV files in batches. Each file can have up to 500 MB.</p> <p>Don't use more than 900 characters in the URL path <code>{{folderName}}/{{datasetFile}}</code>.</p> <div> <p>→ Remember</p> <p>Set the header "Content-Type" to "application/octet-stream" before sending this request.</p> </div>
Delete Dataset	DELETE	<pre> {{url}} /model- manager /v2/lm/ files/ {{folderName}} / {{datasetFile}} </pre>	If you've uploaded dataset CSV files in batches, delete one file at a time.

Operation	HTTP Method	URL	Additional information
Upload Inference Dataset	PUT	<code>{{url}}/model-manager/v2/lm/files/{{inferenceFolderName}}/{{inferenceDatasetFile}}</code>	<p>You can upload inference dataset CSV files in batches. Each CSV file should include a column called <code>_object_id</code> and all the features.</p> <p>The <code>_object_id</code> column is mandatory. Its values should be unique strings that start with a single alphanumeric character followed by zero or more alphanumeric characters.</p>
Delete Inference Dataset	DELETE	<code>{{url}}/model-manager/v2/lm/files/{{inferenceFolderName}}/{{inferenceDatasetFile}}</code>	<p>If you've uploaded dataset CSV files in batches, delete one file at a time.</p>

#### → Remember

Set the header "Content-Type" to "application/octet-stream" before sending this request.

#### → Remember

As of version 3.0 of the executables, Data Attribute Recommendation automatically deletes the dataset and dataset schema used to train a model once training execution reaches its final status ("COMPLETED" or "DEAD").

To prevent the service from deleting the dataset and schema, you can change this default behavior by setting the `deleteAfterTraining` parameter to `false` when you create the [Training Configuration \[page 85\]](#).

## 11.3 AI API - Model Training and Deployment

### Related Information

[Scenarios \[page 72\]](#)

[Artifacts \[page 73\]](#)

[Executables \[page 76\]](#)

[Configurations \[page 84\]](#)

[Executions \[page 96\]](#)

[Metrics \[page 100\]](#)

[Deployments \[page 103\]](#)

## 11.3.1 Scenarios

Operation	HTTP Method	URL	Additional information
List Scenarios	GET	<code>{{url}}/model-manager/v2/lm/scenarios</code>	<p>Data Attribute Recommendation supports the following scenarios:</p> <ul style="list-style-type: none"><li>• AutoML model template: this scenario corresponds to the model template "188df8b2-795a-48c1-8297-37f37b25ea00" of Data Attribute Recommendation.</li><li>• Generic model template: this scenario corresponds to the model template "223abe0f-3b52-446f-9273-f3ca39619d2c" of Data Attribute Recommendation.</li><li>• Hierarchical model template: this scenario corresponds to the model template "d7810207-ca31-4d4d-9b5a-841a644fd81f" of Data Attribute Recommendation.</li><li>• Regression model template: this scenario corresponds to the model template "bdbcd699-4419-40a5-abb8-e7ad43dde49b" of Data Attribute Recommendation.</li><li>• Invoice Object Recommendation business blueprint: this scenario corresponds to the business blueprint "4788254b-0bad-4757-a67f-92d5b55f322d" of Data Attribute Recommendation.</li><li>• Sales Order Completion business blueprint: this scenario corresponds to the business blueprint "9d15125d-2b7b-4136-8872-1ddd337cf36f" of Data Attribute Recommendation.</li></ul> <p>See <a href="#">Model Templates [page 60]</a> and <a href="#">Business Blueprints [page 61]</a>.</p>
Get Scenario Details	GET	<code>{{url}}/model-manager/v2/lm/scenarios/{{scenarioId}}</code>	<p>Before sending this request, enter your <code>scenarioId</code> in the Postman environment variable <code>scenarioId</code>.</p>



Operation	HTTP Method	URL	Additional information
Get Scenario Versions	GET	<code>{{url}}/model-manager/v2/lm/scenarios/{{scenarioId}}/versions</code>	

## 11.3.2 Artifacts

Operation	HTTP Method	URL	Additional information
List Artifacts	GET	<code>{{url}}/model-manager/v2/lm/artifacts</code>	
Create Dataset Schema Artifact	POST	<code>{{url}}/model-manager/v2/lm/artifacts</code>	<p>Before sending this request, enter your <code>datasetSchemaUrl</code> in the Postman environment variable <code>datasetSchemaUrl</code>, and make sure the ID belongs to a dataset in status "SUCCEEDED".</p> <p>In <b>Body raw</b>, enter the following:</p> <pre>{   "labels": [],   "description":     "&lt;description&gt;",   "kind":     "other",   "name":     "&lt;dataset schema name&gt;",   "url":     "{{datasetSchemaUrl}}",   "scenarioId":     "{{scenarioId}}" }</pre>

Operation	HTTP Method	URL	Additional information
Create Dataset Artifact	POST	<code>{{url}}/model-manager/v2/lm/artifacts</code>	<p>Before sending this request, enter your <code>datasetUrl</code> in the Postman environment variable <code>datasetUrl</code>, and make sure the ID belongs to a dataset in status "SUCCEEDED".</p> <p>In <i>Body raw</i>, enter the following:</p> <pre>{   "labels": [],   "description":     "&lt;description&gt;",   "kind":     "dataset",   "name":     "&lt;dataset name&gt;",   "url":     "{{datasetUrl}}",   "scenarioId":     "{{scenarioId}}" }</pre>
Create Inference Dataset Artifact	POST	<code>{{url}}/model-manager/v2/lm/artifacts</code>	<p>Before sending this request, enter your <code>datasetUrl</code> in the Postman environment variable <code>datasetUrl</code>, and make sure the ID belongs to a dataset in status "SUCCEEDED".</p> <p>In <i>Body raw</i>, enter the following:</p> <pre>{   "labels": [],   "description":     "&lt;description&gt;",   "kind":     "dataset",   "name":     "&lt;dataset name&gt;",   "url":     "{{datasetUrl}}",   "scenarioId":     "{{scenarioId}}" }</pre>

Operation	HTTP Method	URL	Additional information
Get Artifact Details	GET	<code>{{url}}/model-manager/v2/lm/artifacts/{{datasetArtifactId}}</code>	Before sending this request, enter your <code>datasetArtifactId</code> in the Postman environment variable <code>datasetArtifactId</code> .

## 11.3.3 Executables

Operation	HTTP Method	URL	Additional information
List Executables	GET	<code>{{url}}/model-manager/v2/lm/scenarios/{{scenarioId}}/executables</code>	<p>See <a href="#">Supported Executables [page 83]</a>.</p> <div><p><b>Note</b></p><p>This endpoint only lists the executables for the given scenario. If for example, your <code>scenarioId</code> corresponds to the generic scenario, you only see the generic training executable, the generic transfer learning executable, the generic batch inference executable, and the generic deployment executable.</p><p>For the executable version, see the <code>versionId</code> attribute in the response.</p><p>Before trying out new configurations and functionalities, check whether they're available with your executable version. See, for example, the restrictions in <a href="#">Training Configuration [page 85]</a>, <a href="#">Transfer Learning Configuration [page 92]</a>, and <a href="#">Batch Inference Configuration [page 93]</a>.</p></div> <p><b>Response Example</b></p> <pre>{   "count": 3,   "resources": [     {</pre>

Operation	HTTP Method	URL	Additional information
			<pre> "createdAt": "2021-11-03T13:42:12Z", , "deployable": false, "description": "Training executable for model template '223abe0f-3b52-446f-9273-f3ca39619d2c'", "id": "13cde9e4-a83d-4eeb-a54b-fb175f1c4d0a", "inputArtifacts": [   {     "description": "Dataset artifact for training",     "kind": "dataset",     "name": "dataset"   },   {     "key": "ext.ai.sap.com/islm_released_version",     "value": "true"   },   {     "key": "ext.ai.sap.com/islm_executable_type",     "value": "train"   } ], "modifiedAt": "2021-11-03T13:42:12Z", "name": "'Generic' training executable", </pre>

Operation	HTTP Method	URL	Additional information
			<pre> "outputArtifacts" :[     {       "description":"Model artifact for deployment",       "kind":"model",       "name":"model"     },     {       "parameters":[         {           "name":"modelName",           "type":"string"         }       ],       "scenarioId":"ccb99c7c-07c1-45f5-b51b-3e7d8b76eb0c",       "versionId":"1.0"     },     {       "createdAt":"2022-11-02T14:45:00Z",       "deployable":false,       "description":"Training executable for model template '223abe0f-3b52-446f-9273-f3ca39619d2c'",       "id":"3d5c9888-18be-468a-b75a-4b056678c246",       "inputArtifacts":[         {           "description":"Dataset artifact for training",           "kind":"dataset", </pre>

Operation	HTTP Method	URL	Additional information
			<pre> "labels": [   {     "key": "ext.ai.sap .com/ islm_datamanageme nt_artifact_type" ,     "value": "dataset"   } ], "name": "dataset" }, {   "description": "Da taset schema artifact for training",   "kind": "other",   "labels": [     {       "key": "ext.ai.sap .com/ islm_datamanageme nt_artifact_type" ,       "value": "schema"     }   ],   "name": "datasetSc hema" }, {   "modifiedAt": "202 2-11-02T14:45:00Z ",   "name": "'Generic' training executable",   "outputArtifacts" : [     { </pre>

Operation	HTTP Method	URL	Additional information
			<pre> "description": "Model artifact suitable for deployment, transfer learning or batch inference", "kind": "model", "name": "model" }, { "parameters": [ { "name": "modelName", "type": "string" } ], "scenarioId": "ccb99c7c-07c1-45f5-b51b-3e7d8b76eb0c", "versionId": "2.0" }, { "createdAt": "2023-06-05T23:48:23Z", "deployable": false, "description": "Training executable for model template '223abe0f-3b52-446f-9273-f3ca39619d2c'", "id": "40dcde13-ce0f-45cc-aac0-74da78175305", "inputArtifacts": [ { "description": "Dataset artifact for training", "kind": "dataset", </pre>



Operation	HTTP Method	URL	Additional information
			<pre> "labels": [   {     "key": "ext.ai.sap .com/ islm_datamanageme nt_artifact_type" ,     "value": "dataset"   } ], "name": "dataset" }, {   "description": "Da taset schema artifact for training",   "kind": "other",   "labels": [     {       "key": "ext.ai.sap .com/ islm_datamanageme nt_artifact_type" ,       "value": "schema"     }   ],   "name": "datasetSc hema" }, {   "labels": [     {       "key": "ext.ai.sap .com/ islm_released_ver sion",       "value": "true"     }   ] } </pre>

Operation	HTTP Method	URL	Additional information
			<pre> "key": "ext.ai.sap .com/ ism_executable_t ype",  "value": "train"     },     {  "key": "ext.ai.sap .com/ ism_datamanageme nt_supported",  "value": "true"     } ],  "modifiedAt": "202 3-06-05T23:48:23Z ",  "name": "'Generic' training executable",  "outputArtifacts" :[     {  "description": "Mo del artifact suitable for deployment, transfer learning or batch inference",  "kind": "model",  "name": "model"     } ],  "parameters": [     {  "name": "modelName ",  "type": "string"     },     {  "default": "true",  "name": "deleteAft erTraining",  "type": "string"     } ] </pre>

Operation	HTTP Method	URL	Additional information
			<pre> "default": "true",  "name": "computeGlobalMetrics",  "type": "string"     },      "scenarioId": "ccb99c7c-07c1-45f5-b51b-3e7d8b76eb0c",      "versionId": "3.0"   } ] } </pre>
Get Executable Details	GET	<code>{{url}}/model-manager/v2/lm/scenarios/{{scenarioId}}/executables/{{executableId}}</code>	Before sending this request, enter your executableId in the Postman environment variable executableId.

### 11.3.3.1 Supported Executables

See at a glance which executables are supported.

Data Attribute Recommendation supports the following executables:

#### Model Templates Executables

- AutoML Executables:
  - AutoML training executable
  - AutoML deployment executable
- Generic Executables:
  - Generic training executable
  - Generic transfer learning executable
  - Generic batch inference executable
  - Generic deployment executable
- Hierarchical Executables:
  - Hierarchical training executable
  - Hierarchical transfer learning executable
  - Hierarchical batch inference executable
  - Hierarchical deployment executable
- Regression Executables:

- Regression training executable
- Regression batch inference executable
- Regression deployment executable

### **Business Blueprints Executables**

- Invoice Object Recommendation Executables:
  - Invoice Object Recommendation training executable
  - Invoice Object Recommendation transfer learning executable
  - Invoice Object Recommendation batch inference executable
  - Invoice Object Recommendation deployment executable
- Sales Order Completion Executables:
  - Sales Order Completion training executable
  - Sales Order Completion transfer learning executable
  - Sales Order Completion batch inference executable
  - Sales Order Completion deployment executable

### **Related Information**

[Model Templates \[page 60\]](#)

[Business Blueprints \[page 61\]](#)

## **11.3.4 Configurations**

### **Related Information**

[Training Configuration \[page 85\]](#)

[Transfer Learning Configuration \[page 92\]](#)

[Batch Inference Configuration \[page 93\]](#)

[Deployment Configuration \[page 95\]](#)

### 11.3.4.1 Training Configuration

Operation	HTTP Method	URL	Additional information
List Configurations	GET	<code>{{url}}/model-manager/v2/lm/configurations</code>	

Operation	HTTP Method	URL	Additional information
Create Training Configuration	POST	<code>{{url}}/model-manager/v2/lm/configurations</code>	<p>For executable versions 1.0 and 2.0, in <i>Body raw</i>, enter the following:</p> <pre> {   "executableId":   "{{trainingExecutableId}}",    "inputArtifactBindings": [ {     "key":     "datasetSchema",      "artifactId":     "{{datasetSchemaArtifactId}}"   }, {     "key":     "dataset",      "artifactId":     "{{datasetArtifactId}}"   } ],    "parameterBindings": [     {       "key":       "modelName",       "value":       "{{modelName}}"     },     {       "name": "Test Training",       "scenarioId":       "{{scenarioId}}"     }   ] } </pre>
			<p><b>▲ Restriction</b></p> <p>The training configuration parameters <code>deleteAfterTraining</code>, <code>computeGlobalMetrics</code>, and <code>enableMasking</code> are available <b>only</b> with executable version 3.0.</p> <p>The parameters <code>deleteAfterTrain</code></p>

Operation	HTTP Method	URL	Additional information
			<p>ing and computeGlobalMetrics are available for all executables.</p> <p>The parameter enableMasking is <b>only</b> available for the generic and Sales Order Completion training executables.</p> <p>By default, Data Attribute Recommendation deletes all data and schemas automatically following training, irrespective of whether training is successful or not.</p> <p>This behavior applies only to SAP AI Core tenants and the file upload API.</p> <p>If you want to retain data and schemas after training, set the parameter deleteAfterTraining to false:</p> <pre>{   "executableId":     "{{trainingExecutableId}}",   "inputArtifactBindings": [{     "key":       "datasetSchema",     "artifactId":       "{{datasetSchemaArtifactId}}"   }, {     "key":       "dataset",     "artifactId":       "{{datasetArtifactId}}"   }],   "parameterBindings": [     {</pre>

Operation	HTTP Method	URL	Additional information
			<pre>       "key":       "modelName",        "value":       "{{modelName}}"     },      "key":     "deleteAfterTrain ing",      "value":     "false"   },   "name": "Test Training",   "scenarioId":   "{{scenarioId}}" } </pre> <p>By default, Data Attribute Recommendation displays global metrics. If you want to hide these metrics, set the parameter <code>computeGlobalMetrics</code> to <code>false</code>:</p> <pre> {   "executableId":   "{{trainingExecut ableId}}",    "inputArtifactBin dings": [{     "key":     "datasetSchema",      "artifactId":     "{{datasetSchemaA rtifactId}}"   }, {     "key":     "dataset",      "artifactId":     "{{datasetArtifac tId}}"   }],    "parameterBinding s": [     {       "key":       "modelName", </pre>



Operation	HTTP Method	URL	Additional information
			<pre>       "value":       "{{modelName}}"     },     {       "key":       "computeGlobalMet rics",       "value":       "false"     },     {       "name": "Test Training",       "scenarioId":       "{{scenarioId}}"     } </pre> <div> <div> <b>⚠ Restriction</b> </div> <div> <p>The <code>computeGlobalMetrics</code> parameter only works if the tenant is on-boarded to the SAP AI Core infrastructure.</p> <p>If you're on SAP Leonardo Machine Learning Foundation and want to use this parameter to hide global metrics, open a ticket that includes your instance details.</p> </div> </div> <p>To enable masking during model training, set the parameter <code>enableMasking</code> to true:</p> <pre> {   "executableId": "{ {trainingExecutab leId}}",   "inputArtifactBin dings": [     { </pre>

Operation	HTTP Method	URL	Additional information
			<pre> "key": "datasetSchema",  "artifactId": "{datasetSchemaArtifactId}" },  "key": "dataset",  "artifactId": "{datasetArtifactId}" },  ],  "parameterBindings": [  {  "key": "modelName",  "value": "{modelName}" },  {  "key": "enableMasking",  "value": "true" },  {  "name": "Test Training",  "scenarioId": "{scenarioId}" } </pre> <p>With this configuration, masking is applied and the feature values are randomly masked before training, making the model learn nontrivial relationships between inputs and outputs (even when the list of features coincides with the list of labels). The result of the training procedure is a model artifact that can be deployed as any other model.</p> <p>Once you've deployed the model (see <a href="#">Deployments</a></p>

Operation	HTTP Method	URL	Additional information
			<p>[page 103]), when sending an inference request to the model (see <a href="#">Get Inference Results [page 64]</a>), you have to indicate the absence of information. To do that, use empty strings as the value of the corresponding features (this guideline applies to all feature types), as you can see in the following example:</p> <pre> {   "objects": [     {       "objectId": "{{objectId}}",       "features": [         {           "name": "description",           "value": ""         },         {           "name": "manufacturer",           "value": ""         },         {           "name": "price",           "value": ""         }       ]     }   ] }</pre>
Get Training Configuration Details	GET	<code>{{url}}/model-manager/v2/lm/configurations/{{trainingConfigurationId}}</code>	Before sending this request, enter your <code>trainingConfigurationId</code> in the Postman environment variable <code>trainingConfigurationId</code> .

## 11.3.4.2 Transfer Learning Configuration

Operation	HTTP Method	URL	Additional information
List Configurations	GET	<code>{{url}}/model-manager/v2/lm/configurations</code>	
Create Transfer Learning Configuration	POST	<code>{{url}}/model-manager/v2/lm/configurations</code>	<p>In <b>Body raw</b>, enter the following:</p> <pre>{   "executableId":     "{{transferLearningExecutableId}}"   ,   "inputArtifactBindings": [ {     "key":       "model " ,     "artifactId":       "{{modelArtifactId}}"     } , {     "key":       "dataset " ,     "artifactId":       "{{datasetArtifactId}}"     } ] ,   "parameterBindings": [     {       "key":         "modelName" ,       "value":         "{{modelName}}"     }   ] ,   "name":     "Test Transfer Learning" ,   "scenarioId":     "{{scenarioId}}" }</pre>

**⚠ Restriction**

The transfer learning functionality is available only with executable version 2.0 and 3.0.

Operation	HTTP Method	URL	Additional information
Get Transfer Learning Configuration Details	GET	<code>{{url}}/model-manager/v2/lm/configurations/{{transferLearningConfigurationId}}</code>	Before sending this request, enter your <code>transferLearningConfigurationId</code> in the Postman environment variable <code>transferLearningConfigurationId</code> .

## Related Information

[Concepts \[page 28\]](#)

### 11.3.4.3 Batch Inference Configuration

Operation	HTTP Method	URL	Additional information
List Configurations	GET	<code>{{url}}/model-manager/v2/lm/configurations</code>	

Operation	HTTP Method	URL	Additional information
Create Batch Inference Configuration	POST	<code>{{url}}/model-manager/v2/lm/configurations</code>	<p>In <b>Body raw</b>, enter the following:</p> <pre> {   "executableId":   "{{batchInferenceExecutableId}}",    "inputArtifactBindings": [{     "key":     "model",      "artifactId":     "{{modelArtifactId}}"   }, {     "key":     "inferenceDataset",      "artifactId":     "{{inferenceDatasetArtifactId}}"   }],    "parameterBindings": [     {       "key":       "topN",       "value":       "{{topN}}"     },     {       "name": "Test Batch Inference",       "scenarioId":       "{{scenarioId}}"     }   ] } </pre> <p>The output artifact <code>inferenceDataset</code> is produced by a batch inference execution, which contains the URL where the JSON file with the model predictions is accessible.</p> <div> <p><b>⚠ Restriction</b></p> <p>The batch inference functionality is available only with executable version 2.0 and 3.0.</p> </div>

Operation	HTTP Method	URL	Additional information
Get Batch Inference Configuration Details	GET	<code>{{url}}/model-manager/v2/lm/configurations/{{batchInferenceConfigurationId}}</code>	Before sending this request, enter your <code>batchInferenceConfigurationId</code> in the Postman environment variable <code>batchInferenceConfigurationId</code> .

## Related Information

[Concepts \[page 28\]](#)

### 11.3.4.4 Deployment Configuration

Operation	HTTP Method	URL	Additional information
List Configurations	GET	<code>{{url}}/model-manager/v2/lm/configurations</code>	
Create Deployment Configuration	POST	<code>{{url}}/model-manager/v2/lm/configurations</code>	<p>In <b>Body raw</b>, enter the following:</p> <pre>{   "executableId":     "{{deploymentExecutableId}}",   "inputArtifactBindings": [{     "key":       "model",     "artifactId":       "{{modelArtifactId}}"   }],   "name": "Test Deployment",   "scenarioId":     "{{scenarioId}}" }</pre>

Operation	HTTP Method	URL	Additional information
Get Deployment Configuration Details	GET	<code>{{url}}/model-manager/v2/lm/configurations/{{deploymentConfigurationId}}</code>	Before sending this request, enter your deploymentConfigurationId in the Postman environment variable deploymentConfigurationId.

## 11.3.5 Executions

Operation	HTTP Method	URL	Additional information
List Executions	GET	<code>{{url}}/model-manager/v2/lm/executions</code>	
Create Training Execution	POST	<code>{{url}}/model-manager/v2/lm/executions</code>	<p>In <b>Body raw</b>, enter the following:</p> <pre>{   "configurationId"   :   "{{trainingConfigurationId}}" }</pre>
Get Execution Details	GET	<code>{{url}}/model-manager/v2/lm/executions/{{trainingExecutionId}}</code>	<p>Before sending this request, enter your trainingExecutionId in the Postman environment variable trainingExecutionId.</p> <p>Make sure the training execution status changes to "COMPLETED" before sending the next request.</p>
Delete Training Execution	DELETE	<code>{{url}}/model-manager/v2/lm/executions/{{trainingExecutionId}}</code>	



Operation	HTTP Method	URL	Additional information
Create Transfer Learning Execution	POST	<code>{{url}}/model-manager/v2/lm/executions</code>	<p>In <b>Body raw</b>, enter the following:</p> <pre>{   "configurationId": "{{transferLearningConfigurationId}}" }</pre>
Get Transfer Learning Execution Details	GET	<code>{{url}}/model-manager/v2/lm/executions/{{transferLearningExecutionId}}</code>	
Delete Transfer Learning Execution	DELETE	<code>{{url}}/model-manager/v2/lm/executions/{{transferLearningExecutionId}}</code>	
Create Batch Inference Execution	POST	<code>{{url}}/model-manager/v2/lm/executions</code>	<p>In <b>Body raw</b>, enter the following:</p> <pre>{   "configurationId": "{{batchInferenceConfigurationId}}" }</pre>

Operation	HTTP Method	URL	Additional information
Get Batch Inference Execution Details	GET	<code>{{url}}/model-manager/v2/lm/executions/{{batchInferenceExecutionId}}</code>	<p>Batch inference details would contain an inferenceResult output artifact, whose url property can be used to download the JSON file</p> <p>"outputArtifacts":</p> <pre>[   {     "createdAt":       "2023-08-23T08:57:59Z",     "description":       "",     "executionId":       "{{batchInferenceExecutionId}}",     "id":       "73677fef-6a29-4778-8110-42a52833140a",     "kind": "other",     "labels": [       {         "key":           "ext.ai.sap.com/artifact",         "value":           "inferenceResult"       }     ],     "modifiedAt":       "2023-08-23T08:57:59Z",     "name":       "inferenceResult",     "scenarioId":       "{{scenarioId}}",     "url":       "{{inferenceResultUrl}}"   } ]</pre> <p>The output artifact <code>inferenceResult</code> is a dataset containing only features (as listed in the dataset schema) and a column called <code>_object_id</code>, which acts as a primary key for the objects to be predicted. This is a mandatory column. If not present, the user receives an error message.</p>

Operation	HTTP Method	URL	Additional information
Delete Batch Inference Execution	DELETE	<code>{{url}}/model-manager/v2/lm/executions/{{batchInferenceExecutionId}}</code>	

## 11.3.6 Metrics

Operation	HTTP Method	URL	Additional information
Get Metric Details	GET	<code>{{url}}/model-manager/v2/lm/metrics?executionIds={{trainingExecutionId}}</code>	<p>Use this operation to gain an overview of the model performance, including the following (available with all executable versions):</p> <ul style="list-style-type: none"> <li>• Global metrics</li> <li>• Per-label metrics</li> <li>• Feature contribution scores</li> </ul>

### ⚠ Restriction

Feature contribution scores aren't currently available for the `scenarioId` that corresponds to AutoML.

### → Tip

See [Concepts \[page 28\]](#) and also the FAQ [What values are used to measure Data Attribute Recommendation performance on specific data?](#).

### Response Example:

```
{
  "count": 1,
  "resources": [
    {
      "executionId": "eela616156e3f46d",
      "metrics": [
        {
          "labels": [
            {
              "name": "type",
              "value": "accuracy"
            }
          ]
        }
      ]
    }
  ]
}
```

Operation	HTTP Method	URL	Additional information
			<pre>     ],     "name":     "ACCURACY",     "timestamp":     "2023-01-16T10:30:16Z",     "value": 0.7     },     {     "labels": [{         "name":         "type",         "value":         "accuracy"     },     {         "name":         "target",         "value":         "F1_readable"     }     ]     },     "name":     "ACCURACY_F1_readable",     "timestamp":     "2023-01-16T10:30:16Z",     "value": 0.9     },     "...", {     "labels": [{         "name":         "type",         "value":         "feature_contribution_scores"     },     { </pre>



## 11.3.7 Deployments

Operation	HTTP Method	URL	Additional information
List Deployments	GET	<code>{{url}}/model-manager/v2/lm/deployments</code>	
Deploy Model	POST	<code>{{url}}/model-manager/v2/lm/deployments</code>	<p>In <b>Body raw</b>, enter the following:</p> <pre>{   "configurationId"   :   "{{deploymentConfigurationId}}" }</pre>
Get Deployment Details	GET	<code>{{url}}/model-manager/v2/lm/deployments/{{deploymentId}}</code>	<p>Before sending this request, enter your <code>deploymentId</code> in the Postman environment variable <code>deploymentId</code>.</p> <p>Make sure the deployment status changes to "RUNNING". This endpoint returns a <code>deploymentUrl</code> key, which can be used for the inference calls.</p>
Delete Deployment	DELETE	<code>{{url}}/model-manager/v2/lm/deployments/{{deploymentId}}</code>	

# 12 Technical Constraints

All Data Attribute Recommendation endpoints exposed to the end user have strict technical limits. The body of the PUT or POST request, for example, cannot exceed a size limit specified per endpoint. The size and content of each field are checked against a set of validation criteria. By default, all endpoints have a limit of 20KB, but there are exceptions. See more details in the following table.

ⓘ Note

The technical limits listed here are relevant only to users of the **Standard** service plan for enterprise accounts. See [Service Plans \[page 32\]](#).

Path	Field	Field Value Size or Length	Allowed Values
/data-manager/api/v3/ /datasetSchemas	Maximum request size for dataset schema	10 KB	
/data-manager/api/v3/ /datasetSchemas	Dataset schema <i>name</i>	Minimum: 1 character  Maximum: 255 characters	^[a-zA-Z]([a-zA-Z0-9] [_ -])*\$(regular expression)
	<div><div>Sample Code</div><div><pre>{   ...   "name":     &lt;value&gt;,   ... }</pre></div></div>		<div><div> ⓘ Note</div><div>You can use spaces in the &lt;value&gt; for <i>name</i> except in the first character that cannot be a number (use letters only).  For example: &lt;Test Dataset Schema 123-5&gt;.</div></div>



Path	Field	Field Value Size or Length	Allowed Values
/data-manager/api/v3/ datasetSchemas	Dataset schema array <i>features</i>	Minimum: 1 item in the <i>features</i> list  Maximum: 60 items in the <i>features</i> list	
	<div> <div>Sample Code</div> <pre>{   ...   "features": [],   "labels": [],   ... }</pre> </div>		
/data-manager/api/v3/ datasetSchemas	Dataset schema array <i>labels</i>	Minimum: 1 item in the <i>labels</i> list  Maximum: 30 items in the <i>labels</i> list	
	<div> <div>Sample Code</div> <pre>{   ...   "features": [],   "labels": [],   ... }</pre> </div>		

Path	Field	Field Value Size or Length	Allowed Values
/data-manager/api/v3/ datasetSchemas	Dataset schema per-feature <i>label</i>	Minimum: 1 character  Maximum: 255 characters	<p><math>^{[a-zA-Z]([a-zA-Z0-9] \_ \-)*\\$}</math> (regular expression)</p> <div> <p><b>Note</b></p> <p>Use <b>only</b> letters in the first character of the <b>&lt;value&gt;</b> for <i>label</i> (do not use numbers). From the second character onwards, use <b>only</b> alphanumeric characters, underscores "_", and hyphens "-". No spaces are allowed.</p> <p>For example: <b>&lt;Test_Label_123-5&gt;</b> (allowed), <b>&lt;-Test_Label_123-5&gt;</b> (not allowed) and <b>&lt;_1_Test_Label_123-5&gt;</b> (not allowed).</p> </div> <div> <p><b>Restriction</b></p> <p>The label value <b>&lt;arg__top_k&gt;</b> is <b>not</b> allowed.</p> </div>
/data-manager/api/v3/ datasetSchemas	Dataset schema per-label <i>label</i>	Minimum: 1 character  Maximum: 255 characters	<p><math>^{[a-zA-Z]([a-zA-Z0-9] \_ \-)*\\$}</math> (regular expression)</p> <div> <p><b>Note</b></p> <p>Use <b>only</b> letters in the first character of the <b>&lt;value&gt;</b> for <i>label</i> (do not use numbers). From the second character onwards, use <b>only</b> alphanumeric characters, underscores "_", and hyphens "-". No spaces are allowed.</p> <p>For example: <b>&lt;Test_Label_123-5&gt;</b> (allowed), <b>&lt;-Test_Label_123-5&gt;</b> (not allowed) and <b>&lt;_1_Test_Label_123-5&gt;</b> (not allowed).</p> </div> <div> <p><b>Restriction</b></p> <p>The label value <b>&lt;arg__top_k&gt;</b> is <b>not</b> allowed.</p> </div>

Path	Field	Field Value Size or Length	Allowed Values
/data-manager/api/v3/ datasetSchemas	Dataset schema per-feature <a href="#">type</a>	<div> <div>↔ Sample Code</div> <pre>{   ...   "features": [{     "type":     "value"   }],   "labels":   [...],   ... }</pre> </div>	<ul style="list-style-type: none"> <li>CATEGORY</li> <li>NUMBER</li> <li>TEXT</li> </ul>
/data-manager/api/v3/ datasetSchemas	Dataset schema per-label <a href="#">type</a>	<div> <div>↔ Sample Code</div> <pre>{   ...   "features": [...],   "labels": [     {       "type":       "value"     }   ],   ... }</pre> </div>	<ul style="list-style-type: none"> <li>CATEGORY (used for the classification model templates, and business blueprints)</li> <li>NUMBER (used for the regression model template)</li> </ul>
/data-manager/api/v3/ datasets	Maximum request size for dataset upload	5 GB	
/model-manager/api/v3	Maximum request size for all model manager endpoints listed below	1 KB	

Path	Field	Field Value Size or Length	Allowed Values
/model-manager/api/v3/jobs	Model job <i>modelName</i>	Minimum: 1 character  Maximum: 56 characters	$^{\wedge}[a-zA-Z]([a-zA-Z0-9] _ -)*\$$ (regular expression)  <div> <p><b>Note</b></p> <p>Use <b>only</b> letters in the first character of the <b>&lt;value&gt;</b> for <i>modelName</i> (do not use numbers). From the second character onwards, use <b>only</b> alphanumeric characters, underscores "_", and hyphens "-". No spaces are allowed.</p> <p>For example: <b>&lt;Test_Model_Name_123-5&gt;</b> (allowed), <b>&lt;-Test_Model_123-5&gt;</b> (not allowed) and <b>&lt;_1_Test_Model_123-5&gt;</b> (not allowed).</p> </div>
/model-manager/api/v3/deployments	Model deployment <i>modelName</i>	Minimum: 1 character  Maximum: 56 characters	$^{\wedge}[a-zA-Z]([a-zA-Z0-9] _ -)*\$$ (regular expression)  <div> <p><b>Note</b></p> <p>Use <b>only</b> letters in the first character of the <b>&lt;value&gt;</b> for <i>modelName</i> (do not use numbers). From the second character onwards, use <b>only</b> alphanumeric characters, underscores "_", and hyphens "-". No spaces are allowed.</p> <p>For example: <b>&lt;Test_Model_Name_123-5&gt;</b> (allowed), <b>&lt;-Test_Model_123-5&gt;</b> (not allowed) and <b>&lt;_1_Test_Model_123-5&gt;</b> (not allowed).</p> </div>
/inference/api/v3/models/{model_name}/versions/1	Maximum request size for inference request	200 KB	

Path	Field	Field Value Size or Length	Allowed Values
/ inference/api/ v3/models/ {model_name}/ versions/1	Inference request <i>topN</i> <div> <p><b>Note</b></p> <p>For regression <i>topN</i> must be set to 1.</p> </div> <div> <p><b>Sample Code</b></p> <pre>{   ...   "topN" :     &lt;value&gt;,   ... }</pre> </div>	Minimum: 1 character  Maximum: 100 characters	
/ inference/api/ v3/models/ {model_name}/ versions/1	Inference request array <i>objects</i> <div> <p><b>Sample Code</b></p> <pre>{   ...   "objects"     : [],   ... }</pre> </div>	Minimum: 1 item in the <i>objects</i> list  Maximum: 50 items in the <i>objects</i> list	

Path	Field	Field Value Size or Length	Allowed Values
/ inference/api/ v3/models/ {model_name}/ versions/1	Inference request array <i>features</i>  <div> Sample Code <pre>{   ...    "objects"   : [{      "features"     : [ ]   }, ... ], }</pre> </div>	Minimum: 1 item in the <i>features</i> list  Maximum: 60 items in the <i>features</i> list and 1024 characters in the <value> for <i>features</i>	
/ inference/api/ v3/models/ {model_name}/ versions/1	Inference request <i>objectId</i>  <div> Sample Code <pre>{   ...    "objectId"   : &lt;value&gt;,   ... }</pre> </div>	Minimum: 1 character  Maximum: 255 characters	<b>^[a-zA-Z0-9]([a-zA-Z0-9] _ -)*\$</b> (regular expression)  <div> Note <p>You can use spaces in the &lt;value&gt; for <i>objectId</i> except in the first character that cannot be a number (use letters only).</p> <p>For example: &lt;Test Object Id 123-5&gt;.</p> </div>

## Related Information

[Free Tier Option and Trial Account Technical Constraints \[page 111\]](#)

## 12.1 Free Tier Option and Trial Account Technical Constraints

When using the free tier option for Data Attribute Recommendation or a trial account, be aware of the following technical limits:

### 📌 Note

The technical limits listed here:

- Are **only** relevant to users of the **Free** service plan for enterprise accounts and the **Standard** service plan for trial accounts. See [Service Plans \[page 32\]](#).
- Are applied on global account level
- Aren't reset, even when deleting dataset schemas, datasets, jobs or models

Variable	Maximum Limit
Number of dataset schemas	50
Number of datasets	20
Size of dataset	5 GB
Number of pending jobs	1
Number of trained models	10
Number of simultaneously deployed models	1
Number of record predictions	2000

### → Remember

When using a trial account, the response takes more time than usual:

- If you make an inference call more than an hour after you deployed the model.
- If you make an inference call more than an hour after the previous inference call.

For the subsequent inference calls, the response time is back to normal unless another hour already passed from the previous inference call.

# 13 Security

Get an overview on the security information that applies to Data Attribute Recommendation. Learn about the main security aspects of the service and its components.

## Related Information

[Technical System Landscape \[page 112\]](#)

[Security Aspects of Data, Data Flow and Processes \[page 114\]](#)

[User Administration, Authentication and Authorization \[page 115\]](#)

[Data Protection and Privacy \[page 116\]](#)

[Auditing and Logging Information \[page 120\]](#)

[Front-End Security \[page 123\]](#)

## 13.1 Technical System Landscape

This section provides an overview of the Data Attribute Recommendation architecture.

Data Attribute Recommendation consists of the following 3 applications:

- Data Manager
- Model Manager
- Inference

See the key responsibilities of each application in the table below.

Data Attribute Recommendation Applications

Application	Purpose
Data Manager	<ul style="list-style-type: none"><li>• Upload training data (dataset with dataset schema)</li><li>• Validate dataset quality</li><li>• Pre-process dataset</li><li>• List datasets and dataset schemas</li><li>• Delete datasets and dataset schemas</li></ul>



Application	Purpose
Model Manager	<ul style="list-style-type: none"> <li>• Start a new training job creating a model</li> <li>• List all training jobs</li> <li>• Delete training jobs</li> <li>• List all models</li> <li>• Quality check models</li> <li>• Delete models</li> <li>• Deploy models</li> <li>• List all deployments</li> <li>• Delete deployments</li> </ul>
Inference	Classify data records or predict the value of missing numerical attributes

Data Attribute Recommendation provides a set of RESTful application programming interfaces (APIs) to communicate with already existing applications. In the Data Attribute Recommendation RESTful APIs table, you can see a list of all available APIs of the Data Attribute Recommendation service. The communication to the APIs is secured via HTTPS protocol. The service provides no graphical user interface and it has no frontend.

#### Data Attribute Recommendation RESTful APIs

API	Purpose
Dataset Schema API	<ul style="list-style-type: none"> <li>• Upload new dataset schemas</li> <li>• List uploaded dataset schemas</li> <li>• Delete dataset schemas</li> </ul>
Dataset API	<ul style="list-style-type: none"> <li>• Upload new datasets</li> <li>• List uploaded datasets</li> <li>• Delete datasets</li> </ul>
Job API	<ul style="list-style-type: none"> <li>• Start model training</li> <li>• List all training jobs</li> <li>• Delete training jobs</li> </ul>
Model API	<ul style="list-style-type: none"> <li>• List all models</li> <li>• Delete models</li> </ul>
Deployment API	<ul style="list-style-type: none"> <li>• Deploy models</li> <li>• List all deployed models</li> <li>• Undeploy models</li> </ul>
Inference API	Classify data records or predict the value of missing numerical attributes

## 13.2 Security Aspects of Data, Data Flow and Processes

This section provides an overview of the data flow of Data Attribute Recommendation.

Data Attribute Recommendation uses services from SAP AI Core to train a new machine learning model on the customer data and to make this model available for inference to customers.

The Data Attribute Recommendation Data Flow table below details the security aspects to be considered in the data processing steps.

Data Attribute Recommendation Data Flow

Step	Description	Security Measure
<b>Upload training data (dataset and dataset schema)</b>	Client application uploads training data to Data Attribute Recommendation. Data Attribute Recommendation saves training data on the Object Store service from SAP BTP.	Only authorized users of SAP Business Technology Platform (SAP BTP) in Cloud Foundry environment can upload data to the service.  The communication between Data Attribute Recommendation and SAP BTP services happens via HTTPS protocol.
<b>Validate training data</b>	Data Attribute Recommendation automatically validates the data quality on file upload and informs customers about issues (if any).	The communication between Data Attribute Recommendation and SAP BTP services happens via HTTPS protocol.
<b>Transport trained model</b>	Once a training of a machine learning model succeeds, Data Attribute Recommendation automatically transfers the trained model to the Object Store service from SAP BTP.	The communication between Data Attribute Recommendation and SAP BTP services happens via HTTPS protocol.

Step	Description	Security Measure
<b>Deploy trained model</b>	On model deployment, Data Attribute Recommendation copies the trained model from the Object Store service from SAP BTP to SAP AI Core. The copy on Model Server is deployed to model runtime where it can be used for inference.	The communication between Data Attribute Recommendation and SAP BTP services happens via HTTPS protocol.
<b>Provide records to classify data records or predict missing attributes</b>	Client application provides to Data Attribute Recommendation records to classify or predict missing attributes.  Data Attribute Recommendation sends the validated records to SAP AI Core for inference.	Only authorized users of SAP BTP in Cloud Foundry environment can send data for inference to the service.  The communication between Data Attribute Recommendation and SAP BTP services happens via HTTPS protocol.

## 13.3 User Administration, Authentication and Authorization

### Introduction

Data Attribute Recommendation uses the standard user authentication and authorization mechanisms provided by SAP Business Technology Platform (SAP BTP) for Cloud Foundry, in particular the user account and authentication service. For more information, see [User Account and Authentication Service of the Cloud Foundry Environment](#).

To use Data Attribute Recommendation, the service customer should create an instance of the service and generate a service key. For more information on how to perform this task, see [Using Services in the Cloud Foundry Environment](#).

The service key contains credentials that allow the business user to retrieve a JWT token necessary for secure communication with the application. Customers are authorized by having a valid JWT token. For more information on this topic, see [Security](#).

## User Administration and Provisioning

The application does not manage or provision users.

## Delivered Default Users

There are no default users.

## Tenants

A tenant is a technical entity that represents a customer as an organization on SAP BTP. Different instances of Data Attribute Recommendation service are isolated. Thus, the service does not allow data share between the different service instances even if they belong to the same business user.

## Standard Roles

The table below shows the standard roles that are used by Data Attribute Recommendation.

Data Attribute Recommendation Standard Roles

Role	Description
Technical user	The single role currently supported by the service. The same access token may be used to access all service's APIs.

## 13.4 Data Protection and Privacy

### Introduction

Data protection is associated with numerous legal requirements and privacy concerns. In addition to compliance with general data privacy acts, it is necessary to consider compliance with industry-specific

legislation in different countries or regions. This section describes the specific features and functions that SAP provides to support compliance with the relevant legal requirements and data privacy.

This section and any other sections in this Security Guide do not give any advice on whether these features and functions are the best method to support company, industry, regional or country/region-specific requirements. Furthermore, this guide does not give any advice or recommendations with regard to additional features that would be required in a particular environment; decisions related to data protection must be made on a case-by-case basis and under consideration of the given system landscape and the applicable legal requirements.

### Note

SAP software supports data protection by providing security features and specific data protection-relevant functions such as functions for the simplified blocking and deletion of personal data. SAP does not provide legal advice in any form. The definitions and other terms used in this document are not taken from any given legal source.

The Data Attribute Recommendation service generally requires the following types of data:

Data required by Data Attribute Recommendation

Data	Purpose
Training Dataset	A set of features together with the labels used to train a machine learning model.
Dataset Schema	<p>A meta-description of the dataset. It should define the names of each single feature and label columns as well as their type.</p> <p>Currently only three types of features are supported: number, text and category. Labels can only be categories.</p>
Data for Inference	<p>A set of features to be predicted or assigned to one or more labels specified by the dataset schema.</p> <p>The test data should reference the features in the dataset schema used to train the machine learning model.</p>

## Glossary

The following terms are general to SAP products. Not all terms may be relevant for this SAP product.

Term	Definition
Blocking	A method of restricting access to data for which the primary business purpose has ended.
Business purpose	The legal, contractual, or in other form justified reason for the processing of personal data to complete an end-to-end business process. The personal data used to complete the process is predefined in a purpose, which is defined by the data controller. The process must be defined before the personal data required to fulfill the purpose can be determined.
Deletion	Deletion of <b>personal data</b> so that the data is no longer available.

Term	Definition
Personal data	Any information relating to an identified or identifiable natural person ("data subject"). An identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier, or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural, or social identity of that natural person.

## Consent

According to Personal Data Processing Agreement for SAP Cloud Services, SAP acts as data processor. Thus, customers are responsible for obtaining relevant consent to process personal data, including when applicable approval by controllers to use SAP as a processor.

## Deletion of Personal Data

The Data Attribute Recommendation service has no mechanism for determining the type of data it processes. This means that the service can't determine whether this data includes personal data, which is subject to the data protection laws applicable in specific countries/regions. Therefore, no dedicated functionality for the deletion of personal data is available. You can delete data uploaded to or created by the service any time. See the tables below for more details on how to delete training datasets, dataset schemas, and data for inference.

### Note

All data associated to a tenant (see [User Administration, Authentication and Authorization \[page 115\]](#)) is automatically deleted by the off-boarding process triggered with the deletion of the service instance.

### → Tip

For more information on how to consume the service using the native Data Attribute Recommendation APIs, see [API Reference \[page 43\]](#).

For more information on how to consume the service using the AI API from SAP AI Core, see [Consuming the Service via AI API \[page 67\]](#).

## Deletion of uploaded data: native APIs

HTTP Method	Path	Description
DELETE	<code>/data-manager/api/v3/ datasetSchemas/ {dataset_schema_id}</code>	Delete a dataset schema with data-set_schema_id. A schema cannot be deleted until all datasets that use it are deleted.

HTTP Method	Path	Description
DELETE	/data-manager/api/v3/datasets/{dataset_id}	Delete a dataset with dataset_id. Only datasets that are not used by any training job can be deleted.
DELETE	/model-manager/api/v3/jobs/{job_id}	Delete a training job with job_id. Only jobs without assigned models can be deleted.
DELETE	/model-manager/api/v3/models/{model_name}	Delete a trained machine learning model with model_name. Only undeployed models can be deleted.
DELETE	/model-manager/api/v3/deployments/{deployment_id}	Undeploy a trained machine learning model with deployment_id. Only undeployed models can be deleted.

### Deletion of uploaded data: AI API

HTTP Method	Path	Description
DELETE	/model-manager/v2/lm/files/{folderName}/{datasetFile}	Delete dataset.
DELETE	/model-manager/v2/lm/files/{folderName}/{datasetSchemaFile}	Delete dataset schema.
DELETE	/model-manager/v2/lm/executions/{executionId}	Delete training execution.
DELETE	/model-manager/v2/lm/deployments/{deploymentId}	Delete deployment.

#### → Remember

As of version 3.0 of the executables, Data Attribute Recommendation automatically deletes the dataset and dataset schema used to train a model once training execution reaches its final status ("COMPLETED" or "DEAD").

To prevent the service from deleting the dataset and schema, you can change this default behavior by setting the `deleteAfterTraining` parameter to `false` when you create the [Training Configuration \[page 85\]](#).

## Read Access Logging

The training data used by Data Attribute Recommendation is controlled and managed by the consuming application/customer which calls the Data Attribute Recommendation APIs. However, the service does not

have any means to verify whether the data uploaded to the service contains any personal information. Therefore, it is not possible for Data Attribute Recommendation to support logging of read access to (sensitive) personal data.

## Information Report

The training data used by Data Attribute Recommendation is controlled and managed by the consuming application/customer which calls the Data Attribute Recommendation APIs. Data Attribute Recommendation does not have any means to verify whether the data uploaded to the service contains any personal data. Therefore, it is not possible for Data Attribute Recommendation to provide a retrieval function to identify data of specific individuals. It is recommended that the consuming application/customer which uses Data Attribute Recommendation provides personal data reports to its users about the data being stored and transferred to Data Attribute Recommendation for processing.

## Change Log

The training data used by Data Attribute Recommendation is controlled and managed by the consuming application/customer which calls the Data Attribute Recommendation APIs.

### Change logging of personal data in Data Attribute Recommendation

Data Attribute Recommendation does not have any means to verify whether the data uploaded to the service contains any personal data. Neither does it allow any change to the content of the uploaded data. Therefore, Data Attribute Recommendation does not support logging of personal data change.

### Change logging of training/test data in Data Attribute Recommendation

Data Attribute Recommendation does not provide means to change the uploaded training data directly. Nonetheless, the training and inference applications as part of Data Attribute Recommendation perform some basic preprocessing of the training and test data, respectively. However, this activity only changes the format of the input data at runtime and does not affect the content of the data, meaning no changes in the stored data occur.

The preprocessing steps depend on the type of the provided data (only numbers, text or categories are allowed) and include, for example, such formatting operations as lowercasing, deletion of repetitive spaces, deletion of empty instances, normalization of numerical features.

## 13.5 Auditing and Logging Information

Here you can find a list of the security events that are logged by the Data Attribute Recommendation service.



Security events written in audit logs

Event grouping	What events are logged	How to identify related log events	Additional information
Dataset related events	Creation of a new dataset	'data': New dataset with id {dataset_id} was created, 'time': {time}	<p>See below the definitions of the notations used in the log events.</p> <ul style="list-style-type: none"> <li>• {dataset_id}: ID of the dataset.</li> <li>• {dataset_schema_id}: ID of the dataset schema.</li> <li>• {deployment_id}: ID of the deployment.</li> <li>• {job_id}: ID of the training job.</li> </ul>
	Dataset status update	'object_id': {dataset_id}, 'new_attributes': {new_attributes}, 'time': {time}, 'success': {true false}	
	Deletion of a dataset	'object_id': {dataset_id}, 'time': {time}, 'success': {true false}	
Dataset schema related events	Creation of a new dataset schema	'data': New dataset schema with id {dataset_schema_id} was created, 'time': {time}	<ul style="list-style-type: none"> <li>• {model_name}: name of the machine learning model.</li> <li>• {new_attributes}: the meaning depends on the business objects listed below.</li> </ul>
	Deletion of dataset schema	'object_id': {dataset_schema_id}, 'time': {time}, 'success': {true false}	
Job related events	Creation of a new job	'data': New training job with id {job_id} was created, 'time': {time}	<ul style="list-style-type: none"> <li>• When a job is updated, the following attributes are updated respectively: <ul style="list-style-type: none"> <li>• status</li> <li>• message</li> <li>• progress</li> <li>• ended_at</li> </ul> </li> <li>• When a model is updated, the following attributes are updated respectively: <ul style="list-style-type: none"> <li>• accuracy</li> <li>• f1_score</li> <li>• precision</li> <li>• recall</li> <li>• mean_squared_error</li> <li>• mean_absolute_percentage_error</li> </ul> </li> </ul>
	Job status update	'object_id': {job_id}, 'new_attributes': {new_attributes}, 'time': {time}, 'success': {true false}	
	Deletion of a job	'object_id': {job_id}, 'time': {time}, 'success': {true false}	
Model activation related events	Model activation	'object_id': {deployment_id}, 'time': {time}, 'success': {true false}	<ul style="list-style-type: none"> <li>• accuracy</li> <li>• f1_score</li> <li>• precision</li> <li>• recall</li> <li>• mean_squared_error</li> <li>• mean_absolute_percentage_error</li> </ul>
	Activated model updated	'object_id': {deployment_id}, 'new_attributes': {new_attributes}, 'time': {time}, 'success': {true false}	
	Model deactivation	'object_id': {deployment_id}, 'time': {time}, 'success': {true false}	

Event grouping	What events are logged	How to identify related log events	Additional information
Model creation related events	Creation of a new model	'data': New model with id {job_id} was stored in DB, 'time': {time}	<ul style="list-style-type: none"> <li>mean_absolute_error</li> </ul> <div> <p><b>Note</b></p> <p>The updated attributes vary according to the selected model template or business blueprint. See <a href="#">Model Templates [page 60]</a> and <a href="#">Business Blueprints [page 61]</a>.</p> </div>
	Model attributes update	'object_id': {model_name}, 'new_attributes': {new_attributes}, 'time': {time}, 'success': {true false}	
	Deletion of a model	'object_id': {model_name}, 'time': {time}, 'success': {true false}	
Tenant related events	Tenant not found	'data': Tenant is not onboarded, 'time': {time}	<ul style="list-style-type: none"> <li>When a deployment is activated or updated, the following attributes are updated respectively: <ul style="list-style-type: none"> <li>name</li> <li>status</li> <li>deployment_id</li> <li>created_at</li> </ul> </li> <li>When a dataset is updated, the following attribute is updated: <ul style="list-style-type: none"> <li>status</li> </ul> </li> <li>'success': it can have one of two possible values (true or false).</li> <li>{time}: time stamp of when a log was created. You can use time stamps to sort the logs by time.</li> </ul> <p>See also <a href="#">Concepts [page 28]</a> and <a href="#">API Reference [page 43]</a>.</p>
	Access of non-existing resource. Use of SAP tenant or customer tenant depends on tenant initiating request.	'data': Attempt to access not existing route: {url}, 'time': {time}	

## Related Information

[Audit Logging in the Cloud Foundry Environment](#)

## 13.6 Front-End Security

Data Attribute Recommendation does not have any user interface component. All functionalities are delivered via web services, JSON over HTTPS.

The service is a backend-only service component and not designed to be invoked by a web browser. Additionally, outputs returned by the service depend on the data submitted to it. Therefore, a consumer of the service should sanitize the data submitted to the service and returned by it to avoid script injection attack.

# 14 Accessibility Features in Data Attribute Recommendation

To optimize your experience of Data Attribute Recommendation, SAP Business Technology Platform (SAP BTP) provides features and settings that help you use the software efficiently.

## Note

Data Attribute Recommendation runs on the SAP BTP cockpit. For this reason, the accessibility features for SAP BTP cockpit apply. For more information, see the accessibility documentation for SAP BTP cockpit on SAP Help Portal at [Accessibility Features in SAP BTP Cockpit](#).

For more information on keyboard handling for SAPUI5 UI elements and screen-reader support for SAPUI5 controls, see [Accessibility for End Users](#).

# 15 Monitoring and Troubleshooting

See answers to frequently asked questions, and find out how to get support.

## Related Information

[FAQ \[page 125\]](#)

[Getting Support \[page 128\]](#)

## 15.1 FAQ

This section provides answers to frequently asked questions about Data Attribute Recommendation.

### What is Data Attribute Recommendation?

Data Attribute Recommendation uses free text, numbers and categories as input to classify entities such as products, stores and users into multiple classes and also to predict the value of missing numerical attributes in your data records. You can use Data Attribute Recommendation, for example, to classify incoming product information and predict the price of commodities based on their description.

### What are the prerequisites to use Data Attribute Recommendation?

For a list of Data Attribute Recommendation prerequisites, see [Initial Setup \[page 37\]](#).

### What machine learning technology is used in Data Attribute Recommendation?

Data Attribute Recommendation uses a variety of machine learning algorithms (including neural networks) to solve classification and regression tasks.

## Can Data Attribute Recommendation be used on premise?

No. Currently the service is available only on SAP Business Technology Platform (Cloud Foundry environment).

## What kinds of training data can be processed by Data Attribute Recommendation?

Data Attribute Recommendation supports tabular data in CSV file format only. The data can contain several columns of different types. Currently, the following types are supported:

- **CATEGORY:** a column of this type define a finite set of allowed values, whereby each record in the column has exactly one value from the set (for example, a column color with three available values: red, yellow, green).
- **NUMBER:** columns of this type represent real or integer numbers (for example, price and size).
- **TEXT:** records in the columns of this type may contain arbitrary text. Currently, only UTF-8 encoding is supported.

## Which languages does Data Attribute Recommendation support?

Data Attribute Recommendation supports UTF-8 encoding and is, therefore, multilingual. The current machine learning model available in Data Attribute Recommendation uses the space character as word delimiter, therefore it may have poor performance on languages with a non-trivial word segmentation, for example, Chinese, Japanese and Vietnamese.

## Can Data Attribute Recommendation be used without training step?

To guarantee better performance, the machine learning algorithm should be trained on the customer specific data. Therefore Data Attribute Recommendation does not allow to skip the training step to classify or predict data records directly.

## Does the quality of the model depend on the amount of data?

Yes. The amount of data has an effect on the machine learning algorithm. Very little data can negatively influence the generalization ability of the model and, hence, results in poor accuracy. Having a large amount of data demands an increase in the number of learning iterations and, therefore, a longer training time.

## What is the minimum dataset size recommended for training a machine learning algorithm?

We recommend to provide at least 3.000 records for training.

## What values are used to measure Data Attribute Recommendation performance on specific data?

In order to measure the performance of the trained models on unseen records, one part of the provided data is held out from the training process and is used to evaluate the performance of the algorithm.

- For classification the following metrics are considered:
  - **Accuracy**: percentage of correctly predicted records. The higher the better.
  - **F1 score**: harmonic mean of precision and recall. The higher the better.
  - **Precision**: ability of the model to assign only the relevant records to the correct attributes. The higher the better.
  - **Recall**: ability of the model to find all the records belonging to the correct attributes. The higher the better.
- For regression the following metrics are considered:
  - **Mean absolute error (MAE)**: average absolute difference between the predicted values and the actual value. The lower the better.
  - **Mean absolute percentage error (MAPE)**: average of the absolute percentage errors of the predictions. The lower the better.

### Note

For predictions which are too high there is no upper limit to the percentage error, resulting in values that may exceed 100%.

- **Mean squared error (MSE)**: average squared difference between the predicted values and the actual value. The lower the better.

## Does the service provides a possibility to train the machine learning algorithm incrementally?

No.

## How long does it take to train a machine learning model?

The training time depends on the size of the training dataset. A bigger training dataset would lead to a longer training time. For each model, Data Attribute Recommendation shows the progress of the training process.

## What is the maximum size of the data file one can upload to the service?

The size of uploaded files is limited to 5GB.

## 15.2 Getting Support

If you encounter an issue with this service, we recommend to follow the procedure below.

### Check Platform Status

Check the availability of the platform at [SAP Trust Center](#).

For more information about selected platform incidents, see [Root Cause Analyses](#).

### Check Guided Answers

In the SAP Support Portal, check the [Guided Answers](#) section for SAP Business Technology Platform. You can find solutions for general platform issues as well as for specific services there.

### Contact SAP Support

You can report an incident or error through the SAP Support Portal. For more information, see [Getting Support](#).

Please use the following component for your incident:

Component Name	Component Description
CA-ML-DAR	Data Attribute Recommendation

When submitting the incident, we recommend including the following information:

- Region information (Canary, EU10, US10, for example)
- Subaccount technical name
- The URL of the page where the incident or error occurs
- The steps or clicks used to replicate the error
- Screenshots, videos, or the code entered





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