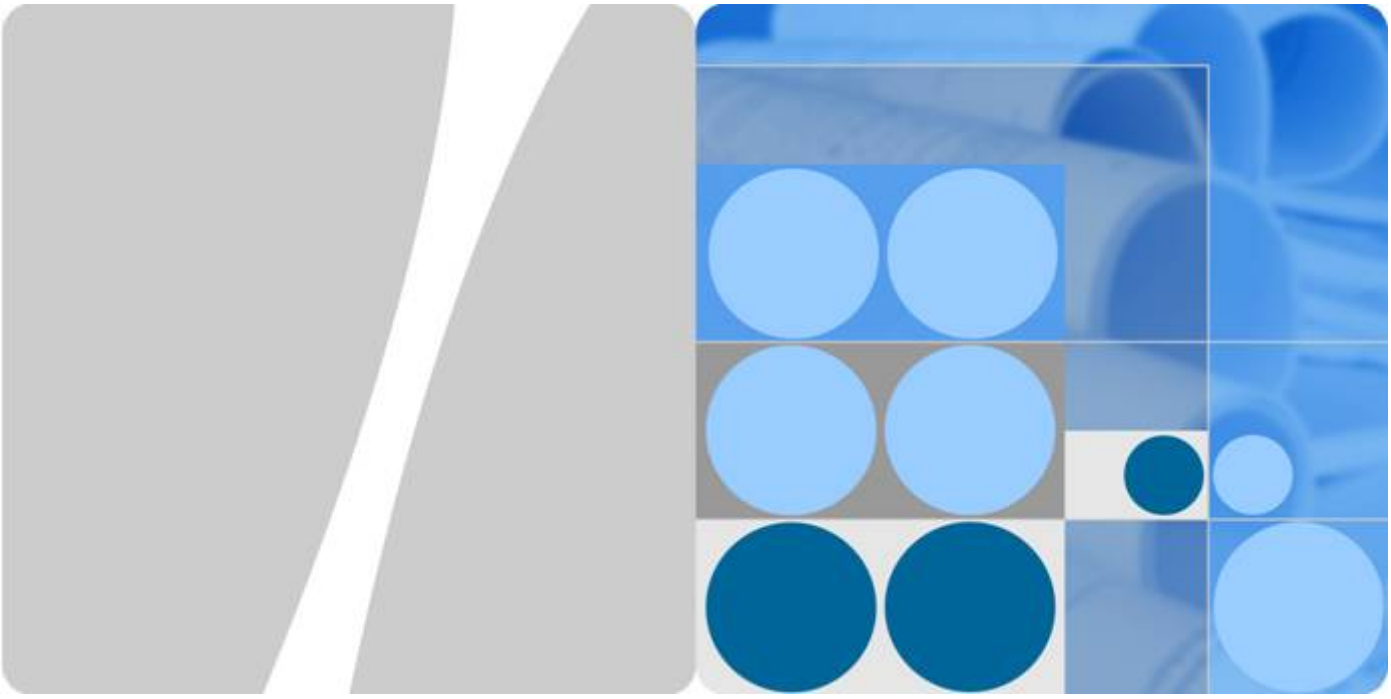

ModelArts Pro

User Guide

Issue 01

Date 2020-10-19

HUAWEI TECHNOLOGIES CO., LTD.

HUAWEI

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1 Preparations

1.1 Registering a HUAWEI CLOUD Account

Register a HUAWEI CLOUD account. With this account, you can use all services on HUAWEI CLOUD and only need to pay for the services you use.

Go to the HUAWEI CLOUD official website and register an account by following the instructions in **Registering a HUAWEI ID and Enabling HUAWEI CLOUD Services**.

After the registration is successful, you can automatically log in to HUAWEI CLOUD. You can use the service only after completing real-name authentication. For details, see **Real-Name Authentication Overview**.

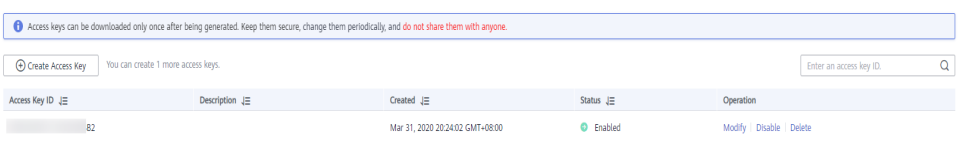
1.2 Obtaining the Access Key and Configuring ModelArts

ModelArts Pro depends on ModelArts for model training and application deployment. Therefore, before using ModelArts Pro, you need to obtain the access key and add it on the ModelArts console.

Obtaining an Access Key

1. Log in to HUAWEI CLOUD, enter the **My Credentials** page, and choose **Access Keys > Create Access Key**. See **Figure 1-1**.

   Figure 1-1 Clicking **Create Access Key**

2. In the **Create Access Key** dialog box that is displayed, enter the verification code received by SMS or email. See **Figure 1-2**.

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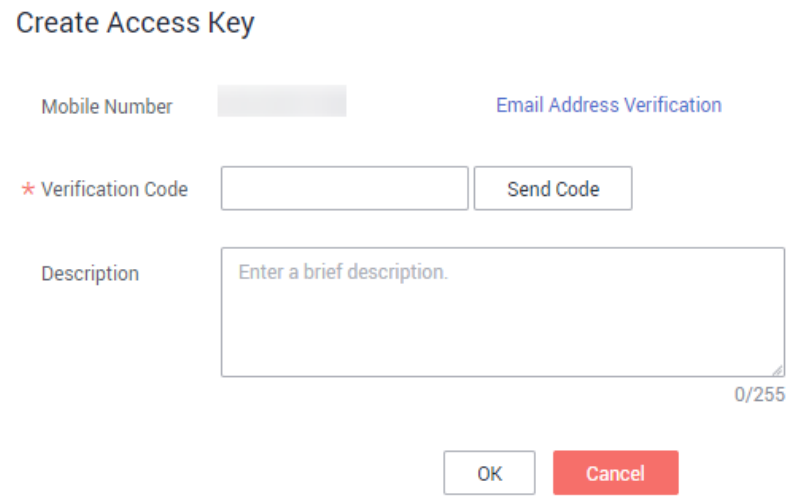
Figure 1-2 Creating an access key



3. Click **OK** and save the access key file as prompted. The access key file is saved in the default download folder of the browser. Open the **credentials.csv** file to view the access key (**Access Key Id** and **Secret Access Key**).

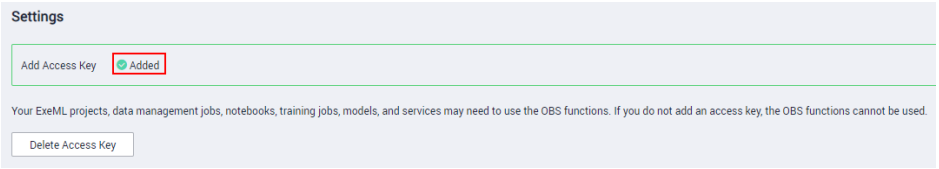
Adding an Access Key

1. Log in to the **ModelArts management console**. In the left navigation pane, click **Settings**. The **Settings** page is displayed.
2. Click **Create Access Key** and enter the obtained access key.
   - **AK**: Enter the value of the **Access Key Id** field in the key file.
   - **SK**: Enter the value of the **Secret Access Key** field in the key file.

   NOTE

   - Ensure that the entered AK and SK are obtained using the current account.
   - If the system displays a message indicating that the AK/SK are unavailable when you add the access key, the account may be in arrears or frozen. For details about the solution, see **What Can I Do If the System Displays a Message Indicating that the AK/SK Are Unavailable?**.
3. Click **OK**. The access key is added.

Figure 1-3 Access key added



1.3 Creating an OBS Bucket

ModelArts Pro uses OBS to store data for model training with a workflow, achieving secure, reliable, and low-cost storage. Therefore, before using ModelArts Pro, create an OBS bucket and folders for storing data.

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Procedure

1. Log in to the **OBS console** and create an OBS bucket. For details, see **Creating a Bucket**. For example, create an OBS bucket named **modelarts-pro**.

   NOTE

   The created OBS bucket and ModelArts Pro are in the same region. For example, if ModelArts Pro is located in **CN North-Beijing4**, select **CN North-Beijing4** when creating a bucket.

2. Create a folder to store data. For details, see **Creating a Folder**. For example, create a folder named **ocr** in the created **modelarts-pro** OBS bucket.

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2 OCR Suite

2.1 Introduction

OCR Suite helps you quickly build OCR services that meet specific service requirements and extract structured information from forms of different formats with rich OCR algorithms.

For details about OCR Suite, see **Service Overview**.

Preset Workflows

OCR Suite provides a single-template workflow and multi-template workflow, which you can use to create an OCR template for text recognition in images and high-precision OCR model to extract structured information from images.

- General single-template workflow

  This workflow allows you to create an OCR template for character recognition in images and high-precision OCR model to extract structured information from images.
- Multi-template classification workflow

  This workflow allows you to customize multiple character recognition templates, which are automatically identified and used by images through model training and from which structured information is extracted. This workflow is generally applied into the logistics industry.

For details, see **Service Overview > OCR Suite**.

Prerequisites

- You have completed the preparations as described in **Preparations**.
- You have applied for OCR Suite as described in **Enabling OCR Suite** if you use it for the first time.

Enabling OCR Suite

OCR Suite is in the open beta test (OBT) phase. If you are a first-time OCR Suite user, apply for the OBT permission first.

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Log in to the ModelArts Pro console and click **Apply for OBT** on the **OCR Suite** card. On the page that is displayed, enter the required information as prompted.

After the application is submitted, click **Go to Open Beta Tests**, and the **My Open Beta Tests** page is displayed. If **Audit Status** is **Approved**, you have obtained the OBT permission for OCR Suite.

Process for Using a Preset Workflow to Develop an Application

OCR Suite provides a single-template workflow and multi-template workflow, which you can use to create an OCR template for text recognition in images. It also provides a high-precision OCR model to extract structured information from images.

Figure 2-1 Process for using a preset workflow to develop an application

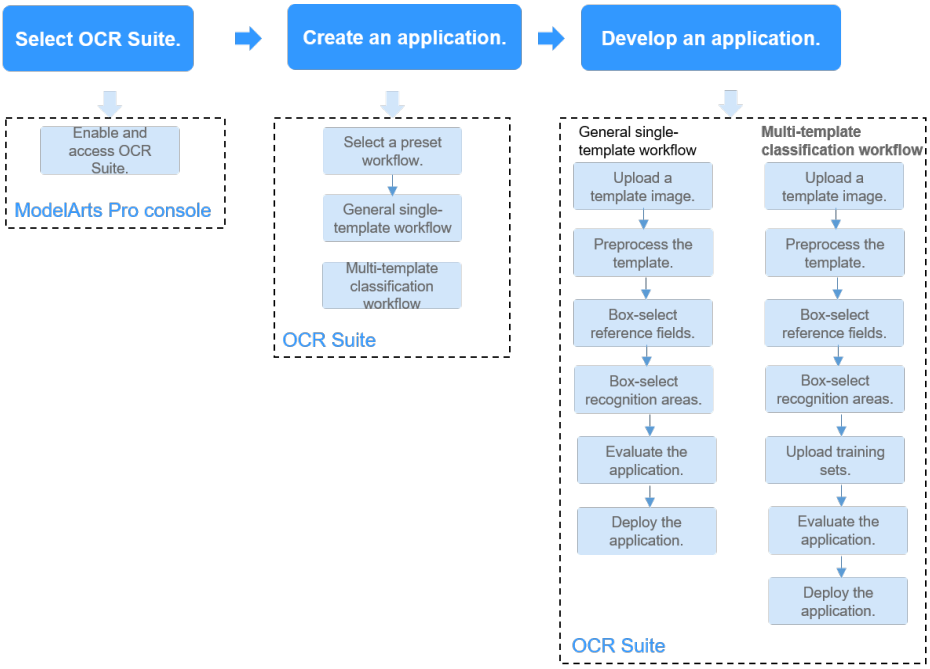

Table 2-1 Process flow

Step	Description	Reference
Select OCR Suite.	Select OCR Suite based on you needs. Alternatively, you can view the workflow to locate the required suite.	On the ModelArts Pro console, click **Access** on the OCR Suite card to access the OCR Suite console.
Create an application.	After subscribing to a workflow, create an application by entering basic information and selecting a workflow.	**Creating an Application**

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Step		Description	Reference
Develop an application.	General single-template workflow	Create a single-template service according to instructions of the workflow to train an OCR model, which extracts structured information from single-template images.	Introduction
	Multi-template classification workflow	Create a multi-template service according to instructions of the workflow to train a classifier and OCR model, which extract structured information from multi-template images.	Introduction

2.2 Configuring the OBS Storage Location

The template images and test images uploaded when you use ModelArts Pro are stored in OBS. Therefore, you need to configure the OBS storage location before using OCR Suite.

Prerequisites

You have registered a HUAWEI CLOUD account, authorized related services, created OBS buckets, and completed other preparations. For details, see **Preparations**.

Procedure

1. On the ModelArts Pro console, click **Access** on the OCR Suite card.

   The OCR Suite console is displayed.

2. In the navigation pane on the left, choose **Configuration Center** > **Basic Configuration**.

   The **Basic Configuration** page is displayed.

3. Click **Modify** next to **Default Storage Location** under **Storage**.

   The **Default Storage Location** dialog box is displayed.

4. In the dialog box that is displayed, select an OBS bucket and folder and click **OK**.

   The OBS storage location is configured.

Follow-up Operations

You can create an application as described in **Creating an Application** and develop it based on a preset workflow on the **ModelArts Pro**> **OCR Suite** console.

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2.3 Creating an Application

Before developing an application with a preset workflow on the ModelArts Pro console, you need to create an application by entering basic information and selecting a workflow.

Prerequisites

- Ensure that the HUAWEI CLOUD account is not in arrears. Developing applications on the ModelArts Pro console may occupy OBS resources and incur fees. For details about the billing rules, see **OBS Pricing Details**.
- You have configured the OBS path for storing test data and training data. For details, see **Configuring the OBS Storage Location**.

Procedure

1. On the ModelArts Pro console, click **Access** on the OCR Suite card.

   The OCR Suite console is displayed.
2. In the navigation pane on the left, choose **AppDev** > **Workbench**.

   The **My Applications** page is displayed by default.
3. On the **My Applications** page, click **Create Application**.

   The **Create Application** page is displayed.

   Alternatively, you can click **My Workflows** to switch to the **My Workflows** page, select a workflow, and click **Create Application** on the card.
4. Specify **Application Name**, **Owner**, **Description**, **Industry**, and **Workflow** based on the service requirements.
5. Confirm the information and click **OK**.

   An application is successfully created.

Follow-up Operations

Develop the application based on the selected workflow.

General Single-Template Workflow

Multi-Template Classification Workflow

2.4 General Single-Template Workflow

2.4.1 Introduction

Workflow Overview

- Functions

  This workflow allows you to create an OCR template for character recognition in images and high-precision OCR model to extract structured information from images.

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- Application scenarios
  - User authentication

    Recognition of key information on certificates, reducing manual input and real-name authentication costs, while improving efficiency and accuracy
  - Express waybill filling

    Recognition of contact information in screenshots and automatic generation of express waybills, eliminating the need for manual input
  - Contract upload and review

    Recognition of structured information and extraction of signatures and seals for quick review
- Advantages
  - Business efficiency is improved after no manual input and multi-language competency required.
  - One-click deployment enables quick output of high-precision structured data.

Workflow Process

After creating an application using the general single-template workflow on the **ModelArts Pro** > **OCR Suite** page, you can create a single-template service to train an OCR model, which extracts structured information from single-template images.

Figure 2-2 Process for developing a single-template application



Table 2-2 Process description

Step	Description	Reference
Upload a template image.	Upload an image as the template for training an OCR model.	**Uploading a Template Image**
Preprocess the template.	Preprocess the template. Retain the key content and remove the redundant part to ensure that the image content is clear and the model recognition is accurate.	**Preprocessing the Template**
Box-select reference fields.	Box-select reference fields in the template to check the consistency between images to be identified and the template.	**Box-selecting Reference Fields**
Box-select recognition areas.	Box-select recognition areas in the template to determine the position of the text to be identified.	**Box-selecting Recognition Areas**

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Step	Description	Reference
Evaluate an application.	Upload a test image that has the same format as the template image to evaluate whether the recognition result is correct.	**Evaluating an Application**
Deploy an application.	Deploy the template to OCR Suite and develop your own OCR application. You can use this application to recognize images with the same format as the template you uploaded.	**Deploying an Application**

2.4.2 Uploading a Template Image

Before using the single-template workflow to create an application, you need to specify an image as the template for training an OCR model based on your needs. For example, if an invoice image is uploaded as a template, the trained OCR model can identify and extract key fields from invoices in the same format.

Prerequisites

- You have obtained related permissions of ModelArts and OBS.
- You have created an application using the general single-template workflow on the OCR Suite console. For details, see **Creating an Application**.

Accessing the Application Development Page

1. Log in to the **ModelArts Pro > OCR Suite** console.

   The **AppDev** > **Workbench** page is displayed by default.

2. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   Go to the **Application Assets** page.

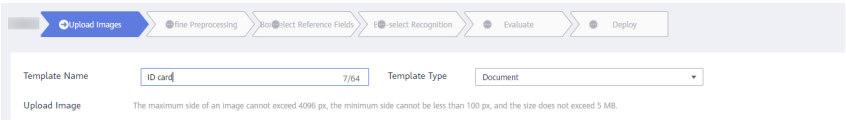
3. Click **Create Template** on the **Templates** page.

   Go to the **Application Development** page and start to develop an application.

Uploading a Template Image

Choose **Application Development** > **Upload Images** and configure the following parameters:

Figure 2-3 Uploading a template image



Template Name: Enter a template name.

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Template Type: Select a template type. The options are **Document**, **General**, and **Ticket and certificate**.

Upload Image: Click the image upload area or drag an image to the image upload area to upload a local image as a template used for recognizing structured information from images.

After confirming configurations, click **Next**. Step **Preprocessing the Template** is displayed. Preprocess the uploaded template image, such as automatically rotating the image and removing the seal.

2.4.3 Preprocessing the Template

After uploading a template image, you need to preprocess it, such as rotate or crop the image, or reduce the noise. The purpose is to retain the key content and remove the redundant part to ensure that the image content is clear and the model recognition is accurate.

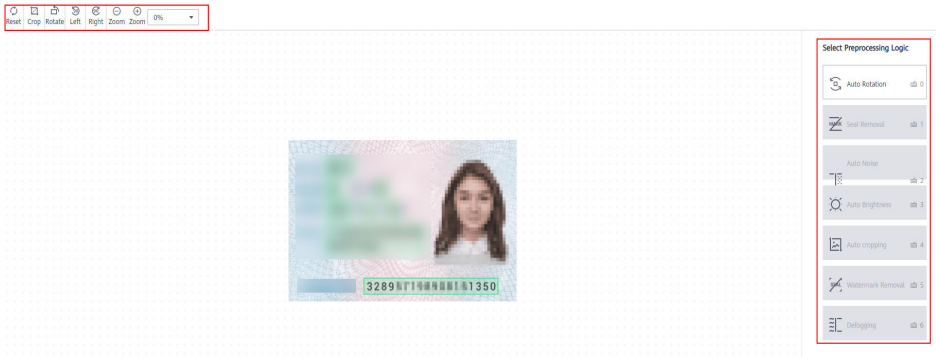
Prerequisites

You have created an application using the general single-template workflow and uploaded a template image on the OCR Suite console. For details, see **Uploading a Template Image**.

Preprocessing the Template

Choose **Application Development** > **Define Preprocessing**, you can select a shortcut option to quickly process the template image or adjust it by following the instructions in the upper left corner.

Figure 2-4 Preprocessing the template



Select the required operation in the **Select Preprocessing Logic** area on the right. Currently, **Auto Rotation** and **Seal Removal** are supported.

- **Auto Rotation**: When you select this option, the system automatically rotates the image with incorrect text direction to the correct direction.
- **Seal Removal**: When you select this option, the system automatically removes the seal on the image to ensure recognition accuracy.

Alternatively, you can click the following operation icons in the upper left corner of the page to adjust the size, direction, and other properties of the template image:

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: Click to reset the image to the initial status, that is, the unprocessed status.

: Click to adjust the cropping range in the **Crop Image** window and click **Crop** to resize the image.

: Click to adjust the image direction. Left-click on in the **Rotate Image** window, hold down the left mouse button and drag your mouse in the direction you want to rotate the image, and click **OK**.

: Click to rotate the image 90 degrees leftwards.

: Click to rotate the image 90 degrees rightwards.

: Click to zoom out the image.

: Click to zoom in the image.

: Click to select an image zoom percentage.

When preprocessing is complete, click **Next** to go to step **Box-selecting Reference Fields**.

2.4.4 Box-selecting Reference Fields

Reference fields are fields that are referred when a model checks consistency between images to be recognized and the template image during OCR. Images to be recognized contain reference fields, and the positions of the reference fields are fixed.

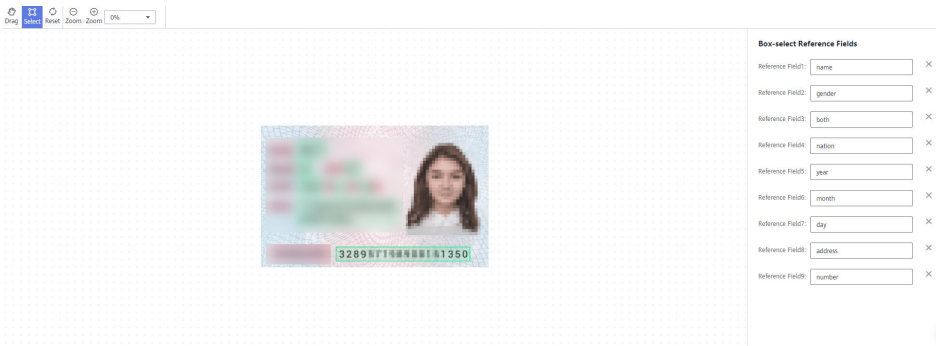
Therefore you need to box-select the reference fields in the template image first so that the model is able to check the image format by identifying the reference fields.

Prerequisites

You have created an application using the general single-template workflow and preprocessed the template image you uploaded on the OCR Suite console. For details, see **Preprocessing the Template**.

Procedure

Figure 2-5 Box-selecting reference fields



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1. Choose **Application Development** > **Box-select Reference Fields**. Click operation icons in the upper left corner to adjust the size of the template image.
2. Click , move the pointer to the upper left corner of the reference field, and box-select the reference field.
   - A reference field contains fixed content in a fixed position.
   - Select the text that does not appear repeatedly in an image as the reference field.
   - Select the text that is horizontally displayed in one line.
   - Select more than four reference fields, which are scattered in four corners of an image.
   - Select an independent text block, instead of parts of a text block, for better recognition precision.
3. Verify whether the reference field in the right box is the same as the box-selected one.
4. When box-selecting and verifying all reference fields, click **Next** to go to step **Box-selecting Recognition Areas**.

2.4.5 Box-selecting Recognition Areas

A recognition area refers to the position where the text to be recognized resides. Images to be recognized contain fields in recognition areas and the positions of the recognition areas are fixed.

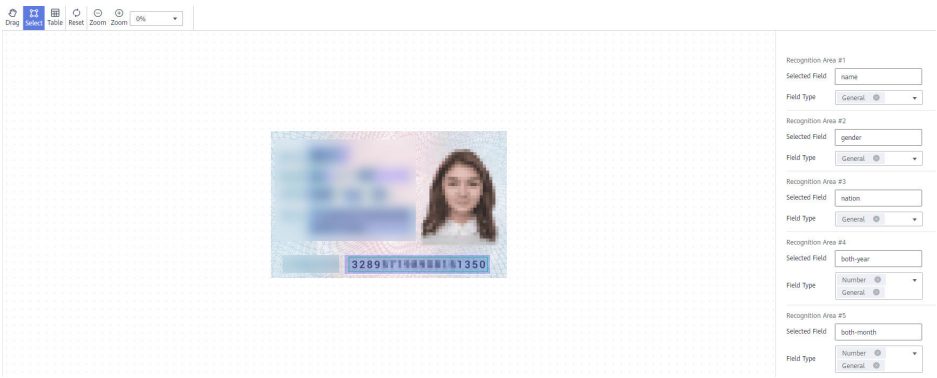
Therefore you need to box-select recognition areas in the template image to determine the position of text to be identified in images so that the model is able to locate the text to be recognized by identifying recognition areas.

Prerequisites

You have created an application using the general single-template workflow and box-selected reference fields on the OCR Suite console. For details, see **Box-selecting Reference Fields**.

Procedure

Figure 2-6 Box-selecting recognition areas



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1. Choose **Application Development** > **Box-select Recognition**. Click operation icons in the upper left corner to adjust the size of the template image.
2. Click ⌗, move the pointer to the upper left corner of the text to be recognized, and box-select the area where the text resides.

   The selected recognition area should be as wide as possible so that the selected recognition area covers the area where the field value may appear.
3. In **Box-select Recognition** on the right, specify **Selected Field** and **Field Type**.

   Field Type refers to the type of text to be recognized. You can select a field type from the **Default Field Type** drop-down list. The following default field types are supported: **Name**, **Number**, **General**, **Phone number**, **Address**, **Amount**, **Long number**, and **Long field**. You can select multiple field types for each recognition area.

   If the default field types cannot meet your service requirements, you can click **Add Field Type** in the drop-down list to add new field type. For details, see **Creating a Field Type**.
4. When box-selecting and verifying all recognition areas, click **Next** to go to step **Evaluating an Application**.

Creating a Field Type

If the default field types in the **Box-select Recognition** page cannot meet your service requirements, you can create a field type.

1. Choose **Application Development** > **Box-select Recognition**, click ⌗, move the pointer to the upper left corner of the text to be recognized, and drag the mouse to box-select the recognition area.
2. Click the **Field Type** drop-down list in the **Box-select Recognition** area on the right and click **Add Field Type** on the bottom to create a field type.

   The **Create Field Type** dialog box is displayed.
3. Specify related parameters.

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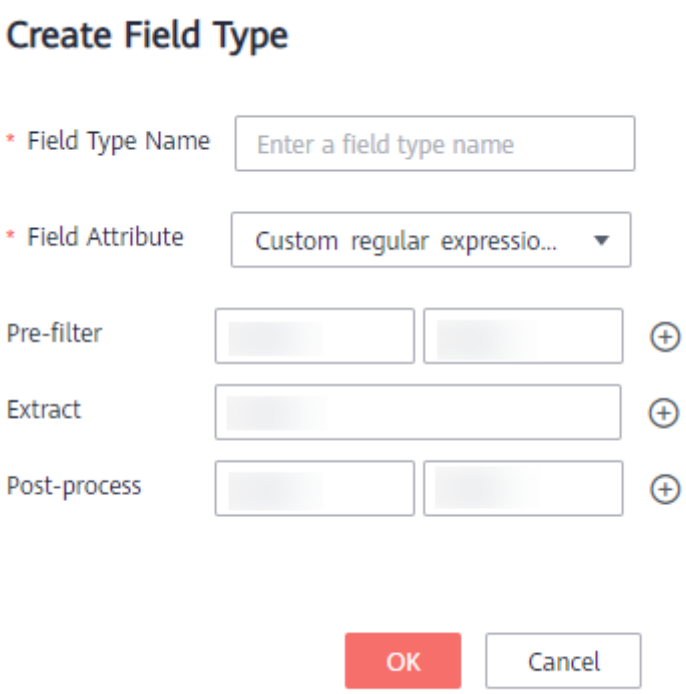
Figure 2-7 Creating a field type



Field Type Name: Enter the name of a field type to be created. For example, if you want to recognize an image of an ID card, you can create a field type named **Birthday**.

Field Attribute: Select a field attribute from the drop-down list. The options are **Custom regular expression extraction** or **Custom dictionary**, and then enter related information by referring to **Table 2-3**.

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Table 2-3 Parameters of a field attribute

Field Attribute	Parameter	Description	Example Value
Custom dictionary	Value Range	When recognizing text of the current field type, select the most similar value in the value range of the dictionary as the final recognition result.	For example, **Field Type Name**: **City** **Field Attribute**: **Custom dictionary** **Value Range**: **Shenzhen**, **Beijing**, and **Xi'an** When the field type of the text to be recognized is **City**, a value most similar to the text to be recognized is selected as the recognition result from values **Shenzhen**, **Beijing**, and **Xi'an**.
Custom regular expression extraction	Pre-filter	Preprocess the to-be-recognized text. Enter a regular expression of text to be replaced in the text box on the left. Enter new text in the text box on the right. If this field is left blank, no preprocessing is performed by default. If you need to preprocess the text for multiple times, click ⊙ and enter new preprocessing rule.	For example, **Field Type Name**: **Birthday** **Field Attribute**: **Custom regular expression extraction** **Pre-filter**: **/** **Extract**: ***year**month**day*** **Post-process**: ***year*/*.day*/.** or ***day*/*year month*** When the text **Born on 2020 January 01** whose field type is **Birthday** is recognized, do not perform pre-filtering, extract key characters **2020 January 01**, and finally post-process the key characters, and finally the

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Field Attribute	Parameter	Description	Example Value
	Extract	Extract key characters from the preprocessed text. Enter a regular expression for searching for key characters in the text box. If this field is left blank, all fields will be extracted by default. If multiple extraction rules are required, click ⊕ to add extraction rules. During extraction, the first non-empty content is selected as the extracted content based on the priority rule from top to bottom.	extracted content is **2020.1.1**.
	Post-process	Post-process the extracted text based on your needs.	

2.4.6 Evaluating an Application

You need to evaluate the template image after determining the reference fields and recognition areas of the template image. You can upload test images to evaluate the recognition results of the template. The purpose is to ensure that text in recognition areas of other images with the same template can be accurately recognized.

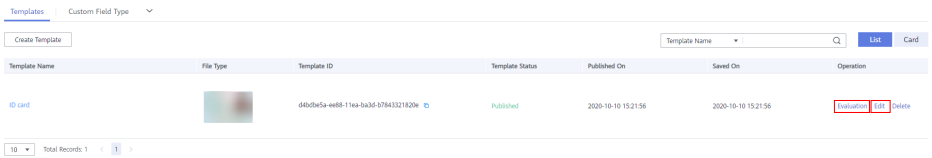
Prerequisites

You have created an application using the general single-template workflow and box-selected recognition areas on the OCR Suite console. For details, see **Box-selecting Recognition Areas**.

Accessing the Evaluate Page

Log in to the **ModelArts Pro** > **OCR Suite** console. By default, the **AppDev** > **Workbench** page is displayed. Locate the target application and click **View** in the **Operation** column. The **Application Assets** page is displayed.

Figure 2-8 Accessing the Evaluate page



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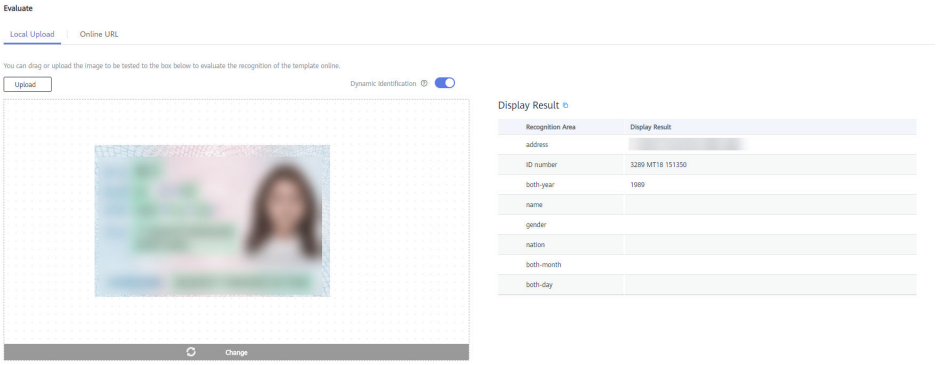
- On the **Application Assets** page, click **Evaluation** in the **Operation** column of a template. The **Evaluate** page is displayed.
- Alternatively, on the **Application Assets** page, click **Edit** in the **Operation** column of a template. The **Application Development** page is displayed. Complete operations **Upload Images**, **Define Preprocessing**, **Box-select Reference Fields**, and **Box-select Recognition** in sequence, and click **Next**. The **Evaluate** page is displayed.

Uploading a Local Test Image

Figure 2-9 Evaluating the template



1. Choose **Application Development** > **Evaluate**. The **Local Upload** page is displayed by default.
2. You can enable **Dynamic Recognition** as required. Click **Upload** or drag an image to the dotted-line box to upload a local image as a test image.

   Dynamic Identification: If the format of the image to be identified is similar to that of the template image but not completely the same, for example, the position of the recognition area on the image relatively changes, you are advised to enable this function for evaluation. If a template in fixed format is evaluated, you are advised to disable this function.
3. After a test image is uploaded, the recognition result is displayed on the right.

   Check whether the recognition result is correct.

   If the recognition result is incorrect, click **Create New Template** in the lower right corner to create a new template, or click **Previous** to modify the current template.

   If the recognition result is correct, click **Next** to deploy the template.

Uploading an Online Test Image

1. Choose **Application Development** > **Evaluate** and click **Online URL**
2. Enter the URL of the image to be tested in the box on the left of **Start**, or drag the test image to the image upload area in the dotted line box.
3. Click **Start**. The recognition result is displayed on the right.

   If the recognition result is incorrect, click **Create New Template** in the lower right corner to create a new template, or click **Previous** to modify the current template.

   If the recognition result is correct, click **Next** to deploy the template.

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2.4.7 Deploying an Application

You can deploy an application to OCR Suite after evaluation and develop your own OCR application. You can use this application to recognize images with the same format as the template you uploaded.

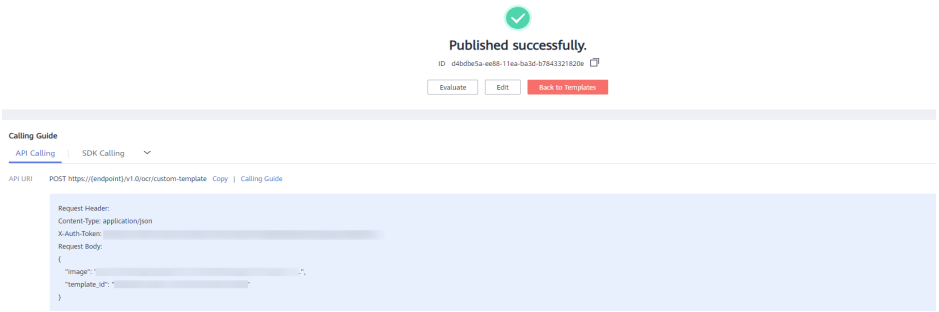
Prerequisites

You have created an application using the general single-template workflow and evaluated the template on the OCR Suite console. For details, see **Evaluating an Application**.

Procedure

After completing template evaluation on the **Application Development** > **Evaluate** page, click **Next** to go to the **Deploy** page to publish the template. A message indicating **Published successfully.** is displayed.

Figure 2-10 Deploying a template



After the template is published, you can perform the following operations on the **Application Development** > **Deploy** page:

Evaluate: Click **Evaluate** to go to the **Evaluate** page and upload more test images to evaluate the template.

Edit: Click **Edit** to return to the **Application Development** > **Upload Images** page and create another template.

Back to Templates: Click **Back to Templates** to return to the **Templates** page.

API Calling and SDK Calling: In the **Calling Guide** area of the lower part of the page, you can directly call APIs or SDKs to easily invoke the current template service.

Calling APIs and SDKs

On the **Application Development** > **Deploy** page, the **Calling Guide** area contains **API Calling** and **SDK Calling** pages in the lower part. You can invoke the current template service by calling APIs or SDKs.

- Calling APIs

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The service automatically generates an API URI. You can click **Copy** on the right of the URI to copy the URI and invoke the current template service. For details, see **OCR API Reference**.

- Calling SDKs

  OCR Suite provides a software development kit (SDK) that encapsulates the REST APIs of OCR.

  Multiple SDK tool packages are offered, such as Java SDK, Python SDK, iOS SDK, Android SDK, and Node.js SDK. You can download the required SDK to invoke the template service.

  For details, see **OCR SDK Reference**.

2.4.8 Customizing a Field Type

During application development, you need to select a field type when box-selecting a recognition area. If the box-selected text is a number, you can select the default field type **Number**.

If the default field types cannot meet your service requirements, you can create a field type.

Prerequisites

You have created an application using the general single-template workflow on the OCR Suite console. For details, see **Creating an Application**.

Procedure

1. Log in to the **ModelArts Pro > OCR Suite** console.

   The **AppDev** > **Workbench** page is displayed by default.
2. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   Go to the **Application Assets** page.
3. Click **Custom Field Types** The **Custom Field Types** page is displayed.
4. Click **Create Field Type** in the upper left corner.

   The **Create Field Type** dialog box is displayed.
5. Specify related parameters.

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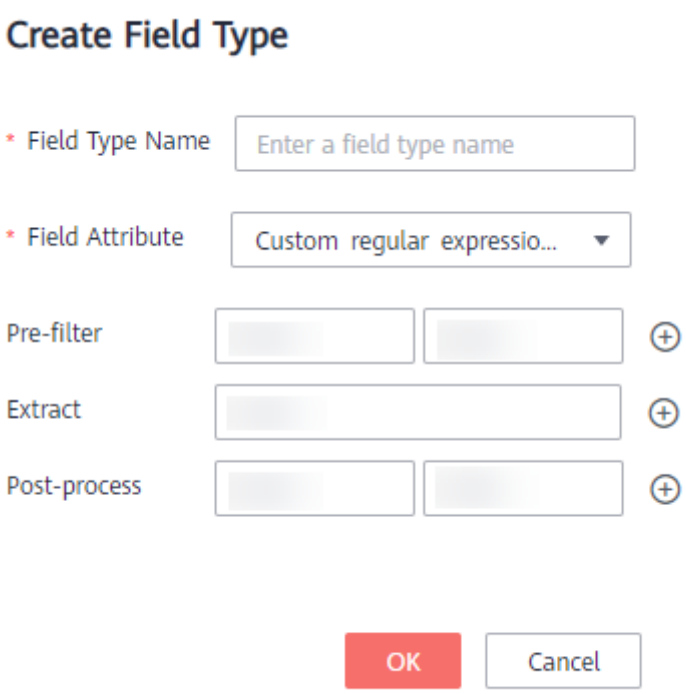
Figure 2-11 Creating a field type



Field Type Name: Enter the name of a field type to be created. For example, if you want to recognize an image of an ID card, you can create a field type named **Birthday**.

Field Attribute: Select a field attribute from the drop-down list. The options are **Custom regular expression extraction** or **Custom dictionary**, and then enter related information by referring to **Table 2-4**.

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Table 2-4 Parameters of a field attribute

Field Attribute	Parameter	Description	Example Value
Custom dictionary	Value Range	When recognizing text of the current field type, select the most similar value in the value range of the dictionary as the final recognition result.	For example, **Field Type Name**: **City** **Field Attribute**: **Custom dictionary** **Value Range**: **Shenzhen**, **Beijing**, and **Xi'an** When the field type of the text to be recognized is **City**, a value most similar to the text to be recognized is selected as the recognition result from values **Shenzhen**, **Beijing**, and **Xi'an**.
Custom regular expression extraction	Pre-filter	Preprocess the to-be-recognized text. Enter a regular expression of text to be replaced in the text box on the left. Enter new text in the text box on the right. If this field is left blank, no preprocessing is performed by default. If you need to preprocess the text for multiple times, click ⊙ and enter new preprocessing rule.	For example, **Field Type Name**: **Birthday** **Field Attribute**: **Custom regular expression extraction** **Pre-filter**: **/** **Extract**: ***year**month**day*** **Post-process**: ***year*/*.day*/.** or ***day*/*year month*** When the text **Born on 2020 January 01** whose field type is **Birthday** is recognized, do not perform pre-filtering, extract key characters **2020 January 01**, and finally post-process the key characters, and finally the

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Field Attribute	Parameter	Description	Example Value
	Extract	Extract key characters from the preprocessed text. Enter a regular expression for searching for key characters in the text box. If this field is left blank, all fields will be extracted by default. If multiple extraction rules are required, click ⊕ to add extraction rules. During extraction, the first non-empty content is selected as the extracted content based on the priority rule from top to bottom.	extracted content is **2020.1.1**.
	Post-process	Post-process the extracted text based on your needs.	

You can also create a field type by choosing **Application Development** > **Box-select Recognition**. For details, see **Creating a Field Type**.

2.4.9 Editing an Application

You can edit a created application to match service changes.

Prerequisites

An application has been created.

Procedure

1. Log in to the **ModelArts Pro > OCR Suite** console.

   The **AppDev** > **Workbench** page is displayed by default.

2. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   Go to the **Application Assets** page.

3. On the **Templates** page, locate a template and click **Edit** in the **Operation** column.

   The **Application Development** page is displayed. You can modify configurations in steps **Upload Images**, **Define Preprocessing**, **Box-select Reference Fields**, **Box-select Recognition**, and **Evaluate** in sequence, and redeploy the template. For details, see the following sections:

   - **Uploading a Template Image**
   - **Preprocessing the Template**

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  - **Box-selecting Reference Fields**
  - **Box-selecting Recognition Areas**
  - **Evaluating an Application**
  - **Deploying an Application**

2.4.10 Deleting an Application

If an application is no longer in use, you can delete it to release resources.

Procedure

1. Log in to the **ModelArts Pro > OCR Suite** console.

   The **AppDev** > **Workbench** page is displayed by default.
2. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   Go to the **Application Assets** page.
3. On the **Templates** page, locate a template and click **Delete** in the **Operation** column.

   The **Delete Template** dialog box is displayed.
4. Click **OK**.

2.5 Multi-Template Classification Workflow

2.5.1 Introduction

Workflow Overview

- Functions

  This workflow allows you to customize multiple character recognition templates, which are automatically identified and used by images through model training and from which structured information is extracted. This workflow is generally applied into the logistics industry.
- Application scenarios
  - User authentication

    Recognition of key information on certificates, reducing manual input and real-name authentication costs, while improving efficiency and accuracy
  - Express waybill filling

    Recognition of contact information in screenshots and automatic generation of express waybills, eliminating the need for manual input
  - Contract upload and review

    Recognition of structured information and extraction of signatures and seals for quick review
- Advantages
  - Business efficiency is improved after no manual input and multi-language competency required.

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- One-click deployment enables quick output of high-precision structured data.
- Multiple templates can be customized to quickly match new formats, resolving problems of complex and varied formats and multiple languages.
- Structured information can be extracted from images in different formats.

Workflow Process

After creating an application using the multi-template classification workflow on the **ModelArts Pro** > **OCR Suite** page, you can create a multi-template service and multiple templates to train a classification and OCR model, which extract structured information from images with different templates.

Figure 2-12 Process for developing a multi-template application



Table 2-5 Process description

Step	Description	Reference
Upload a template image.	Upload images as templates for training an OCR model.	**Uploading Template Images**
Preprocess the template.	Preprocess the template. Retain the key content and remove the redundant part to ensure that the image content is clear and the model recognition is accurate.	**Preprocessing Templates**
Box-select reference fields.	Box-select reference fields in the template to check the consistency between images to be identified and the template.	**Box-selecting Reference Fields**
Box-select recognition areas.	Box-select recognition areas in the template to determine the position of the text to be identified.	**Box-selecting Recognition Areas**
Upload training sets.	Upload a training set to train a template classification model, which accurately classifies different template images, performs OCR, and extracts structured information from them.	**Uploading Training Sets**
Evaluate an application.	Upload test images and evaluate the classification and OCR results online to ensure that the model can correctly classify test images in the case of multiple templates and recognize text in recognition areas of test images.	**Evaluating an Application**

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Step	Description	Reference
Deploy an application.	Deploy the template to OCR Suite and develop your own OCR application. You can use this application to recognize images with the same formats as the templates you uploaded.	**Deploying an Application**

2.5.2 Uploading Template Images

Before using the multi-template classification workflow to create an application, you need to specify images as the template for training an OCR model based on your needs. For example, if two invoice images in different formats are uploaded as templates, the trained OCR model can identify and extract key fields from invoices in the two formats.

Prerequisites

- You have obtained related permissions of ModelArts and OBS.
- You have created an application using the multi-template classification workflow on the OCR Suite console. For details, see **Creating an Application**.

Accessing the Application Development Page

1. Log in to the **ModelArts Pro > OCR Suite** console.

   The **AppDev** > **Workbench** page is displayed by default.
2. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

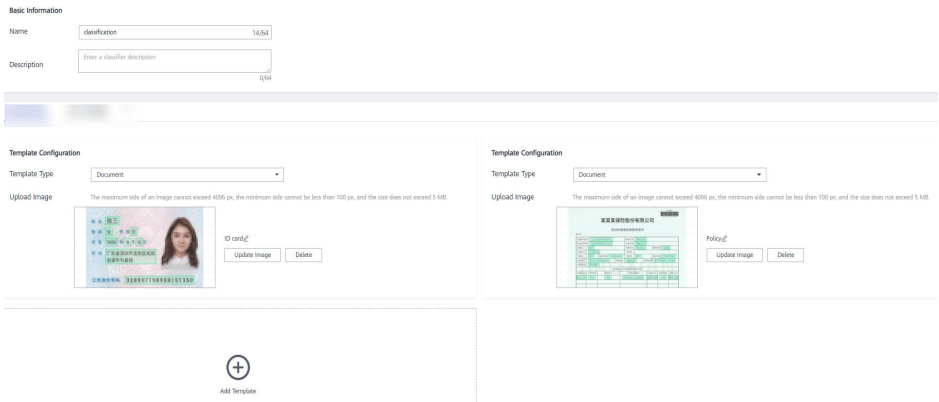
   Go to the **Application Assets** page.
3. Click **Create Classifier** in the upper left corner.

   Go to the **Application Development** page and start to develop an application.

Uploading Template Images

Choose **Application Development** > **Upload Images** and configure the following parameters:

Figure 2-13 Uploading template images



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- **Basic Information**

  Specify **Name** and **Description** of a multi-template classifier.

- **Template Configuration**

  Click ⊕ to add multiple templates, select a template type for each template, and upload images.

  Template Type: Select a template type. The options are **Document**, **General**, and **Ticket and certificate**.

  Upload Image: Click the image upload area or drag an image to the image upload area to upload a local image as a template used for recognizing structured information from images.

  Change Template Name: Click ✎ on the right of the image, enter a new template name in the text box, and click **Yes**.

  Delete Template: Click **Delete** on the right of the image. In the dialog box that is displayed, click **OK**.

After confirming configurations, click **Next**. Step **Preprocessing Templates** is displayed. You can preprocess the uploaded template image, such as automatically rotating the image and removing the seal.

2.5.3 Preprocessing Templates

After uploading template images, you need to preprocess them, such as rotate or crop the images, or reduce the noise. The purpose is to retain the key content and remove the redundant part to ensure that the image content is clear and the model recognition is accurate.

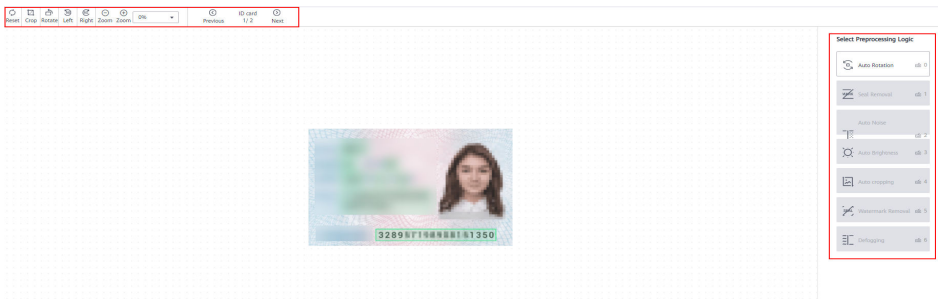
Prerequisites

You have created an application using the multi-template classification workflow and uploaded template images on the OCR Suite console. For details, see **Uploading Template Images**.

Preprocessing Templates

Choose **Application Development** > **Define Preprocessing**. Click Previous 1/2 Next to select the desired template and preprocess it.

Figure 2-14 Preprocessing templates



Select the required operation in the **Select Preprocessing Logic** area on the right. Currently, **Auto Rotation** and **Seal Removal** are supported.

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- **Auto Rotation**: When you select this option, the system automatically rotates the image with incorrect text direction to the correct direction.
- **Seal Removal**: When you select this option, the system automatically removes the seal on the image to ensure recognition accuracy.

Alternatively, you can click the following operation icons in the upper left corner of the page to adjust the size, direction, and other properties of the template image:

: Click to reset the image to the initial status, that is, the unprocessed status.

: Click to adjust the cropping range in the **Crop Image** window and click **Crop** to resize the image.

: Click to adjust the image direction. Left-click on in the **Rotate Image** window, hold down the left mouse button and drag your mouse in the direction you want to rotate the image, and click **OK**.

: Click to rotate the image 90 degrees leftwards.

: Click to rotate the image 90 degrees rightwards.

: Click to zoom out the image.

: Click to zoom in the image.

10%: Click to select an image zoom percentage.

When preprocessing is complete, click **Next** to go to step **Box-selecting Reference Fields**.

2.5.4 Box-selecting Reference Fields

Reference fields are fields that are referred when a model checks consistency between images to be recognized and the template image during OCR. Images to be recognized contain reference fields, and the positions of the reference fields are fixed.

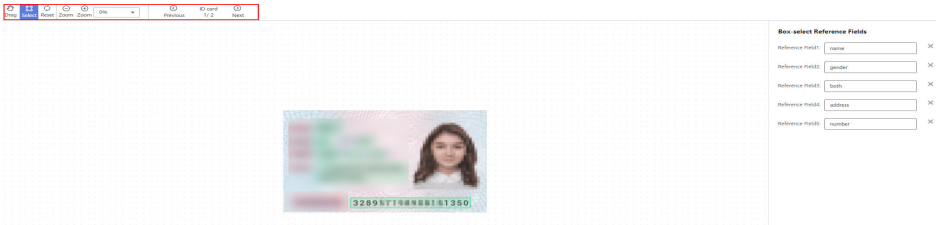
Therefore you need to box-select the reference fields in the template image first so that the model is able to check the image format by identifying the reference fields.

Prerequisites

You have created an application using the multi-template classification workflow and preprocessed the template images you uploaded on the OCR Suite console. For details, see **Preprocessing Templates**.

Procedure

Figure 2-15 Box-selecting reference fields



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1. Choose **Application Development** > **Box-select Reference Fields**. Click Previous 1/2 Next to select the desired template and box-select reference fields for each template.
2. Click the required operation icons in the upper left corner to adjust the size and position of the current template image.
3. Click , move the pointer to the upper left corner of the reference field, and box-select the reference field.
   - A reference field contains fixed content in a fixed position.
   - Select the text that does not appear repeatedly in an image as the reference field.
   - Select the text that is horizontally displayed in one line.
   - Select more than four reference fields, which are scattered in four corners of an image.
   - Select an independent text block, instead of parts of a text block, for better recognition precision.
4. Verify whether the reference field in the right box is the same as the box-selected one.
5. When box-selecting and verifying reference fields of all template images, click **Next** to go to step **Box-selecting Recognition Areas**.

2.5.5 Box-selecting Recognition Areas

A recognition area refers to the position where the text to be recognized resides. Images to be recognized contain fields in recognition areas and the positions of the recognition areas are fixed.

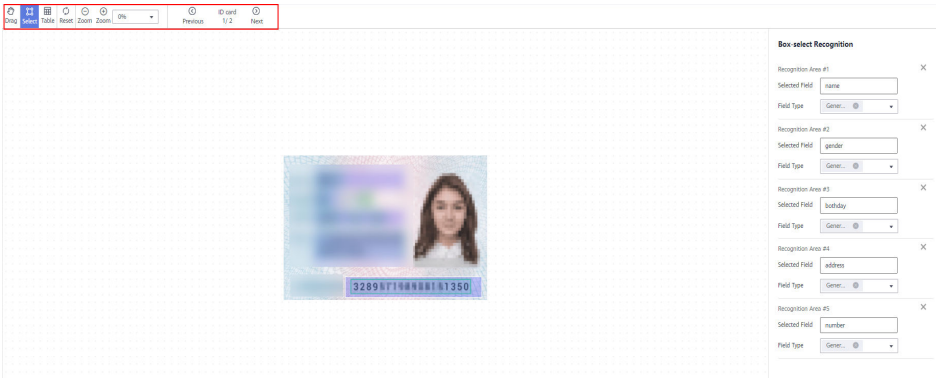
Therefore you need to box-select recognition areas in the template image to determine the position of text to be identified in images so that the model is able to locate the text to be recognized by identifying recognition areas.

Prerequisites

You have created an application using the multi-template classification workflow and box-selected reference fields on the OCR Suite console. For details, see **Box-selecting Reference Fields**.

Procedure

Figure 2-16 Box-selecting recognition areas



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1. Choose **Application Development** > **Box-select Reference Fields**. Click  to select the desired template and box-select recognition areas for each template.
2. Click the required operation icons in the upper left corner to adjust the size of the current template image.
3. Click , move the pointer to the upper left corner of the text to be recognized, and box-select the area where the text resides.

   The selected recognition area should be as wide as possible so that the selected recognition area covers the area where the field value may appear.
4. In **Box-select Recognition** on the right, specify **Selected Field** and **Field Type**.

   Field Type refers to the type of text to be recognized. You can select a field type from the **Default Field Type** drop-down list. The following default field types are supported: **Name**, **Number**, **General**, **Phone number**, **Address**, **Amount**, **Long number**, and **Long field**. You can select multiple field types for each recognition area.

   If the default field types cannot meet your service requirements, you can click **Add Field Type** in the drop-down list to add new field type. For details, see **Creating a Field Type**.
5. When box-selecting and verifying recognition areas of all template images, click **Next** to go to step **Uploading Training Sets**.

Creating a Field Type

If the default field types in the **Box-select Recognition** page cannot meet your service requirements, you can create a field type.

1. Choose **Application Development** > **Box-select Recognition**, click , move the pointer to the upper left corner of the text to be recognized, and drag the mouse to box-select the recognition area.
2. Click the **Field Type** drop-down list in the **Box-select Recognition** area on the right and click **Add Field Type** on the bottom to create a field type.

   The **Create Field Type** dialog box is displayed.
3. Specify related parameters.

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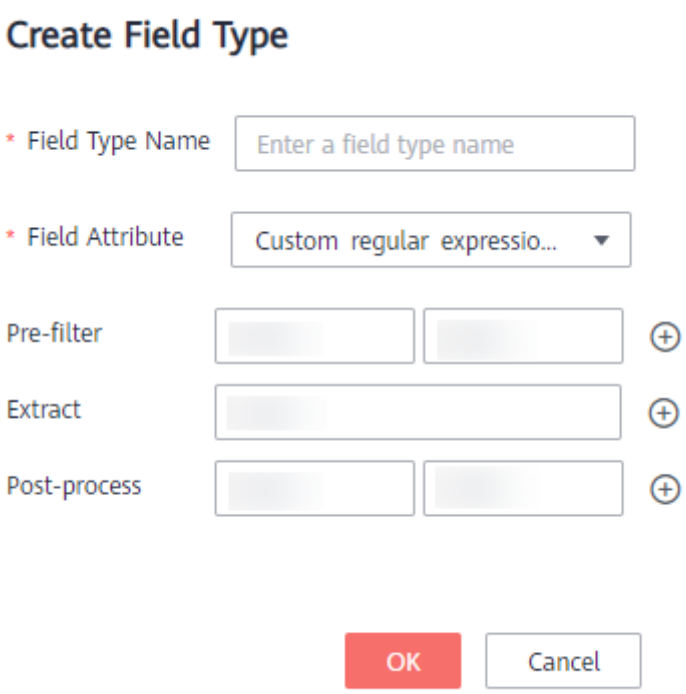
Figure 2-17 Creating a field type



Field Type Name: Enter the name of a field type to be created. For example, if you want to recognize an image of an ID card, you can create a field type named **Birthday**.

Field Attribute: Select a field attribute from the drop-down list. The options are **Custom regular expression extraction** or **Custom dictionary**, and then enter related information by referring to **Table 2-6**.

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Table 2-6 Parameters of a field attribute

Field Attribute	Parameter	Description	Example Value
Custom dictionary	Value Range	When recognizing text of the current field type, select the most similar value in the value range of the dictionary as the final recognition result.	For example, **Field Type Name**: **City** **Field Attribute**: **Custom dictionary** **Value Range**: **Shenzhen**, **Beijing**, and **Xi'an** When the field type of the text to be recognized is **City**, a value most similar to the text to be recognized is selected as the recognition result from values **Shenzhen**, **Beijing**, and **Xi'an**.
Custom regular expression extraction	Pre-filter	Preprocess the to-be-recognized text. Enter a regular expression of text to be replaced in the text box on the left. Enter new text in the text box on the right. If this field is left blank, no preprocessing is performed by default. If you need to preprocess the text for multiple times, click ⊙ and enter new preprocessing rule.	For example, **Field Type Name**: **Birthday** **Field Attribute**: **Custom regular expression extraction** **Pre-filter**: **/** **Extract**: ***year**month**day*** **Post-process**: ***year*/*.day*/.** or ***day*/*year month*** When the text **Born on 2020 January 01** whose field type is **Birthday** is recognized, do not perform pre-filtering, extract key characters **2020 January 01**, and finally post-process the key characters, and finally the

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Field Attribute	Parameter	Description	Example Value
	Extract	Extract key characters from the preprocessed text. Enter a regular expression for searching for key characters in the text box. If this field is left blank, all fields will be extracted by default. If multiple extraction rules are required, click ⊕ to add extraction rules. During extraction, the first non-empty content is selected as the extracted content based on the priority rule from top to bottom.	extracted content is **2020.1.1**.
	Post-process	Post-process the extracted text based on your needs.	

2.5.6 Uploading Training Sets

After specifying reference fields and recognition areas of template images, you need to upload the specified training set for each template to train a template classification model when there are a large number of templates or the image formats are highly similar. In this case, the model is able to accurately classify different template images, perform OCR, and extract structured information from them.

NOTE

If the number of templates is small and their formats are not much similar, you do not need to upload training sets. Click **Train** on the **Upload Training Sets** page to train the model. In this case, the algorithm directly uses template images to train and generate a classifier.

Prerequisites

You have created an application using the multi-template classification workflow and box-selected recognition areas of these templates on the OCR Suite console. For details, see **Box-selecting Recognition Areas**.

Adding an Existing Template

You can add a published template to the current multi-template classification workflow for model training.

1. Choose **Application Development** > **Upload Training Sets** and click **Add Existing Template**.

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The **Add Existing Template** dialog box is displayed.

2. Select the desired template, confirm its information, and click **Yes**.

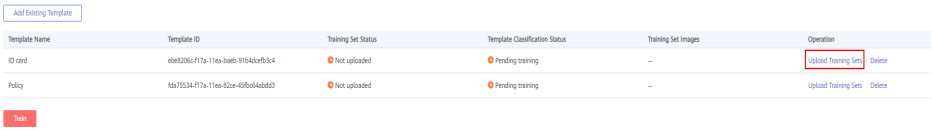
   The newly added template is displayed on the **Application Development** > **Upload Training Sets** page.

Preparing Training Sets

You need to prepare training sets on the local host for the templates involved in the training in this multi-template classification workflow. Pack the images into a folder, compress the folder into a **.zip** package, and upload the package to the current workflow. The size of the **.zip** package cannot exceed 10 MB.

Uploading Training Sets

Figure 2-18 Uploading training sets



1. Choose **Application Development** > **Upload Training Sets**. Locate the desired template and click **Upload Training Sets** in the **Operation** column.

   The **Upload Training Sets** dialog box is displayed.

2. In the **Upload Training Sets** dialog box, upload the prepared **.zip** package.

   After the upload is successful, the system displays a message indicating that the file is uploaded successfully.

3. After a training set is uploaded for each template, click **Train**.

   Go to the **Application Development** > **Evaluate** page and start to train the model.

   After the model training is complete, you can evaluate the classifier and template on the **Application Development** > **Evaluate** page. For details, see **Evaluating an Application**.

Deleting Training Sets

If an application is no longer in use, you can delete it to release resources.

Choose **Application Development** > **Upload Training Sets**, locate the desired template, and click **Delete** in the **Operation** column. In the displayed dialog box, click **OK**.

2.5.7 Evaluating an Application

After a template classification model is trained, you can evaluate the template classifier and template images. You can upload test images and evaluate the template classification and OCR results online to ensure that the model can correctly classify test images in the case of multiple templates and recognize text in recognition areas of test images.

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Prerequisites

You have created an application using the multi-template classification workflow and uploaded training sets for templates on the OCR Suite console. For details, see **Uploading Training Sets**.

Accessing the Evaluate page

Log in to the **ModelArts Pro** > **OCR Suite** console. By default, the **AppDev** > **Workbench** page is displayed. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column. The application details page is displayed. You can access the **Evaluate** page from the **Application Assets** and **Application Development** pages.

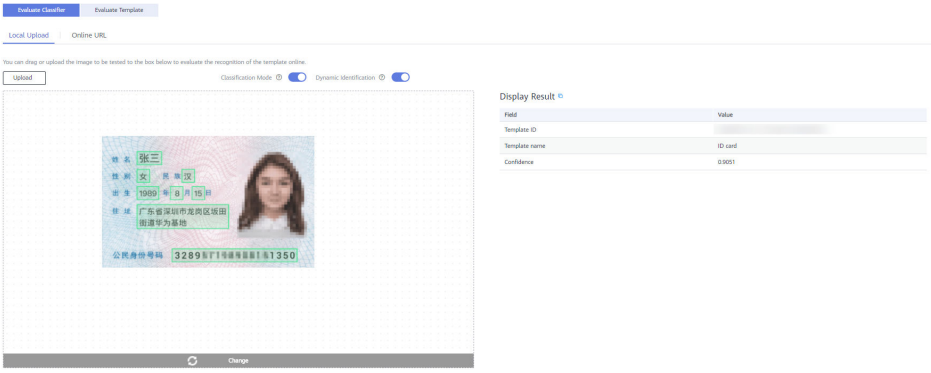
- On the **Application Assets** page, the **Classifiers** page is displayed by default. Click **Evaluation** in the **Operation** column of the desired template. The **Evaluate** page is displayed.
- Alternatively, on the **Application Development** page, complete operations **Upload Images**, **Define Preprocessing**, **Box-select Reference Fields**, **Box-select Recognition**, and **Upload Training Sets** in sequence, and click **Next**. The **Evaluate** page is displayed.

Evaluating the Classifier

You can evaluate whether the template classifier after model training can correctly classify templates online by uploading test images.

On the **Application Development** > **Evaluate** page, you can upload test images from the local host or upload images online.

Figure 2-19 Evaluating the classifier



- **Uploading a local test image**

  The **Local Upload** page is displayed by default. You can enable **Classification Mode** and **Dynamic Recognition** as required. Click **Upload** or drag an image to the dotted-line box to upload a local image as a test image.

  Classification Mode: When this function is enabled, the accuracy of the classifier is evaluated separately. After an image is uploaded, the automatic classification result is displayed on the right, indicating the template ID, template name, and confidence. When this function is disabled, both

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automatic classification of the template and structured recognition of text are performed.

Dynamic Identification: If the format of the image to be identified is similar to that of the template image but not completely the same, for example, the position of the recognition area on the image relatively changes, you are advised to enable this function for evaluation. If a template in fixed format is evaluated, you are advised to disable this function.

After a test image is uploaded, the recognition result is displayed on the right.

- **Uploading an online test image**

  Click **Online URL**. Enter the URL of the image to be tested in the box on the left of **Start**, or drag the test image to the image upload area in the dotted line box to upload a test image online.

  After an image is uploaded, the template recognition result is displayed on the right, indicating the template ID, template name, and confidence.

Check whether the recognition result is correct.

If the recognition result is incorrect, click **Previous** to modify the template.

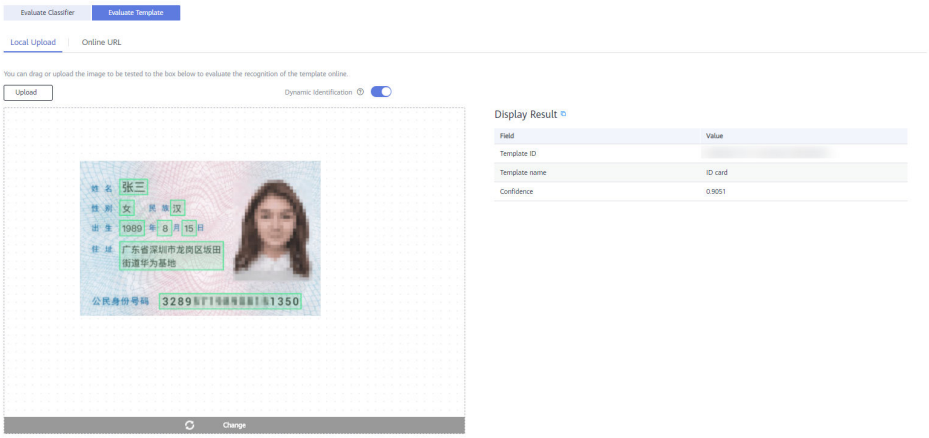
If the recognition result is correct, you can further evaluate the template. For details, see **Evaluating a Template**.

Evaluating a Template

You can evaluate the template recognition and structured information extraction capabilities of the model online by uploading test images.

Choose **Application Development** > **Evaluate**, select the template to be evaluated on the right, and upload a test image from the local host or upload an online image to evaluate the template.

Figure 2-20 Evaluating a template



- **Uploading a local test image**

  The **Local Upload** page is displayed by default. You can enable **Dynamic Recognition** as required. Click **Upload** or drag an image to the dotted-line box to upload a local image as a test image.

  Dynamic Identification: If the format of the image to be identified is similar to that of the template image but not completely the same, for example, the

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position of the recognition area on the image relatively changes, you are advised to enable this function for evaluation. If a template in fixed format is evaluated, you are advised to disable this function.

After an image is uploaded, the text recognition result is displayed on the right, indicating the recognition area and result.

- **Uploading an online test image**

  Click **Online URL**. Enter the URL of the image to be tested in the box on the left of **Start**, or drag the test image to the image upload area in the dotted line box to upload a test image online.

  After an image is uploaded, the text recognition result is displayed on the right, indicating the recognition area and result.

Check whether the recognition result is correct.

If the recognition result is incorrect, click **Previous** to modify the template.

If the recognition result is correct, click **Next** to deploy the template.

Follow-up Operations

If the recognition result is correct after evaluating the classifier and template, click **Next** to go to step **Deploying an Application**.

2.5.8 Deploying an Application

You can deploy an application to OCR Suite after evaluation and develop your own OCR application. You can use this application to identify which template the image you upload belongs to and recognize text on the image.

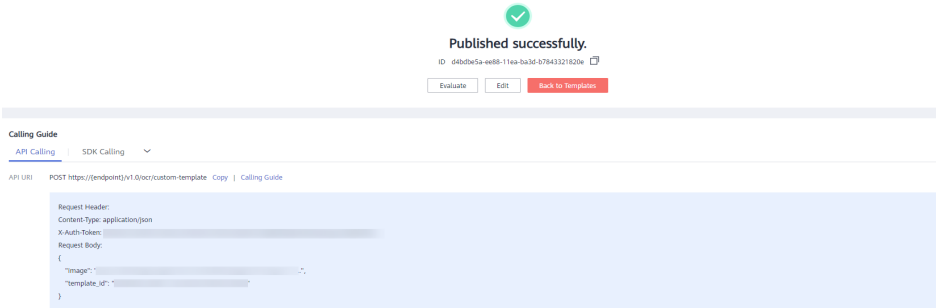
Prerequisites

You have created an application using the multi-template classification workflow and evaluated the template on the OCR Suite console. For details, see **Evaluating an Application**.

Procedure

After completing template evaluation on the **Application Development** > **Evaluate** page, click **Next** to go to the **Deploy** page to publish the template. A message indicating **Published successfully.** is displayed.

Figure 2-21 Deploying a template



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After the template is published, you can perform the following operations on the **Application Development** > **Deploy** page:

Evaluate: Click **Evaluate** to go to the **Evaluate** page and upload more test images to evaluate the template.

Edit: Click **Edit** to return to the **Application Development** > **Upload Images** page and create another template.

Back to Templates: Click **Back to Templates** to return to the **Templates** page.

API Calling and SDK Calling: In the **Calling Guide** area of the lower part of the page, you can directly call APIs or SDKs to easily invoke the current template service.

Calling APIs and SDKs

On the **Application Development** > **Deploy** page, the **Calling Guide** area contains **API Calling** and **SDK Calling** pages in the lower part. You can invoke the current template service by calling APIs or SDKs.

- Calling APIs

  The service automatically generates an API URI. You can click **Copy** on the right of the URI to copy the URI and invoke the current template service. For details, see **OCR API Reference**.

- Calling SDKs

  OCR Suite provides a software development kit (SDK) that encapsulates the REST APIs of OCR.

  Multiple SDK tool packages are offered, such as Java SDK, Python SDK, iOS SDK, Android SDK, and Node.js SDK. You can download the required SDK to invoke the template service.

  For details, see **OCR SDK Reference**.

2.5.9 Editing an Application

You can edit a created application to match service changes.

Prerequisites

An application has been created.

Procedure

1. Log in to the **ModelArts Pro > OCR Suite** console.

   The **AppDev** > **Workbench** page is displayed by default.

2. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   Go to the **Application Assets** page.

3. On the **Templates** page, locate a template and click **Edit** in the **Operation** column.

   The **Application Development** page is displayed. You can modify configurations in steps **Upload Images**, **Define Preprocessing**, **Box-select**

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Reference Fields, **Box-select Recognition**, **Upload Training Sets**, and **Evaluate** in sequence, and redeploy the template. For details, see the following sections:

- **Uploading Template Images**
- **Preprocessing Templates**
- **Box-selecting Reference Fields**
- **Box-selecting Recognition Areas**
- **Uploading Training Sets**
- **Evaluating an Application**
- **Deploying an Application**

2.5.10 Customizing a Field Type

During application development, you need to select a field type when box-selecting a recognition area. If the box-selected text is a number, you can select the default field type **Number**.

If the default field types cannot meet your service requirements, you can create a field type.

Prerequisites

You have created an application using the multi-template classification workflow on the OCR Suite console. For details, see **Creating an Application**.

Procedure

1. Log in to the **ModelArts Pro > OCR Suite** console.

   The **AppDev** > **Workbench** page is displayed by default.
2. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   Go to the **Application Assets** page.
3. Click **Custom Field Types** The **Custom Field Types** page is displayed.
4. Click **Create Field Type** in the upper left corner.

   The **Create Field Type** dialog box is displayed.
5. Specify related parameters.

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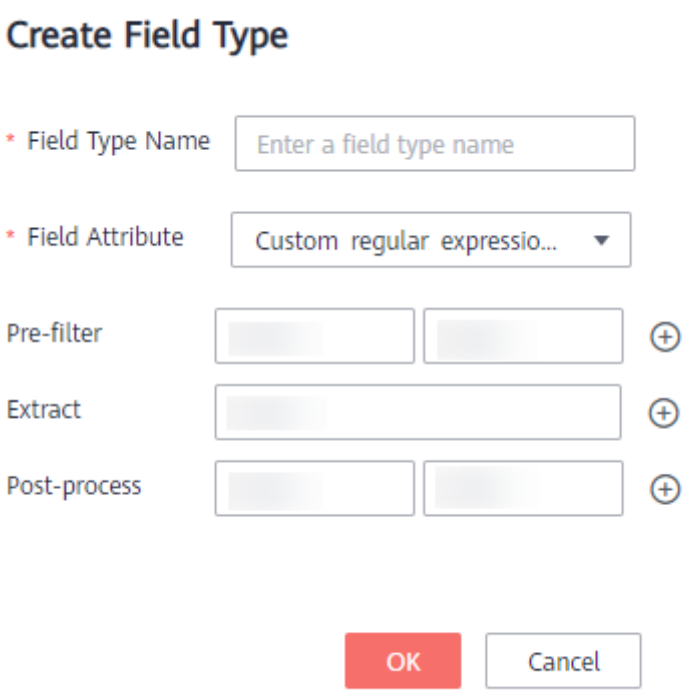
Figure 2-22 Creating a field type



Field Type Name: Enter the name of a field type to be created. For example, if you want to recognize an image of an ID card, you can create a field type named **Birthday**.

Field Attribute: Select a field attribute from the drop-down list. The options are **Custom regular expression extraction** or **Custom dictionary**, and then enter related information by referring to **Table 2-7**.

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Table 2-7 Parameters of a field attribute

Field Attribute	Parameter	Description	Example Value
Custom dictionary	Value Range	When recognizing text of the current field type, select the most similar value in the value range of the dictionary as the final recognition result.	For example, **Field Type Name**: **City** **Field Attribute**: **Custom dictionary** **Value Range**: **Shenzhen**, **Beijing**, and **Xi'an** When the field type of the text to be recognized is **City**, a value most similar to the text to be recognized is selected as the recognition result from values **Shenzhen**, **Beijing**, and **Xi'an**.
Custom regular expression extraction	Pre-filter	Preprocess the to-be-recognized text. Enter a regular expression of text to be replaced in the text box on the left. Enter new text in the text box on the right. If this field is left blank, no preprocessing is performed by default. If you need to preprocess the text for multiple times, click ⊙ and enter new preprocessing rule.	For example, **Field Type Name**: **Birthday** **Field Attribute**: **Custom regular expression extraction** **Pre-filter**: **/** **Extract**: ***year**month**day*** **Post-process**: ***year*/*.day*/.** or ***day*/*year month*** When the text **Born on 2020 January 01** whose field type is **Birthday** is recognized, do not perform pre-filtering, extract key characters **2020 January 01**, and finally post-process the key characters, and finally the

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Field Attribute	Parameter	Description	Example Value
	Extract	Extract key characters from the preprocessed text. Enter a regular expression for searching for key characters in the text box. If this field is left blank, all fields will be extracted by default. If multiple extraction rules are required, click ⊕ to add extraction rules. During extraction, the first non-empty content is selected as the extracted content based on the priority rule from top to bottom.	extracted content is **2020.1.1**.
	Post-process	Post-process the extracted text based on your needs.	

You can also create a field type by choosing **Application Development** > **Box-select Recognition**. For details, see **Creating a Field Type**.

2.5.11 Deleting an Application

If an application is no longer in use, you can delete it to release resources.

Procedure

1. Log in to the **ModelArts Pro > OCR Suite** console.

   The **AppDev** > **Workbench** page is displayed by default.
2. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   Go to the **Application Assets** page.
3. On the **Templates** page, locate a template and click **Delete** in the **Operation** column.

   The **Delete Template** dialog box is displayed.
4. Click **OK**.

2.6 Viewing Application Details

After creating an application, you can view the application details on the ModelArts Pro console, such as information about the application development configurations and application assets.

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Prerequisites

You have created an application using a preset workflow on the OCR Suite console. For details, see **Creating an Application**.

Accessing the Application Details Page

1. Log in to the ModelArts Pro console, click **Access** on the OCR Suite card.

   The OCR Suite console is displayed.

2. In the navigation pane on the left, choose **AppDev** > **Workbench**.

   The **My Applications** page is displayed by default.

3. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   The application details page is displayed. By default, the **Application Assets** page is displayed. You can **view the application assets**.

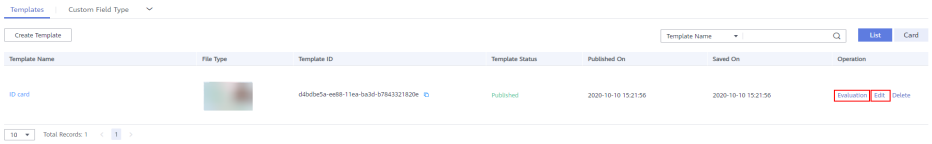
   Alternatively, you can click **Application Development** to switch to the **Application Development** page and **view the application development configurations**.

Viewing Application Assets

On the **Application Assets** page, you can view the asset information of the current application.

Using a preset workflow to develop an application, you can view the template list and custom field types on the **Application Assets** page.

Figure 2-23 Application Assets page



On the **Application Assets** > **Templates**, you can view the list of templates you created and perform the following operations in the **Operation** column:

- **Evaluation**: Click **Evaluation** to go to the **Application Development** > **Evaluation** page and evaluate the current template. For details, see **Evaluating an Application**.
- **Edit**: Click **Edit**. On the displayed **Application Development** page, edit the template information. For details about how to edit the template using the general single-template workflow, see **Introduction**. For details about how to edit the template using the multi-template workflow, see **Introduction**.
- **Delete**: Click **Delete**. In the displayed **Delete Template** dialog box, click **OK** to delete the current template.

On the **Application Assets** > **Custom Field Type** page, you can view custom field types. You can also click **Create Field Type** to create a field type. For details, see **Customizing a Field Type** for a general single-template workflow and **Customizing a Field Type** for a multi-template classification workflow.

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Viewing the Application Development Configurations

On the **Application Development** page, you can view the configuration information of each step in the application development process.

You can also edit the configuration information in the application development process. For details about a general single-template workflow, see **Introduction**. For details about a multi-template workflow, see **Introduction**.

Alternatively, you can edit the configuration on the **Application Development** page and click **Update** on the right of the version number in the upper left corner to update the current application into a new version.

2.7 Deleting an Application

If an application is no longer in use, you can delete it to release resources.

Procedure

1. Log in to the ModelArts Pro console, click **Access** on the OCR Suite card.
   The OCR Suite console is displayed.
2. In the navigation pane on the left, choose **AppDev** > **Workbench**.
   The **My Applications** page is displayed by default.
3. On the **My Applications** page, locate the desired application and click **Delete** in the **Operation** column.
   The **Delete Application** dialog box is displayed.
4. In the displayed dialog box, click **OK**.

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3 NLP Suite

3.1 Introduction

NLP Suite offers NLP custom tools for you to easily create domain-specific high-precision text processing models for industries such as government affairs, finance, and legal services.

Preset Workflow

NLP Suite provides a general text classification workflow, which you can use to create a high-precision text classification prediction model and quickly deploy a custom service.

For details, see **Service Overview > NLP Suite**.

Prerequisites

- You have completed the preparations as described in **Preparations**.
- You have applied for NLP Suite as described in **Enabling NLP Suite** if you use it for the first time.

Enabling NLP Suite

NLP Suite is in the OBT phase. If you are a first-time user of NLP Suite, apply for the OBT permission first.

Log in to the ModelArts Pro console and click **Apply for OBT** on the **NLP Suite** card. On the page that is displayed, enter the required information as prompted.

After the application is submitted, click **Go to Open Beta Tests**, and the **My Open Beta Tests** page is displayed. If **Audit Status** is **Approved**, you have obtained the OBT permission for NLP Suite.

Process for Using a Preset Workflow to Develop an Application

NLP Suite provides a general text classification workflow, which you can use to create a high-precision text classification prediction model with training data and quickly deploy a custom service.

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Figure 3-1 Process for using a preset workflow to develop an application

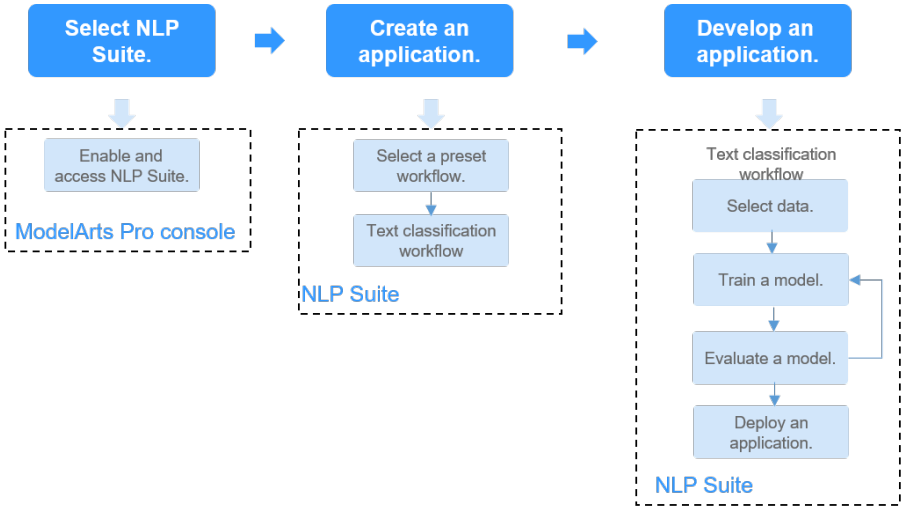

Table 3-1 Process flow

Step	Description	Reference
Select NLP Suite.	Select NLP Suite based on you needs. Alternatively, you can view the workflow to locate the required suite.	On the ModelArts Pro console, click **Access** on the NLP Suite card to access the NLP Suite console.
Create an application.	Create an application by entering basic information and selecting a workflow.	**Creating an Application**
Develop an application using the general text classification workflow.	Develop a text classification service based on the workflow guide. Upload training data, train a text prediction and classification model, and update and adjust the model precision to achieve high-precision text prediction classification.	**General Text Classification Workflow**

3.2 Configuring the OBS Storage Location

The training and test data uploaded when you use ModelArts Pro are stored in OBS. Therefore, you need to configure the OBS storage location before using NLP Suite.

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Prerequisites

You have registered a HUAWEI CLOUD account, authorized related services, created OBS buckets, and completed other preparations. For details, see **Preparations**.

Procedure

1. On the ModelArts Pro console, click **Access** on the NLP Suite card.

   The NLP Suite console is displayed.
2. In the navigation pane on the left, choose **Configuration Center** > **Basic Configuration**.

   The **Basic Configuration** page is displayed.
3. Click **Modify** next to **Default Storage Location** under **Storage**.

   The **Default Storage Location** dialog box is displayed.
4. In the dialog box that is displayed, select an OBS bucket and folder and click **OK**.

   The OBS storage location is configured.

Follow-up Operations

You can create an application as described in **Creating an Application** and develop it based on a workflow on the **ModelArts Pro**> **NLP Suite** console.

3.3 Creating an Application

Before developing an application with a preset workflow on the ModelArts Pro console, you need to create an application by entering basic information and selecting a workflow.

Prerequisites

- Ensure that the HUAWEI CLOUD account is not in arrears. Developing applications on the ModelArts Pro console may occupy OBS resources and incur fees. For details about the billing rules, see **OBS Pricing Details**.
- You have configured the OBS path for storing test data and training data. For details, see **Configuring the OBS Storage Location**.

Procedure

1. On the ModelArts Pro console, click **Access** on the NLP Suite card.

   The NLP Suite console is displayed.
2. In the navigation pane on the left, choose **AppDev** > **Workbench**.

   The **My Applications** page is displayed by default.
3. On the **My Applications** page, click **Create Application**.

   The **Create Application** page is displayed.

   Alternatively, you can click **My Workflows** to switch to the **My Workflows** page, select a workflow, and click **Create Application** on the card.

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4. Specify **Application Name**, **Owner**, **Description**, **Industry**, and **Workflow** based on the service requirements.
5. Confirm the information and click **OK**.

   The **Application Development** page is displayed. You can develop the application based on the workflow.

Follow-up Operations

Develop the application based on the selected workflow.

General Text Classification Workflow

3.4 General Text Classification Workflow

3.4.1 Introduction

Workflow Overview

- Functions

  This workflow allows you to upload text data to create a high-precision text classification prediction model and quickly deploy a custom service.
- Application scenarios

  This workflow applies to scenarios such as intelligent question answering, public opinion analysis, and content recommendation.
- Advantages
  - Pre-trained models specific to scenarios ensure high accuracy of classification.
  - Comprehensive text processing capabilities support a range of data formats in different scenarios.
  - Models can be continuously optimized based on the feedback during use.

Workflow Process

After creating a text classification application on the **ModelArts Pro** > **NLP Suite** console, you can develop this application by training a text classification prediction model to implement text classification.

Figure 3-2 Process for developing a text classification application



Table 3-2 Process description

Step	Description	Reference
Select data.	Select data and create a training dataset for subsequent model training.	**Selecting Data**

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Step	Description	Reference
Train a model.	Select a pre-trained model and configure parameters based on the labeled training data to train a text classification model.	**Training a Model**
Evaluate a model.	Evaluate the model after training. Some common metrics, such as precision, recall rate, and F1 score, help you effectively evaluate and obtain a satisfactory model.	**Evaluating a Model**
Deploy an application.	After the model is prepared, you can deploy an application to classify text you upload or directly call the corresponding APIs and SDKs.	**Deploying an Application**

3.4.2 Selecting Data

Select data and create a training dataset for subsequent model training.

Prerequisites

- You have obtained permissions to access OBS. For details on how to obtain OBS permissions, see **Obtaining the Access Key and Configuring ModelArts**.
- You have created an OBS bucket and folder for storing data. The OBS bucket should be in the same region as ModelArts Pro (Currently, only CN North-Beijing4 is supported). For details, see **Creating an OBS Bucket**.
- You have uploaded required data to OBS. For details, see **How Do I Upload Data to OBS**.
- You have created an application using the general text classification workflow on the NLP Suite console. For details, see **Creating an Application**.

Requirements on Datasets

- Unlabeled data

  Put data to be labeled in a text file.

- Labeled data

  The labeled objects and labels for text classification are in the same text file. You can specify a separator to separate the labeled objects and labels, as well as multiple labeled objects.

  For example, the following shows an example text file. The **Tab** key is used to separate the labeled object from the label.

  ```
  It touches good and responds quickly. I don't know how it performs in the future.  positive
  Three months ago, I bought a very good phone and replaced my old one with it. It can operate longer between charges.  positive
  Why does my phone heat up if I charge it for a while? The volume button stuck after being pressed down.  negative
  It's a gift for Father's Day. The delivery is fast and I received it in 24 hours. I like the earphones because the bass sounds feel good and they would not fall off.  positive
  ```

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Accessing the Application Development Page

- Method 1: Accessing the page for the first time

  Create an application based on a preset workflow. The **Application Development** page is directly displayed.

- Method 2: Accessing the page when you have created an application before

  Log in to the **ModelArts Pro** > **NLP Suite** console. By default, the **AppDev** > **Workbench** page is displayed. Locate the target application and click **View** in the **Operation** column. The **Application Development** page is displayed.

Creating Training Datasets

Choose **Application Development** > **Select Data**. On the page that is displayed, click **Create Dataset**. On the **Create Dataset** page that is displayed on the right, set basic information about a dataset based on its storage location and labeling information and click **OK**. For details, see **Table 3-3**.

Table 3-3 Parameters required for creating a dataset

Parameter	Description
Dataset	Name of a dataset to be created
Description	Dataset description
Upload Mode	Mode for uploading training data. Currently, data can only be uploaded to OBS. Therefore the default value is **OBS**.
Input Dataset Path	Location where training data is stored in OBS Click the text box on the right of **Input Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.
Output Dataset Path	Location where the dataset to be created is stored in OBS Click **Modify** on the right of **Output Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.

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Parameter	Description
Dataset Status	The uploaded training data can be labeled or unlabeled. You can set this parameter to **Labeled** or **Unlabeled** based on your service requirements. After selecting a dataset status, you can click **Upload datasets in the same format as the labeled text classification template.** or **Upload datasets in the same format as the unlabeled text classification template.** to download a dataset template.

After creating training datasets, select the training dataset required for application development.

Labeled data is required during model training. If you upload labeled data, you can **view the label parsing** after the upload. If you want to modify the label of a dataset, click **Label** in the **Operation** column of the dataset. On the **Dashboard** page that is displayed, click **Label** in the upper right corner. On the displayed page, manually label data. For details, see **Labeling Data > Text Classification**.

If you upload unlabeled data, click **Label** in the **Operation** column of the dataset. On the **Dashboard** page that is displayed, click **Label** in the upper right corner. On the displayed page, manually label data. For details, see **Labeling Data > Text Classification**.

Merging Labels

If some labels of the selected dataset have a small number of samples, you can merge them.

Enable the label merging function , and enter the maximum number of samples of labels to be merged and a new label name after label merging in the lower part of the page.

Viewing Label Parsing

After creating and selecting a training dataset, you can view the statistical data of label samples in the **Label Parsing** area. The horizontal axis indicates the labels, and the vertical axis indicates the number of valid samples corresponding to the label.

Follow-up Operations

On the **Application Development** > **Select Data** page, select a training dataset, label the data that is not labeled, and click **Next** to go to step **Train Model**. For details, see **Training a Model**.

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3.4.3 Labeling Data

Model training requires a large amount of labeled data. When datasets you upload are unlabeled during application development, label them.

Text is classified based on labels in the text classification scenario. A label name can contain a maximum of 32 characters, including Chinese characters, letters, digits, hyphens (-), and underscores (_).

Accessing the Label Data Page

Choose **Application Development** > **Select Data**, create a dataset, and click **Label** in the **Operation** column. The **Dashboard** page is displayed. Click **Label** in the upper right corner to go to the data labeling page.

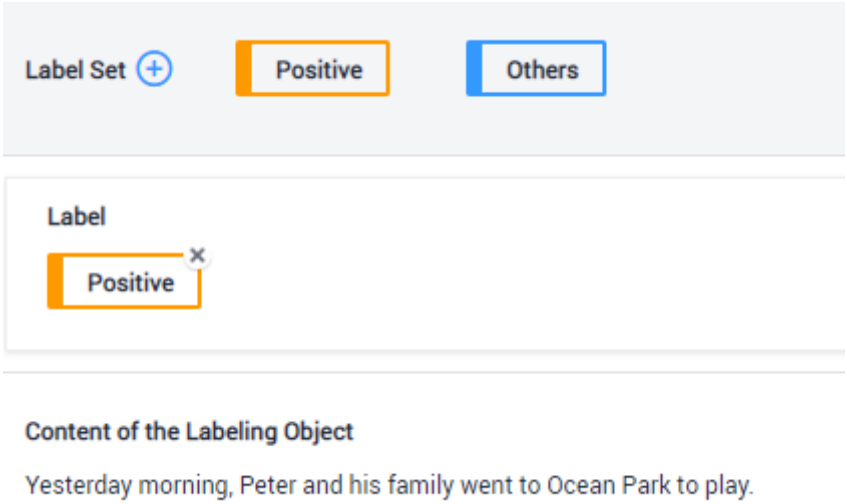
Labeling Content

The dataset details page displays the labeled and unlabeled text files in the dataset. The **Unlabeled** tab page is displayed by default.

1. On the **Unlabeled** tab page, the objects to be labeled are listed in the left pane. In the list, click the text object to be labeled, and select a label in the **Label Set** area in the right pane. Multiple labels can be added to a labeling object.

   You can repeat this operation to select objects and add labels to the objects.

   Figure 3-3 Labeling for text classification

2. After all objects are labeled, click **Save Current Page** at the bottom of the page to complete labeling text files on the **Unlabeled** tab page.

Adding Labels

- Adding labels on the **Unlabeled** tab page: Click the plus sign (+) next to **Label Set**. On the **Add Label** page that is displayed, add a label name, select a label color, and click **OK**.

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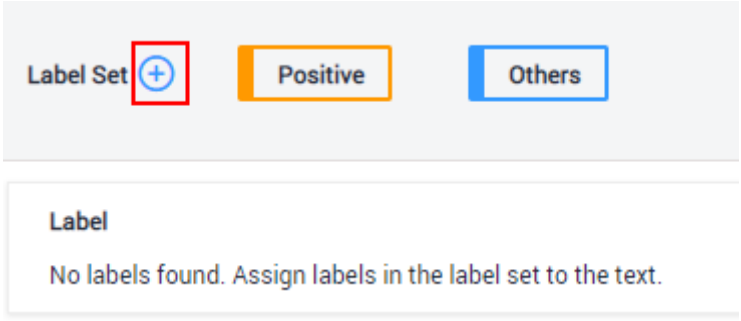
Figure 3-4 Adding a label (1)



- Adding labels on the **Labeled** tab page: Click the plus sign (+) next to **All Labels**. On the **Add Label** page that is displayed, add a label name, select a label color, and click **OK**.

Figure 3-5 Adding a label (2)

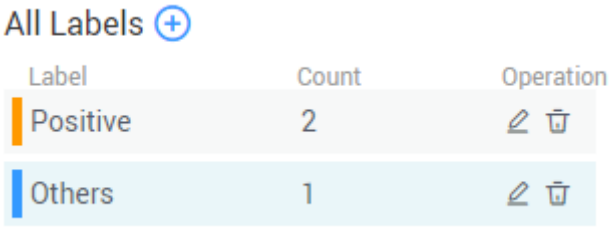
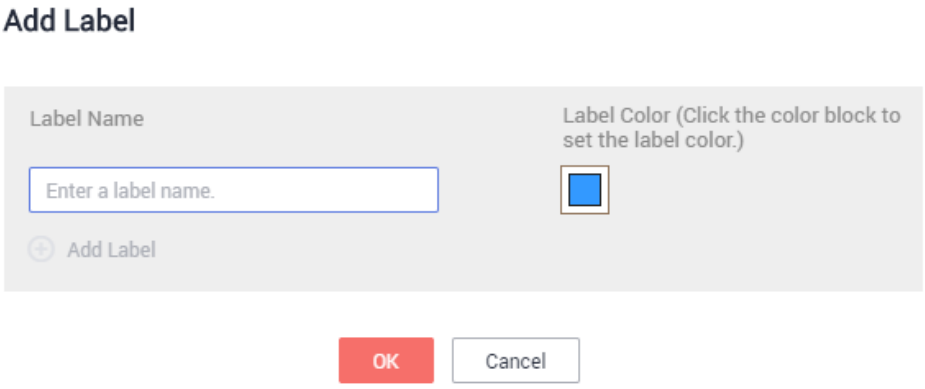


Figure 3-6 Adding a label



Viewing the Labeled Text

On the dataset details page, click the **Labeled** tab to view the list of the labeled text. You can also view all labels supported by the dataset in the **All Labels** area on the right.

Modifying Labeled Data

After labeling data, you can modify labeled data on the **Labeled** tab page.

- **Modifying based on texts**

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On the dataset details page, click the **Labeled** tab, and select the text to be modified from the text list.

In the text list, click the text. When the text background turns blue, the text is selected. If a text file has multiple labels, you can click above a label to delete the label.

- **Modifying based on labels**

  On the dataset details page, click the **Labeled** tab. The information about all labels is displayed on the right.

  - Batch modification: In the **All Labels** area, click the editing icon in the **Operation** column, modify the label name in the text box, select a label color, and click **OK**.
  - Batch deletion: In the **All Labels** area, click the deletion icon in the **Operation** column to delete the label. In the dialog box that is displayed, select **Delete label** or **Delete label and objects with only the label**, and click **OK**.

Adding Files

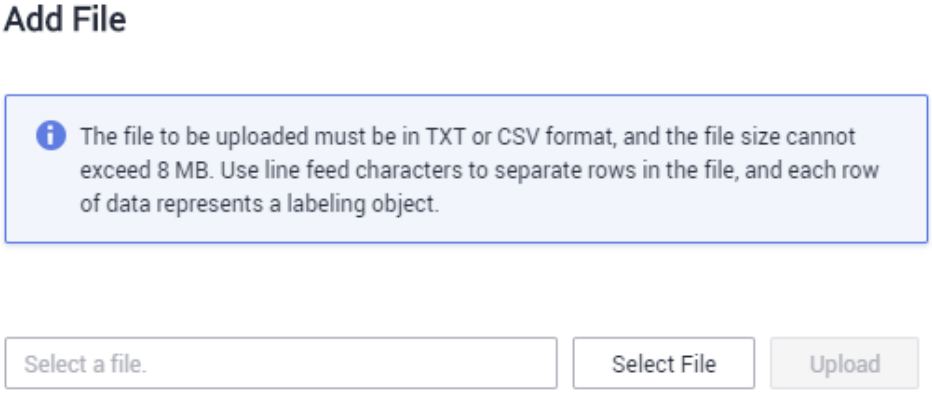
In addition to automatically synchronizing data from **Input Dataset Path**, you can directly add text files on ModelArts for data labeling.

1. On the dataset details page, click the **Unlabeled** tab. Then click **Add File**.
2. In the displayed **Add File** dialog box, set the parameters as required and then select the file to be uploaded.

   Select one or more files to be uploaded in the local environment. Only **.txt** and **.csv** files are supported. The total size of files uploaded at a time cannot exceed 8 MB. **Text and Label Separator** and **Label Separator** must be different.

   - **Pattern**: Select **Merge text objects and labels** or **Separate text objects and labels**. An example is provided. Determine the mode of the file to be added by referring to the example.
   - **Text and Label Separator**: Select **Tab**, **Space**, **Semicolon**, **Comma**, or **Other**. If you select **Other**, enter a separator in the text box on the right.
   - **Label Separator**: Select **Tab**, **Space**, **Semicolon**, **Comma**, or **Other**. If you select **Other**, enter a separator in the text box on the right.

Figure 3-7 Adding a file



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3. In the **Add File** dialog box, click **Upload**. The files you add will be automatically displayed on the **Unlabeled** or **Labeled** tab page.

Deleting a File

You can quickly delete the files you want to discard.

- On the **Unlabeled** tab page, select the text to be deleted, and click **Delete** in the upper left corner to delete the text.
- On the **Labeled** tab page, select the text to be deleted and click **Delete**. Alternatively, you can tick **Select Images on Current Page** to select all text on the current page and click **Delete** in the upper left corner.

The background of the selected text is blue.

3.4.4 Training a Model

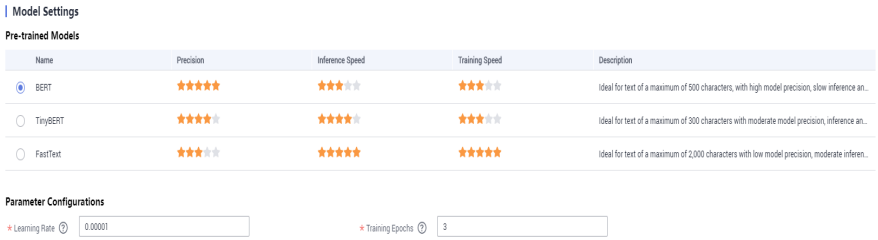
Select a pre-trained model and configure parameters based on the labeled training data to train a text classification model.

Prerequisites

You have created an application using the general text classification workflow and selected a training dataset on the NLP Suite console. For details, see **Selecting Data**.

Training a Model

Figure 3-8 Training a model



Choose **Application Development** > **Train Model**. Select a pre-trained model used for model training and set training parameters to start model training.

- **Pre-trained Models**

  Currently, pre-trained models include **BERT**, **TinyBERT**, and **FastText**. You can view the model precision, inference speed, training speed, and description in the pre-trained model list.

- **Parameter Configurations**

  In the **Parameter Configurations** area, specify **Learning Rate** and **Training Epochs**.

  – **Learning Rate** indicates the learning speed of a model. The value ranges from 0 to 1 (1 included).

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- **Training Epochs** indicates the number of dataset iterations during model training.

Confirm the information and click **Train**.

Generally, model training takes a period of time. After the training is complete, **the training details** are displayed in the lower part of the **Application Development** > **Train Model** page.

Viewing Training Details

After the model training is complete, view the training details on the **Application Development** > **Train Model** page, such as accuracy and loss differences.

Follow-up Operations

After the model training is complete, click **Next** to go to step **Evaluate Model**. For details, see **Evaluating a Model**.

3.4.5 Evaluating a Model

Evaluate the model after training. Typically, you cannot obtain a satisfactory model after the first evaluation, and may need to repeatedly adjust algorithm parameters and data to further optimize the model.

Some common metrics, such as precision, recall rate, and F1 score, help you evaluate and obtain a satisfactory model.

Prerequisites

You have created an application using the general text classification workflow and trained a model on the NLP Suite console. For details, see **Training a Model**.

Overall Evaluation

On the **Application Development** > **Evaluate Model** page, you can comprehensively evaluate the model of the current version.

On the left of the **Overall Evaluation** area display the version, number of labels, and number of test sets of the current model.

On the right of the **Overall Evaluation** area display evaluation parameter values of the current model, such as precision, recall rate, and F1 score. You can click ▾ in the upper part of the page to select an evaluation scope and click ⊕ to add a version for comparison.

Detailed Evaluation

On the **Application Development** > **Evaluate Model** page, you can search for and view the model prediction result for a test set.

You can search for a label in the search box on the left of the **Detailed Evaluation** area. On the right display correct and predicted labels of the sample corresponding to the correct label. You can compare the correct label and predicted label to determine whether the sample prediction of the current model is correct.

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For example, if you enter label **1** in the search box, the ratio of correct samples in the test set will be displayed. On the right display the information about the sample whose correct label is **1**, such as the correct label and predicted label of the sample.

Follow-up Operations

After the overall and detailed evaluation of the model of the current version, if the model needs to be further optimized based on service requirements, click **Previous** to return to the model training step. For details, see **Training a Model**.

If the model meets service requirements, click **Deploy** to go to step **Deploy Service**. For details, see **Deploying an Application**.

3.4.6 Deploying an Application

After evaluating the model, you can deploy and develop your own text classification application. This application is used to classify the text you upload. You can also directly call the corresponding APIs and SDKs.

Prerequisites

- You have created an application using the general text classification workflow and evaluated a model on the NLP Suite console. For details, see **Evaluating a Model**.
- Ensure that the account is not in arrears. Resources are consumed during application deployment.

Procedure

Choose **Application Development** > **Deploy Service**, set related parameters by referring to **Table 3-4**, and click **Deploy**.

Table 3-4 Parameters required for deploying a service

Parameter	Description
Service Name	Name of the service to be deployed. You can click to modify the default service name.
Description	Brief description of the service to be deployed
Compute Node Specifications	The following specifications are supported: • **CPU: 2 vCPUs | 8 GiB**: suitable for models with only CPU loads. • **CPU+GPU: 2 vCPUs | 8 GiB+P4**: suitable for models requiring CPU and GPU (NVIDIA P4) resources.

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Parameter	Description
Service Automatic Stop	Time when the service automatically stops. The service will automatically stop at the time you specified and will no longer be billed after it stops.
Compute Nodes	Instances for the current model version. If you set **Compute Nodes** to **1**, the standalone computing mode is used. If you set **Compute Nodes** to a value greater than 1, the distributed computing mode is used. Set an appropriate value based on the actual requirements.

When the deployment is successful, a message indicating **Service deployed successfully** is displayed on the page. You can click **View Monitoring** to go to the **Monitoring** page and view the monitoring information. For details, see **Monitoring an Application**.

3.5 Updating an Application Version

During model building, you may need to frequently tune the data, training parameters, or the model based on the training results to obtain a satisfactory model.

You can edit the model configuration information to match service changes. Specifically, ModelArts Pro generates a version each time when a modification is performed. You can compare different versions to quickly get the difference.

Prerequisites

You have created an application using the general text classification workflow on the NLP Suite console. For details, see **Creating an Application**.

Updating an Application Version

1. Log in to the ModelArts Pro console. Click **Access** on the NLP Suite card.

   The NLP Suite console is displayed.

2. In the navigation pane on the left, choose **AppDev** > **Workbench**.

   The **My Applications** page is displayed by default.

3. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   The application details page is displayed. By default, the **Application Development** page is displayed.

4. To update the version, click **Update** on the right of the version on the **Application Development** page.

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Figure 3-9 Updating a version

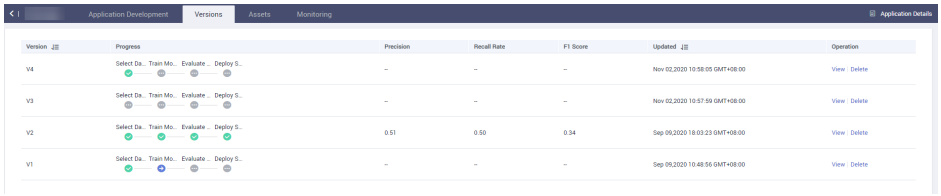


5. On the **Application Development** page, you can modify the configurations of **Select Data**, **Train Model**, **Evaluate Model**, and **Deploy Service** and redeploy the service. For details, see the following sections:
   - **Selecting Data**
   - **Training a Model**
   - **Evaluating a Model**
   - **Deploying an Application**

Follow-up Operations

After updating the version, you can click **Versions** on the application details page. On the **Versions** page, you can view the version name, progress, model precision, recall rate, F1 score, update time, and operations that can be performed of the current application.

Figure 3-10 Versions



3.6 Viewing Application Details

After creating an application, you can view the application details on the ModelArts Pro console, such as information about the application development configurations, versions, assets, and monitoring.

Prerequisites

You have created an application using the general text classification workflow on the NLP Suite console. For details, see **Creating an Application**.

Accessing the Application Details Page

1. Log in to the ModelArts Pro console. Click **Access** on the NLP Suite card.

   The NLP Suite console is displayed.
2. In the navigation pane on the left, choose **AppDev** > **Workbench**.

   The **My Applications** page is displayed by default.
3. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   The application details page is displayed. By default, the **Application Development** page is displayed.

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On the application details page, you can switch to any tab page to view the **application development configurations**, **application versions**, **application assets** (datasets), and **application monitoring**.

Viewing the Application Development Configurations

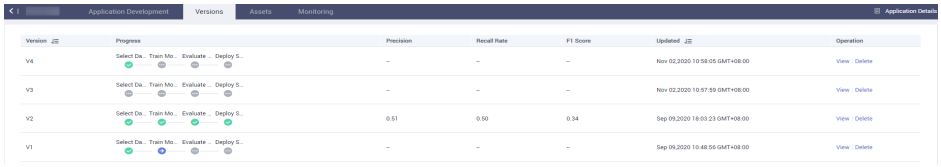
On the application details page, the **Application Development** page is displayed by default. You can view the configuration information of each step during application development, including **Select Data**, **Train Model**, **Evaluate Model**, and **Deploy Service**.

Alternatively, you can edit the configuration on the **Application Development** page and click **Update** on the right of the version in the upper left corner to update the current application into a new version.

Viewing Application Versions

After updating the version, you can click **Versions** on the application details page. On the **Versions** page, you can view the version name, progress, model precision, recall rate, F1 score, update time, and operations that can be performed of the current application.

Figure 3-11 Versions



Viewing Application Assets

On the **Assets** page of the application details page, you can view the asset information of the current application. For example, the asset information using the general text classification workflow is information about a training dataset. You can view the dataset name, description, number of data records, labeling progress, total number of labels, creation time, and operation. You can perform **View** and **Delete** operations in the **Operation** column.

View: Click **View** to go to the datasets details page. Click **Label** to manually label data. For details, see **Labeling Data > Text Classification**.

Delete: Click **Delete**. The **Delete Dataset** dialog box is displayed. Click **OK** to delete the current dataset.

Viewing Application Monitoring

On the **Monitoring** page of the application details page, you can view the basic information, historical versions, and API calling guide of the current application version, and test it online. For details, see **Monitoring an Application**.

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3.7 Monitoring an Application

After developing and deploying an application, you can monitor the application, view its basic information, historical versions, and API calling guide, and test it online.

Prerequisites

You have developed and deployed an application. For details, see **Deploying an Application**.

Accessing the Monitoring Page

1. Log in to the ModelArts Pro console. Click **Access** on the NLP Suite card.

   The NLP Suite console is displayed.

2. In the navigation pane on the left, choose **AppDev** > **Workbench**.

   The **My Applications** page is displayed by default.

3. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   The application details page is displayed. By default, the **Application Development** page is displayed.

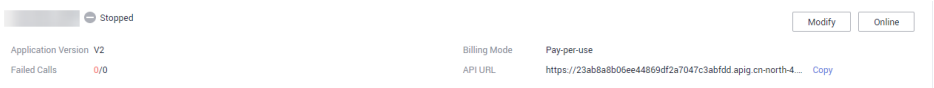
4. In the upper part of the page, click **Monitoring**.

   On the **Monitoring** page, you can view the basic information, historical versions, and API calling guide of the current application version, and test it online.

Basic Information

On the **Monitoring** page, you can view the basic information about the application. If the information is incorrect, you can click **Modify** to change the deployment information in the displayed dialog box on the right.

Figure 3-12 Basic information about an application



Testing an Application Online

On the **Monitoring** page, you can test a running application online. Enter the test text below the **Enter text.** box and click **Test**. The prediction result is displayed on the right.

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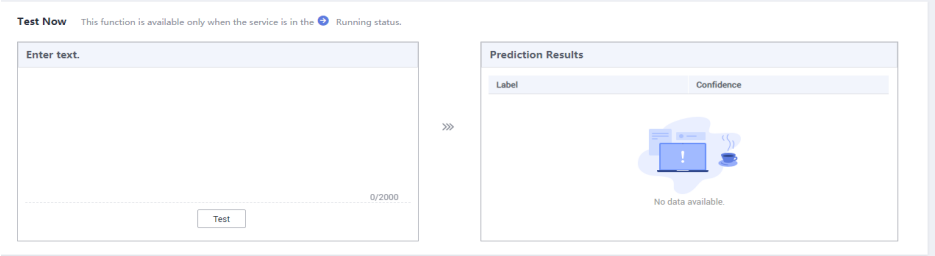
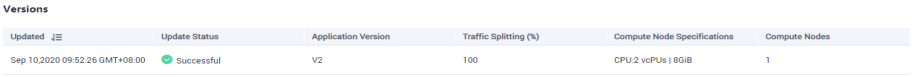
Figure 3-13 Online test



Viewing Versions

On the **Monitoring** page, you can view the version information about the current application, such as update time, update status, application version, traffic splitting (%), compute node specifications, and number of compute nodes.

Figure 3-14 Versions



Viewing the API Calling Guide

On the **Monitoring** page, you can view the API calling information of the current application. For details, see **NLP API Reference**.

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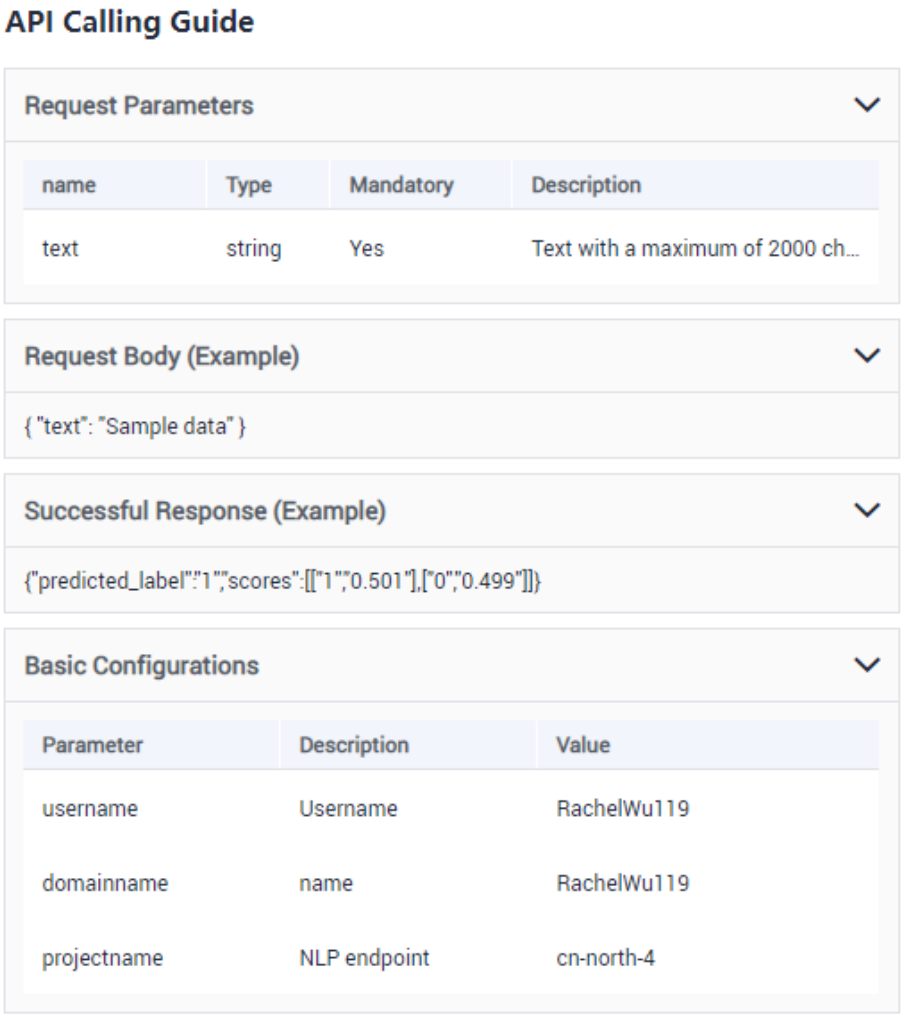
Figure 3-15 API calling guide



3.8 Deleting an Application

If an application is no longer in use, you can delete it to release resources.

Procedure

1. Log in to the ModelArts Pro console. Click **Access** on the NLP Suite card.
   The NLP Suite console is displayed.
2. In the navigation pane on the left, choose **AppDev** > **Workbench**.
   The **My Applications** page is displayed by default.
3. On the **My Applications** page, locate the desired application and click **Delete** in the **Operation** column.
   The **Delete Application** dialog box is displayed.
4. In the displayed dialog box, click **OK**.

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4 Vision Suite

4.1 Introduction

Vision Suite assists you to quickly develop vision AI applications that meet service requirements. It enables you to orchestrate workflows independently, so that you can rapidly develop and deploy vision AI applications.

Preset Workflows

Vision Suite provides preset workflows that cover a wide range of scenarios. You can upload training data and configure parameters to build and upgrade high-precision recognition models. A custom model has high precision and superior recognition efficiency.

- Retail goods recognition workflow

  This workflow allows you to customize high-precision goods recognition algorithms, improving the launch efficiency of new products and consumer experience.
- Hot-rolled steel sheet surface defect detection workflow

  This workflow allows you to upload data of hot-rolled steel sheet surface images to build a model for detecting surface defects of hot-rolled steel sheets.
- Cloud type recognition workflow

  This workflow allows you to upload images of different types of cloud types to build a cloud type recognition model that can precisely recognize cloud types used for weather forecast.
- Disc brake recognition workflow

  This workflow allows you to upload images of different disc brakes to build a disc brake recognition model that can quickly and accurately recognize disc brakes.

For details, see **Service Overview > Visual Suite**.

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Process for Using a Preset Workflow to Develop an Application

Preset workflows allow you to upload training data to build and upgrade high-precision recognition models.

Figure 4-1 Process for using a preset workflow to develop an application

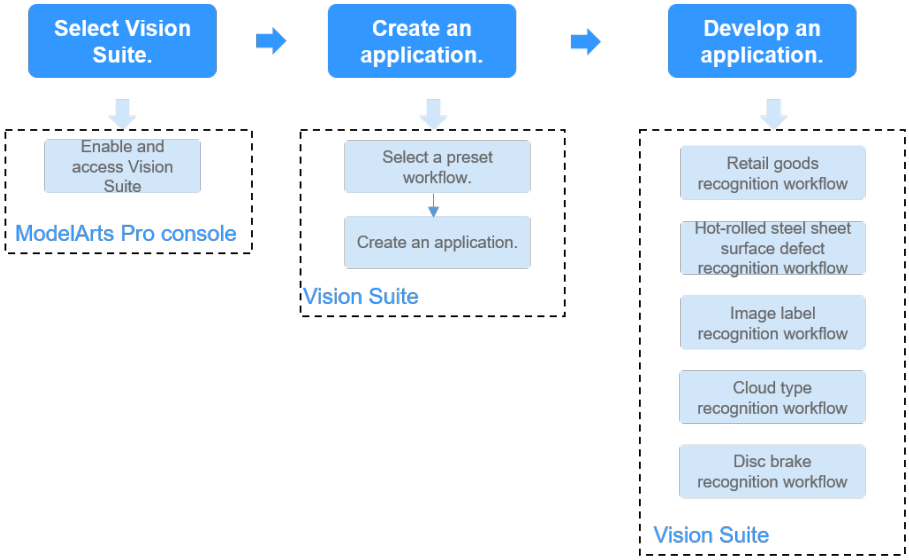

Table 4-1 Process description

Step		Description	Reference
Select Vision Suite.		Select Vision Suite based on you needs. Alternatively, you can view the workflow to locate the required suite.	On the ModelArts Pro console, click **Access** on the **Vision Suite** card to access the Vision Suite console.
Create an application.		Create an application by entering basic information and selecting a workflow.	**Creating an Application**
Develop an application.	Retail goods recognition workflow	Develop a goods recognition service based on the workflow guide. Upload training data, train a goods recognition model, and update and adjust the model precision to achieve high goods recognition precision.	**Retail Goods Recognition Workflow**

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Step		Description	Reference
	Hot-rolled steel sheet surface defect detection workflow	Develop a hot-rolled steel sheet surface defect detection service based on the workflow guide. Upload training data, train a defect detection model, and update and adjust the model precision to achieve high defect detection precision.	**Hot-rolled Steel Sheet Surface Defect Recognition Workflow**
	Cloud type recognition workflow	Develop a cloud type recognition service based on the workflow guide. Upload training data, train a cloud type recognition model, and update and adjust the model precision to achieve high cloud type recognition precision.	**Cloud Type Recognition Workflow**
	Disc brake recognition workflow	Develop a disc brake recognition service based on the workflow guide. Upload training data, train a disc brake model, and update and adjust the model precision to achieve high disc brake recognition precision.	**Disc Brake Recognition Workflow**

4.2 Configuring the OBS Storage Location

The template images and test images uploaded when you use ModelArts Pro are stored in OBS. Therefore, you need to configure the OBS storage location before using OCR Suite.

Prerequisites

You have registered a HUAWEI CLOUD account, authorized related services, created OBS buckets, and completed other preparations. For details, see **Preparations**.

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Procedure

1. On the ModelArts Pro console, click **Access** on the **Vision Suite** card.
   The Vision Suite console is displayed.
2. In the navigation pane on the left, choose **Configuration Center** > **Basic Configuration**.
   The **Basic Configuration** page is displayed.
3. Click **Modify** next to **Default Storage Location** under **Storage**.
   The **Default Storage Location** dialog box is displayed.
4. In the dialog box that is displayed, select an OBS bucket and folder and click **OK**.
   The OBS storage location is configured.

Follow-up Operations

You can create an application as described in **Creating an Application** and develop it based on the workflow on the **ModelArts Pro** > **Vision Suite** console.

4.3 Creating an Application

Before developing an application with a preset workflow on the ModelArts Pro console, you need to create an application by entering basic information and selecting a workflow.

Prerequisites

- Ensure that the HUAWEI CLOUD account is not in arrears. Developing applications on the ModelArts Pro console may occupy OBS resources and incur fees. For details about the billing rules, see **OBS Pricing Details**.
- You have configured the OBS path for storing test data and training data. For details, see **Configuring the OBS Storage Location**.

Procedure

1. On the ModelArts Pro console, click **Access** on the **Vision Suite** card.
   The Vision Suite console is displayed.
2. In the navigation pane on the left, choose **AppDev** > **Workbench**.
   The **My Applications** page is displayed by default.
3. On the **My Applications** page, click **Create Application**.
   The **Create Application** page is displayed.
   Alternatively, you can click **My Workflows** to switch to the **My Workflows** page, select a workflow, and click **Create Application** on the card.
4. Specify **Basic Information**, **Workflow Settings**, and **Resource Settings** based on your service requirements.
   - **Basic Information**
     Specify **Application Name** (mandatory), **Owner**, **Description**.
   - **Workflow Settings**

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Specify **Industry** and **Workflow**. Vision Suite now provides the retail goods recognition workflow, hot-rolled steel sheet surface defect detection workflow, cloud type recognition workflow, and disc brake recognition workflow.

- **Resource Settings**
  - Specify **Data Processing Resource**, **Model Training Resource**, and **Test Resource Deployment**, which are the resource pools and resource types used for data processing, model training, and online test, respectively.

    Resource pools include **Public resource pool** and **Dedicated resource pool**.

    Public resource pool provides public large-scale computing clusters. Resources are isolated by job. You can select the resource type based on your needs.

    Dedicated resource pool provides dedicated computing resources that cannot be shared with other users and delivers higher efficiency. To use the dedicated resource pool, you need to create a dedicated resource pool in ModelArts. For details, see **Resource Pools**.
  - **Deployment Mode**: Select the deployment mode of the application. The hot-rolled steel sheet surface defect recognition workflow and retail goods recognition workflow support only online deployment. The cloud type recognition workflow and disc brake recognition workflow support both online deployment and HiLens deployment.

    If you want to use the HiLens deployment mode to develop applications, register Atlas 500 on the Huawei HiLens console in advance.

5. Confirm the information and click **OK**.

   An application is successfully created.

Follow-up Operations

Develop the application based on the selected workflow.

- **Retail Goods Recognition Workflow**
- **Hot-rolled Steel Sheet Surface Defect Recognition Workflow**
- **Cloud Type Recognition Workflow**
- **Disc Brake Recognition Workflow**

4.4 Retail Goods Recognition Workflow

4.4.1 Introduction

Workflow Overview

In scenarios such as supermarkets and retail stores where goods are updated quickly, the goods recognition technology greatly improves goods optimization and operation efficiency. The retail goods recognition workflow provided by

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ModelArts Pro delivers high-precision goods recognition algorithms, improving the launch efficiency of new products and consumer experience.

- Functions

  This workflow allows you to customize high-precision goods recognition algorithms, improving the launch efficiency of new products and consumer experience.

- Application scenarios

  This workflow can be applied in retail scenarios such as unattended supermarkets, cake and fresh food recognition, and self-checkout.

- Advantages

  The model features high precision and quick recognition, and is easy to update.

- Functions

  This workflow allows you to customize high-precision goods recognition algorithms, improving the launch efficiency of new products and consumer experience.

- Application scenarios

  This workflow can be applied in retail scenarios such as unattended supermarkets, cake and fresh food recognition, and self-checkout.

- Advantages

  The model features high precision and quick recognition, and is easy to update.

Workflow Process

After creating a goods recognition application on the **ModelArts Pro** > **Vision Suite** console, you can develop this application by training a model to implement goods recognition for quicker goods rollout and better customer experience.

Figure 4-2 Process for developing a goods recognition application

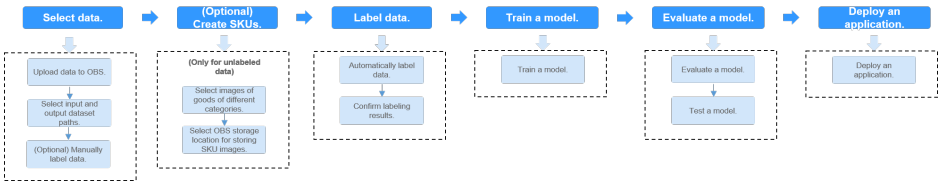

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Table 4-2 Process description

Step	Description	Reference
Select data.	Select data and create a training dataset for subsequent model training. Labeled data is required during model training. If data you upload is unlabeled, you can **manually label the data**. Alternatively, you can **create stock keeping units (SKUs)** and **automatically label the data**.	**Selecting Data**
(Optional) Create SKUs.	In the goods recognition scenario, if the uploaded data contains unlabeled data, you need to create SKUs, that is, images of a type of goods, to facilitate automatic labeling of data in the dataset. If a dataset has been labeled, skip this step.	**Creating SKUs**
Label data.	ModelArts Pro automatically labels data and SKUs on the **Application Development** > **Label Data** page. After the automatic labeling is complete, you can check and confirm the labeling result of each data record.	**Automatically Labeling Data**
Train a model.	Train the goods recognition model, free from any parameter configuration, and view the accuracy and loss differences of the trained model.	**Training a Model**
Evaluate a model.	Evaluate the model after training. Some common metrics, such as precision, recall rate, and F1 score, and also an online test service help you effectively evaluate and obtain a satisfactory model.	**Evaluating a Model**
Deploy an application.	After the model is prepared, you can deploy an application to identify goods images or directly call the corresponding APIs and SDKs.	**Deploying an Application**

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4.4.2 Selecting Data

Select data and create a training dataset for subsequent model training.

Prerequisites

- You have obtained permissions to access OBS. For details on how to obtain OBS permissions, see **Obtaining the Access Key and Configuring ModelArts**.
- You have created an OBS bucket and folder for storing data. The OBS bucket should be in the same region as ModelArts Pro. For details, see **Creating an OBS Bucket**.
- You have uploaded required data to OBS. See **Requirements on Datasets** for requirements on data and **How Do I Upload Data to OBS** for guide on how to upload data to OBS.
- You have created an application using the goods recognition workflow on the Vision Suite console. For details, see **Creating an Application**.

Requirements on Datasets

- Unlabeled datasets

  Images must be stored in one directory, as shown in the following example.

  ```
  ├─dataset-import-example
  │      IMG_20180919_114732.jpg
  │      IMG_20180919_114745.jpg
  │      IMG_20180919_114945.jpg
  ```

  – If data is imported from an OBS path, you must have the permission to read the OBS path.

  – Images in JPG, JPEG, PNG, and BMP formats are supported.

- Labeled datasets

  Labeled objects and their labeling files (in one-to-one relationship with the labeled objects) must be in the same directory. For example, if the name of the labeled object file is **IMG_20180919_114745.jpg**, the name of the labeling file must be **IMG_20180919_114745.xml**.

  The labeling files must be in PASCAL VOC format. For details about the format, see **Table 4-3**.

  Example:

  ```
  ├─dataset-import-example
  │      IMG_20180919_114732.jpg
  │      IMG_20180919_114732.xml
  │      IMG_20180919_114745.jpg
  │      IMG_20180919_114745.xml
  │      IMG_20180919_114945.jpg
  │      IMG_20180919_114945.xml
  ```

  A labeling file example is as follows:

  ```
  <?xml version="1.0" encoding="UTF-8" standalone="no"?>
  <annotation>
     <folder>NA</folder>
     <filename>bike_1_1593531469339.png</filename>
     <source>
        <database>Unknown</database>
     </source>
     <size>
        <width>554</width>
        <height>606</height>
  ```

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```
    <depth>3</depth>
  </size>
  <segmented>0</segmented>
  <object>
    <name>Dog</name>
    <pose>Unspecified</pose>
    <truncated>0</truncated>
    <difficult>0</difficult>
    <occluded>0</occluded>
    <polygon>
      <x1>100<x1>
      <y1>100<y1>
      <x2>200<x2>
      <y2>100<y2>
      <x3>250<x3>
      <y3>150<y3>
      <x4>200<x4>
      <y4>200<y4>
      <x5>100<x5>
      <y5>200<y5>
      <x6>50<x6>
      <y6>150<y6>
    </polygon>
  </object>
  <object>
    <name>Cat</name>
    <pose>Unspecified</pose>
    <truncated>0</truncated>
    <difficult>0</difficult>
    <occluded>0</occluded>
    <polygon>
      <x1>100<x1>
      <y1>100<y1>
      <x2>200<x2>
      <y2>100<y2>
      <x3>250<x3>
      <y3>150<y3>
      <x4>200<x4>
      <y4>200<y4>
      <x5>100<x5>
      <y5>200<y5>
      <x6>50<x6>
      <y6>150<y6>
    </polygon>
  </object>
</annotation>
```

– Images in JPG, JPEG, PNG, and BMP formats are supported. The size of a single image cannot exceed 5 MB, and the total size of all images uploaded in one attempt cannot exceed 8 MB.

Table 4-3 PASCAL VOC format description

Parameter	Mandatory	Description
folder	Yes	Directory where the data source is located
filename	Yes	Name of the file to be labeled

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Parameter	Mandatory	Description
size	Yes	Image pixel • **width**: image width. This parameter is mandatory. • **height**: image height. This parameter is mandatory. • **depth**: number of image channels. This parameter is mandatory.
segmented	Yes	Segmented or not
object	Yes	Object detection information. Multiple **object{}** functions are generated for multiple objects. • **name**: class of the labeled object. This parameter is mandatory. • **pose**: shooting angle of the labeled object. This parameter is mandatory. • **truncated**: whether the labeled object is truncated (**0** indicates that the object is not truncated). This parameter is mandatory. • **occluded**: whether the labeled object is occluded (**0** indicates that the object is not occluded). This parameter is mandatory. • **difficult**: whether the labeled object is difficult to identify (**0** indicates that the object is easy to identify). This parameter is mandatory. • **confidence**: confidence score of the labeled object. The value range is 0 to 1. This parameter is optional. • **polygon**: class of the bounding box. This parameter is mandatory. When labeling with the retail goods recognition workflow, this bounding box type (**polygon**) must be selected to label the goods. The labeling information indicates coordinates of each point, as shown in the following: <x1>100<x1> <y1>100<y1> <x2>200<x2> <y2>100<y2> <x3>250<x3> <y3>150<y3> <x4>200<x4> <y4>200<y4> <x5>100<x5> <y5>200<y5> <x6>50<x6> <y6>150<y6>

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Accessing the Application Development Page

- Method 1: Accessing the page for the first time

  Create an application as described in **Creating an Application** based on a preset workflow. The **Application Development** page is directly displayed.

- Method 2: Accessing the page when you have created an application before

  Log in to the **ModelArts Pro** > **Vision Suite** console. By default, the **AppDev** > **Workbench** page is displayed. Locate the target application and click **View** in the **Operation** column. The **Application Development** page is displayed.

Creating Training Datasets

Choose **Application Development** > **Select Data**. On the page that is displayed, click **Create Dataset**. On the **Create Dataset** page that is displayed on the right, set basic information about a dataset based on its storage location and labeling information and click **OK**. For details, see **Table 4-4**.

Table 4-4 Parameters required for creating a dataset

Parameter	Description
Dataset	Name of a dataset to be created
Description	Dataset description
Upload Mode	Mode for uploading training data. Currently, data can only be uploaded to OBS. Therefore the default value is **OBS**.
Input Dataset Path	Location where training data is stored in OBS Click the text box on the right of **Input Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.
Output Dataset Path	Location where the dataset to be created is stored in OBS There is a default path for storing a dataset to be created. To modify it, click **Modify** on the right of **Output Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.

After creating training datasets, select the training dataset required for application development.

Labeled data is required during model training. For uploaded datasets, you can

- Manually add or modify labels.

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Click **Label** in the **Operation** column of the dataset. On the **Dashboard** page that is displayed, click **Label** in the upper right corner. On the displayed page, manually label data. For details, see **Labeling Data > Object Detection**.

NOTE

When labeling data with the retail goods recognition workflow, the polygon bounding box must be used to label goods outline.

- Automatically label data.

  Click **Next**. **Create SKUs** and **automatically label data**.

Viewing Label Parsing

After creating and selecting a training dataset, you can view the statistical data of label samples in the **Label Parsing** area. The horizontal axis indicates the labels, and the vertical axis indicates the number of valid samples corresponding to the label.

Follow-up Operations

On the **Application Development** > **Select Data** page, select a training dataset and label the data that is not labeled. You can **manually label the data**. Click **Next** to go to step **Create SKU**. For details, see **Creating SKUs**.

4.4.3 Creating SKUs

In the goods recognition scenario, if the uploaded data contains unlabeled data, you need to create SKUs, that is, images of a type of goods, to facilitate automatic labeling of data in the dataset.

Prerequisites

- You have obtained permissions to access OBS. For details on how to obtain OBS permissions, see **Obtaining the Access Key and Configuring ModelArts**.
- You have prepared SKU data, that is, images of a range of goods, either stored locally or uploaded to OBS.

  Files have been placed in a path either like **goods folder/goods image** or **parent folder/goods folder/goods image**.

  To ensure the automatic labeling effect, it is recommended that the number of images for each SKU, that is, for each goods category, be greater than 20.
- You have created an OBS bucket and folder for storing SKU images later. The OBS bucket should be in the same region as ModelArts Pro. For details, see **Creating an OBS Bucket**.
- You have created an application using the retail goods recognition workflow and selected a training dataset on the Vision Suite console. For details, see **Selecting Data**.

  NOTE

  If the dataset you selected is labeled, skip this section. Go to step **Label Data** and **automatically label data**.

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Creating an SKU

When uploading an SKU, that is, goods images of a category, create an SKU and upload images.

1. On the **Create SKU** page, click **Create**.

   The **Create SKU** dialog box is displayed.

2. In the displayed dialog box, specify parameters as required and click **OK**. See **Table 4-5**.

   Table 4-5 Parameters required for creating an SKU

Parameter	Description
Name	Name of an SKU
Upload Image	Select a prepared SKU containing images of a category of goods from the local host. Click **Select File** on the right of **Upload Image** and select one or more images from the local host. **NOTE** Put files in a path either like **goods folder/goods image** or **parent folder/goods folder/goods image**. Therefore the system can recognize folders of goods images. The number of images for each SKU must be greater than 20.
OBS Storage Location	Select an OBS bucket and folder for storing SKU images. Click the text box on the right of **OBS Storage Location**. In the displayed dialog box, select an OBS bucket and folder for storing the SKU, and click **OK**.

Batch Uploading SKUs

You can upload multiple SKUs in batches, that is, multiple categories of good images.

1. On the **Create SKU** page, click **Batch Upload**.

   The **Batch Upload SKU** dialog box is displayed.

2. In the displayed **Batch Upload SKU** dialog box, specify parameters as required and click **OK**. See **Table 4-6**.

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Table 4-6 Parameters for batch uploading SKUs

Parameter	Description
Upload From	Mode for uploading SKUs **OBS** is the default value.
Input SKU Path	OBS bucket and folder from which SKU data is input If **Upload From** is set to **Local**, the local SKU data is automatically uploaded to OBS. If **Upload From** is set to **OBS**, the OBS path for storing SKU data is directly selected. Click the text box on the right of **OBS Storage Location**. In the displayed dialog box, select an OBS bucket and folder for storing the SKU, and click **OK**.
Output SKU Path	OBS path into which SKU data is output Click **Modify** to modify the OBS bucket or folder.

Follow-up Operations

After creating SKUs on the **Application Development** > **Create SKU** page, click **Next** in the lower right corner to go to step **Label Data**. For details, see **Automatically Labeling Data**.

4.4.4 Automatically Labeling Data

ModelArts Pro automatically labels data and SKUs on the **Application Development** > **Label Data** page. After the automatic labeling is complete, you can check and confirm the labeling result of each data record.

Prerequisites

You have created an application using the retail goods recognition workflow and created SKUs on the Vision Suite console. For details, see **Creating SKUs**.

Automatically Labeling Data

Choose **Application Development** > **Label Data**. The automatic labeling progress is displayed. If the automatic labeling is complete, the labeling progress is 100%.

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Figure 4-3 Automatic labeling complete



After the labeling is complete, you can click **Confirm** in the **Confirm labeling results** area to go to the labeling dashboard page.

On the **Dashboard** page, click **Label** in the upper right corner. On the manual labeling page that is displayed, check data on the **Labeled** page. For details, see **Labeling Data > Object Detection**. **Modify labels** for the data that is incorrectly labeled.

NOTE

When labeling data with the retail goods recognition workflow, the polygon bounding box must be used to label goods outline.

4.4.5 Training a Model

Train a model based on the labeled training data. You can view the accuracy and loss differences of the training model.

Prerequisites

You have created an application using the retail goods recognition workflow and labeled data on the Vision Suite console. For details, see **Automatically Labeling Data**.

Training a Model

Choose **Application Development** > **Train Model** and click **Train**.

Generally, model training takes a period of time. After the training is complete, **the training details** are displayed in the lower part of the **Application Development** > **Train Model** page.

Viewing Training Details

After the model training is complete, view the training details on the **Application Development** > **Train Model** page, such as accuracy and loss differences.

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Figure 4-4 Training a model



Follow-up Operations

After the model training is complete, click **Next** to go to step **Evaluate Model**. For details, see **Evaluating a Model**.

4.4.6 Evaluating a Model

Evaluate the model after training. Typically, you cannot obtain a satisfactory model after the first evaluation, and may need to repeatedly adjust algorithm parameters and data to further optimize the model.

Some common metrics, such as precision, recall rate, and F1 score, help you effectively evaluate and obtain a satisfactory model.

Prerequisites

You have created an application using the retail goods recognition workflow and trained a model on the Vision Suite console. For details, see **Training a Model**.

Evaluating a Model

On the **Application Development** > **Evaluate Model** page, you can evaluate the model of the current version by viewing parameters and detailed evaluation data, and conducting online test.

- **Evaluate Model**

  Under the **Evaluate Model** area display the version, number of labels, and number of test sets of the current model.

- **Parameter Comparison**

  Under the **Parameter Comparison** area display evaluation parameter values of the current model, such as precision, recall rate, and F1 score. You can click ▾ in the upper part of the page to select an evaluation scope and click ⊕ to add a version for comparison.

- **Detailed Evaluation**

  Under the **Detailed Evaluation** area display the proportion of samples under different labels. You can click a label to view images that are incorrectly identified under this label.

Follow-up Operations

After the model evaluation, if the model needs to be further optimized based on service requirements, click **Previous** to return to the model training step. For details, see **Training a Model**.

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If the model meets service requirements, click **Deploy** to go to step **Deploy Service**. For details, see **Deploying an Application**.

4.4.7 Deploying an Application

After evaluating the model, you can deploy and develop your own retail goods recognition application. This application is used to recognize goods images you upload. You can also directly call the corresponding APIs and SDKs.

Prerequisites

- You have created an application using the retail goods recognition workflow and evaluated a model on the Vision Suite console. For details, see **Evaluating a Model**.
- Ensure that the account is not in arrears. Resources are consumed during application deployment.

Procedure

Choose **Application Development** > **Deploy Service**, set related parameters by referring to **Table 4-7**, and click **Deploy**.

Table 4-7 Parameters required for deploying a service

Parameter	Description
Service Name	Name of the service to be deployed. You can click to modify the default service name.
Description	Brief description of the service to be deployed
Deployed As	Currently, only **Real-time service** is supported.
Compute Node Specifications	The value can be **CPU+GPU: 2 vCPUs | 8 GiB+P4**, which is suitable for models requiring CPU and GPU (one NVIDIA P4) resources.
Service Automatic Stop	Time when the service automatically stops. The service will automatically stop at the time you specified and will no longer be billed after it stops.

After the deployment is successful, the system displays a message indicating **Service deployed successfully**. You can click **View Monitoring** to go to the **Monitoring** page and view the monitoring information. For details, see **Monitoring an Application**.

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4.5 Hot-rolled Steel Sheet Surface Defect Recognition Workflow

4.5.1 Introduction

Workflow Overview

In steel mills, the service life of steel sheets will be determined by the material, heat treatment technique, and application environment. These factors also lead to defects for steel sheets. Research on steel sheet surface defects is critical to the service life of steel sheets. ModelArts Pro provides a workflow for detecting defects on hot-rolled steel sheet surfaces and high-precision algorithms for identifying these defects.

- Functions

  This workflow allows you to upload data of hot-rolled steel sheet surface images to build a model for detecting defects.
- Application scenarios

  This workflow applies to steel and iron manufacturing.
- Advantages

  The model features high precision and quick recognition, and is easy to update.

Workflow Process

After creating a defect recognition application on the **ModelArts Pro** > **Vision Suite** console, you can develop this application in automobile or electronic manufacturing by uploading data to train a model for recognizing steel sheet surface defects.

Figure 4-5 Process for developing a hot-rolled steel sheet surface defect recognition application

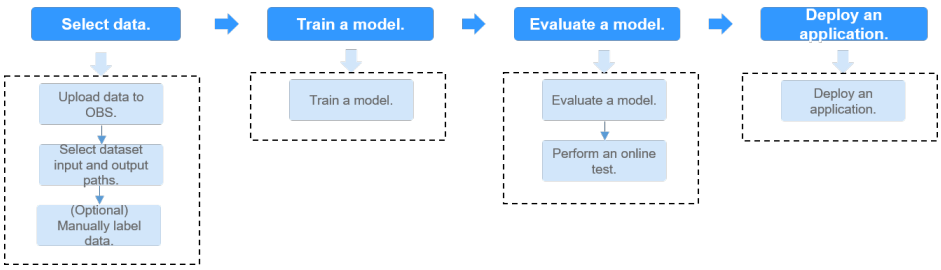

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Table 4-8 Process description

Step	Description	Reference
Select data.	Select data and create a training dataset for subsequent model training. Labeled data is required during model training. If the data you upload is unlabeled, **manually label the data**.	**Selecting Data**
Train a model.	Train the defect recognition model, free from any parameter configuration, and view the accuracy and loss differences of the trained model.	**Training a Model**
Evaluate a model.	Evaluate the model after training. Some common metrics, such as precision, recall rate, and F1 score, and also an online test service help you effectively evaluate and obtain a satisfactory model.	**Evaluating a Model**
Deploy an application.	After the model is prepared, you can deploy an application to detect surface defects on hot-rolled steel sheets or directly call the corresponding APIs and SDKs.	**Deploying an Application**

4.5.2 Selecting Data

Select data and create a training dataset for subsequent model training.

Prerequisites

- You have obtained permissions to access OBS. For details on how to obtain OBS permissions, see **Obtaining the Access Key and Configuring ModelArts**.
- You have created an OBS bucket and folder for storing data. The OBS bucket should be in the same region as ModelArts Pro. For details, see **Creating an OBS Bucket**.
- You have uploaded required data to OBS. See **Requirements on Datasets** for requirements on data and **How Do I Upload Data to OBS?** for guide on how to upload data to OBS.
- You have created an application using the surface defect recognition workflow for steel sheets on the Vision Suite console. For details, see **Creating an Application**.

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Requirements on Datasets

- Unlabeled datasets

  Images must be stored in one directory, as shown in the following example.

  ```
  ├─dataset-import-example
  │      IMG_20180919_114732.jpg
  │      IMG_20180919_114745.jpg
  │      IMG_20180919_114945.jpg
  ```

  – If data is imported from an OBS path, you must have the permission to read the OBS path.

  – Images in JPG, JPEG, PNG, and BMP formats are supported.

- Labeled datasets

  Labeled objects and their labeling files (in one-to-one relationship with the labeled objects) must be in the same directory. For example, if the name of the labeled object file is **IMG_20180919_114745.jpg**, the name of the labeling file must be **IMG_20180919_114745.xml**.

  The labeling files must be in PASCAL VOC format. For details about the format, see **Table 4-9**.

  Example:

  ```
  ├─dataset-import-example
  │      IMG_20180919_114732.jpg
  │      IMG_20180919_114732.xml
  │      IMG_20180919_114745.jpg
  │      IMG_20180919_114745.xml
  │      IMG_20180919_114945.jpg
  │      IMG_20180919_114945.xml
  ```

  A labeling file example is as follows:

  ```
  <?xml version="1.0" encoding="UTF-8" standalone="no"?>
  <annotation>
     <folder>NA</folder>
     <filename>bike_1_1593531469339.png</filename>
     <source>
        <database>Unknown</database>
     </source>
     <size>
        <width>554</width>
        <height>606</height>
        <depth>3</depth>
     </size>
     <segmented>0</segmented>
     <object>
        <name>Dog</name>
        <pose>Unspecified</pose>
        <truncated>0</truncated>
        <difficult>0</difficult>
        <occluded>0</occluded>
        <bndbox>
           <xmin>279</xmin>
           <ymin>52</ymin>
           <xmax>474</xmax>
           <ymax>278</ymax>
        </bndbox>
     </object>
     <object>
        <name>Cat</name>
        <pose>Unspecified</pose>
        <truncated>0</truncated>
        <difficult>0</difficult>
        <occluded>0</occluded>
        <bndbox>
           <xmin>279</xmin>
  ```

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```
        <ymin>198</ymin>
        <xmax>456</xmax>
        <ymax>421</ymax>
      </bndbox>
   </object>
</annotation>
```

– Images in JPG, JPEG, PNG, and BMP formats are supported. The size of a single image cannot exceed 5 MB, and the total size of all images uploaded in one attempt cannot exceed 8 MB.

Table 4-9 PASCAL VOC format description

Parameter	Mandatory	Description
folder	Yes	Directory where the data source is located
filename	Yes	Name of the file to be labeled
size	Yes	Image pixel • **width**: image width. This parameter is mandatory. • **height**: image height. This parameter is mandatory. • **depth**: number of image channels. This parameter is mandatory.
segmented	Yes	Segmented or not

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Parameter	Mandatory	Description
object	Yes	Object detection information. Multiple **object{}** functions are generated for multiple objects. • **name**: class of the labeled object. This parameter is mandatory. • **pose**: shooting angle of the labeled object. This parameter is mandatory. • **truncated**: whether the labeled object is truncated (**0** indicates that the object is not truncated). This parameter is mandatory. • **occluded**: whether the labeled object is occluded (**0** indicates that the object is not occluded). This parameter is mandatory. • **difficult**: whether the labeled object is difficult to identify (**0** indicates that the object is easy to identify). This parameter is mandatory. • **confidence**: confidence score of the labeled object. The value range is 0 to 1. This parameter is optional. • **bndbox**: type of the bounding box. This parameter is mandatory. When labeling with the surface defect recognition workflow on steel sheets, you are advised to set the bounding box type to **bndbox**, namely, select the rectangle as the bounding box type to label the defects. The labeling information indicates coordinates of upper left and lower right points, as shown in the following: <xmin>100<xmin> <ymin>100<ymin> <xmax>200<xmax> <ymax>200<ymax>

Accessing the Application Development Page

- Method 1: Accessing the page for the first time

  Create an application as described in **Creating an Application** based on a preset workflow. The **Application Development** page is directly displayed.

- Method 2: Accessing the page when you have created an application before

  Log in to the **ModelArts Pro** > **Vision Suite** console. By default, the **AppDev** > **Workbench** page is displayed. Locate the target application and click **View** in the **Operation** column. The **Application Development** page is displayed.

Creating Training Datasets

Choose **Application Development** > **Select Data**. On the page that is displayed, click **Create Dataset**. On the **Create Dataset** page that is displayed on the right,

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set basic information about a dataset based on its storage location and labeling information and click **OK**. For details, see **Table 4-10**.

Table 4-10 Parameters required for creating a dataset

Parameter	Description
Dataset	Name of a dataset to be created
Description	Dataset description
Upload Mode	Mode for uploading training data. Currently, data can only be uploaded to OBS. Therefore the default value is **OBS**.
Input Dataset Path	Location where training data is stored in OBS Click the text box on the right of **Input Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.
Output Dataset Path	Location where the dataset to be created is stored in OBS There is a default path for storing a dataset to be created. To modify it, click **Modify** on the right of **Output Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.

After creating training datasets, select the training dataset required for application development.

Labeled data is required during model training. For uploaded datasets, you can add or modify labels.

Click **Label** in the **Operation** column of the dataset. On the **Dashboard** page that is displayed, click **Label** in the upper right corner. On the displayed page, manually label data. For details, see **Labeling Data > Object Detection**.

NOTE

When labeling data with the hot-rolled steel sheet surface defect recognition workflow, set the bounding box type to **bndbox**, namely, select the rectangle as the bounding box type to label the defects.

Viewing Label Parsing

After creating and selecting a training dataset, you can view the statistical data of label samples in the **Label Parsing** area. The horizontal axis indicates the labels, and the vertical axis indicates the number of valid samples corresponding to the label.

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Follow-up Operations

After selecting the training dataset, click **Next** to go to step **Train Model**. For details, see **Training a Model**.

4.5.3 Training a Model

Train a model based on the labeled training data. You can view the accuracy and loss differences of the training model.

Prerequisites

You have created an application using the surface defect recognition workflow for steel sheets and created a dataset on the Vision Suite console. For details, see **Selecting Data**.

Training a Model

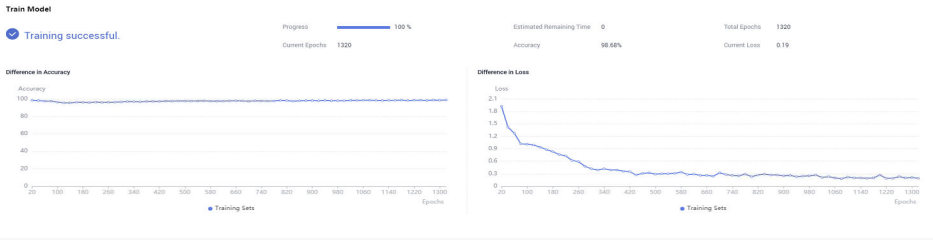
Choose **Application Development** > **Train Model** and click **Train**.

Generally, model training takes a period of time. After the training is complete, the training details are displayed in the lower part of the **Application Development** > **Train Model** page. See **Viewing Training Details**.

Viewing Training Details

After the model training is complete, view the training details on the **Application Development** > **Train Model** page, such as accuracy and loss differences.

Figure 4-6 Training a model



Follow-up Operations

After the model training is complete, click **Next** to go to step **Evaluate Model**. For details, see **Evaluating a Model**.

4.5.4 Evaluating a Model

Evaluate the model after training. Typically, you cannot obtain a satisfactory model after the first evaluation, and may need to repeatedly adjust algorithm parameters and data to further optimize the model.

Some common metrics, such as precision, recall rate, and F1 score, help you effectively evaluate and obtain a satisfactory model.

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Prerequisites

You have created an application using the surface defect recognition workflow for steel sheets and trained a model on the Vision Suite console. For details, see **Training a Model**.

Evaluating a Model

On the **Application Development** > **Evaluate Model** page, you can evaluate the model of the current version by viewing parameters and detailed evaluation data, and conducting online test.

- **Evaluate Model**

  Under the **Evaluate Model** area display the version, number of labels, and number of test sets of the current model.

- **Parameter Comparison**

  Under the **Parameter Comparison** area display evaluation parameter values of the current model, such as precision, recall rate, and F1 score. You can click ▾ in the upper part of the page to select an evaluation scope and click ⊕ to add a version for comparison.

- **Detailed Evaluation**

  Under the **Detailed Evaluation** area display the proportion of samples under different labels. You can click a label to view images that are incorrectly identified under this label.

Follow-up Operations

After the model evaluation, if the model needs to be further optimized based on service requirements, click **Previous** to return to the model training step. For details, see **Training a Model**.

If the model meets service requirements, click **Deploy** to go to step **Deploy Service**. For details, see **Deploying an Application**.

4.5.5 Deploying an Application

After evaluating the model, you can deploy and develop your own hot-rolled steel sheet surface defect recognition application. This application is used to recognize defects on hot-rolled steel sheet images you upload. You can also directly call the corresponding APIs and SDKs.

Prerequisites

- You have created an application using the surface defect recognition workflow for steel sheets and evaluated a model on the Vision Suite console. For details, see **Training a Model**.
- Ensure that the account is not in arrears. Resources are consumed during application deployment.

Procedure

Choose **Application Development** > **Deploy Service**, set related parameters by referring to **Table 4-11**, and click **Deploy**.

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Table 4-11 Parameters required for deploying a service

Parameter	Description
Service Name	Name of the service to be deployed. You can click to modify the default service name.
Description	Brief description of the service to be deployed
Deployed As	Currently, only **Real-time service** is supported.
Compute Node Specifications	The value can be **CPU+GPU: 2 vCPUs | 8 GiB+P4**, which is suitable for models requiring CPU and GPU (one NVIDIA P4) resources.
Service Automatic Stop	Time when the service automatically stops. The service will automatically stop at the time you specified and will no longer be billed after it stops.

After the deployment is successful, the system displays a message indicating **Service deployed successfully**. You can click **View Monitoring** to go to the **Monitoring** page and view the monitoring information. For details, see **Monitoring an Application**.

4.6 Cloud Type Recognition Workflow

4.6.1 Introduction

Workflow Overview

Observing the cloud form, that is, the shape, structure and height of a cloud, is essential to weather forecast. ModelArts Pro provides a cloud type recognition workflow that delivers a high-precision cloud type recognition algorithm to predict weather changes based on cloud types.

- Functions
  - This workflow allows you to upload images of different types of cloud types to build cloud type recognition models that can precisely recognize types of clouds used for weather forecast.
  - Models and skills can be deployed to the edge device Atlas 500 with just a few clicks, and managed on the Huawei HiLens console.
- Application scenarios

  This workflow applies to scenarios such as intelligent weather forecast.
- Advantages

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The model features high precision and quick recognition, and is easy to update.

Workflow Process

After creating a cloud type recognition application on the **ModelArts Pro** > **Vision Suite** console, you can develop this application by uploading data to train a model for recognizing cloud types.

Figure 4-7 Process for developing a cloud type recognition application

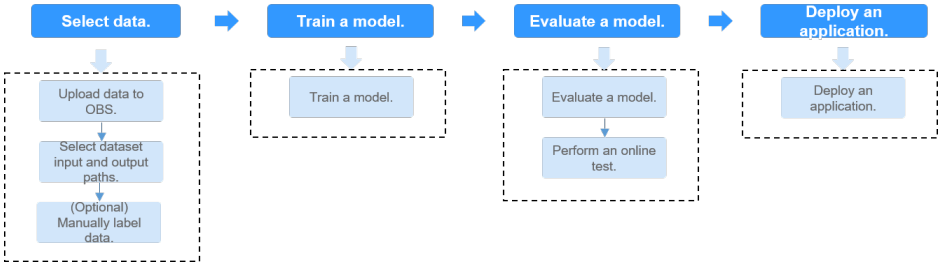

Table 4-12 Process description

Step	Description	Reference
Select data.	Select data and create a training dataset for subsequent model training. Labeled data is required during model training. If the data you upload is unlabeled, **manually label the data**.	**Selecting Data**
Train a model.	Train the cloud type recognition model, free from any parameter configuration, and view the accuracy and loss differences of the trained model.	**Training a Model**
Evaluate a model.	Evaluate the model after training. Some common metrics, such as precision, recall rate, and F1 score, and also an online test service help you effectively evaluate and obtain a satisfactory model.	**Evaluating a Model**
Deploy an application.	After the model is prepared, you can deploy an application to identify cloud types or directly call the corresponding APIs and SDKs.	**Deploying an Application**

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4.6.2 Selecting Data

Select data and create a training dataset for subsequent model training.

Prerequisites

- The cloud type recognition workflow allows you to deploy the service to edge devices with just a few clicks. If you want to deploy the service to edge devices, register Atlas 500 on the Huawei HiLens console in advance.
- You have obtained permissions to access OBS. For details on how to obtain OBS permissions, see **Obtaining the Access Key and Configuring ModelArts**.
- You have created an OBS bucket and folder for storing data. The OBS bucket should be in the same region as ModelArts Pro. For details, see **Creating an OBS Bucket**.
- You have uploaded required data to OBS. See **Requirements on Datasets** for requirements on data and **How Do I Upload Data to OBS?** for guide on how to upload data to OBS.
- You have created an application using the cloud type recognition workflow on the Vision Suite console. For details, see **Creating an Application**.

Requirements on Datasets

- Unlabeled datasets

  Images must be stored in one directory, as shown in the following example.

  ```
  ├─dataset-import-example
  │      IMG_20180919_114732.jpg
  │      IMG_20180919_114745.jpg
  │      IMG_20180919_114945.jpg
  ```

  – If data is imported from an OBS path, you must have the permission to read the OBS path.

  – Images in JPG, JPEG, PNG, and BMP formats are supported.

- Labeled datasets

  The cloud type recognition workflow only supports recognition of a single label for one image.

  – Images with the same label must be stored in the same directory, and the label name is the directory name. If there are multiple levels of directories, the last level is used as the label name.

    In the following example, **Cat** and **Dog** are label names.

    ```
    dataset-import-example
    ├─Cat
    │      10.jpg
    │      11.jpg
    │      12.jpg
    │
    └─Dog
           1.jpg
           2.jpg
           3.jpg
    ```

  – If **.txt** files exist in the directory, the content in the **.txt** files is used as the image label. This mode is better than the previous one.

    In the following example, **import-dir-1** and **import-dir-2** are the imported subdirectories:

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```
dataset-import-example
├─import-dir-1
│      10.jpg
│      10.txt
│      11.jpg
│      11.txt
│      12.jpg
│      12.txt
└─import-dir-2
       1.jpg
       1.txt
       2.jpg
       2.txt
```

The following shows a label file for a single label, for example, the **1.txt** file:

```
Cat
```

Images in JPG, JPEG, PNG, and BMP formats are supported. The size of a single image cannot exceed 5 MB, and the total size of all images uploaded in one attempt cannot exceed 8 MB.

Accessing the Application Development Page

- Method 1: Accessing the page for the first time

  Create an application as described in **Creating an Application** based on a preset workflow. The **Application Development** page is directly displayed.

- Method 2: Accessing the page when you have created an application before

  Log in to the **ModelArts Pro** > **Vision Suite** console. By default, the **AppDev** > **Workbench** page is displayed. Locate the target application and click **View** in the **Operation** column. The **Application Development** page is displayed.

Creating Training Datasets

Choose **Application Development** > **Select Data**. On the page that is displayed, click **Create Dataset**. On the **Create Dataset** page that is displayed on the right, set basic information about a dataset based on its storage location and labeling information and click **OK**. For details, see **Table 4-13**.

Table 4-13 Parameters required for creating a dataset

Parameter	Description
Dataset	Name of a dataset to be created
Description	Dataset description
Upload Mode	Mode for uploading training data. Currently, data can only be uploaded to OBS. Therefore the default value is **OBS**.

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Parameter	Description
Input Dataset Path	Location where training data is stored in OBS Click the text box on the right of **Input Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.
Output Dataset Path	Location where the dataset to be created is stored in OBS There is a default path for storing a dataset to be created. To modify it, click **Modify** on the right of **Output Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.

After creating training datasets, select the training dataset required for application development.

Labeled data is required during model training. For uploaded datasets, you can add or modify labels.

Click **Label** in the **Operation** column of the dataset. On the **Dashboard** page that is displayed, click **Label** in the upper right corner. On the displayed page, manually label data. For details, see **Labeling Data > Image Classification**.

Viewing Label Parsing

After creating and selecting a training dataset, you can view the statistical data of label samples in the **Label Parsing** area. The horizontal axis indicates the labels, and the vertical axis indicates the number of valid samples corresponding to the label.

Follow-up Operations

After selecting the training dataset, click **Next** to go to step **Train Model**. For details, see **Training a Model**.

4.6.3 Training a Model

Train a model based on the labeled training data. You can view the accuracy and loss differences of the training model.

Prerequisites

You have created an application using the cloud type recognition workflow and created a dataset on the Vision Suite console. For details, see **Selecting Data**.

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Training a Model

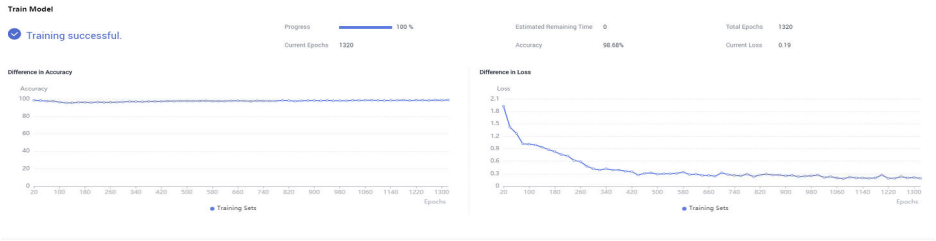
Choose **Application Development** > **Train Model** and click **Train**.

Generally, model training takes a period of time. After the training is complete, the training details are displayed in the lower part of the **Application Development** > **Train Model** page. See **Viewing Training Details**.

Viewing Training Details

After the model training is complete, view the training details on the **Application Development** > **Train Model** page, such as accuracy and loss differences.

Figure 4-8 Training a model



Follow-up Operations

After the model training is complete, click **Next** to go to step **Evaluate Model**. For details, see **Evaluating a Model**.

4.6.4 Evaluating a Model

Evaluate the model after training. Typically, you cannot obtain a satisfactory model after the first evaluation, and may need to repeatedly adjust algorithm parameters and data to further optimize the model.

Some common metrics, such as precision, recall rate, and F1 score, help you effectively evaluate and obtain a satisfactory model.

Prerequisites

You have created an application using the cloud type recognition workflow and trained a model on the Vision Suite console. For details, see **Training a Model**.

Evaluating a Model

On the **Application Development** > **Evaluate Model** page, you can evaluate the model of the current version by viewing parameters and detailed evaluation data, and conducting online test.

- **Evaluate Model**

  Under the **Evaluate Model** area display the version, number of labels, and number of test sets of the current model.

- **Parameter Comparison**

  Under the **Parameter Comparison** area display evaluation parameter values of the current model, such as precision, recall rate, and F1 score. You can click

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in the upper part of the page to select an evaluation scope and click ⊕ to add a version for comparison.

- **Detailed Evaluation**

  Under the **Detailed Evaluation** area display the proportion of samples under different labels. You can click a label to view images that are incorrectly identified under this label.

Follow-up Operations

After the model evaluation, if the model needs to be further optimized based on service requirements, click **Previous** to return to the model training step. For details, see **Training a Model**.

If the model meets service requirements, click **Deploy Service** to go to step **Deploy Service**. For details, see **Deploying an Application**.

4.6.5 Deploying an Application

After evaluating the model, you can deploy and develop your own cloud type recognition application. This application is used to recognize cloud types for weather forecast. You can also directly call the corresponding APIs and SDKs.

Prerequisites

- You have created an application using the cloud type recognition workflow and evaluated a model on the Vision Suite console. For details, see **Evaluating a Model**.
- Ensure that the account is not in arrears. Resources are consumed during application deployment.
- The cloud type recognition workflow allows you to deploy the service to edge devices with just a few clicks. If you want to deploy the service to edge devices, register Atlas 500 on the Huawei HiLens console in advance.

Procedure

Choose **Application Development** > **Deploy Service**, set related parameters by referring to **Table 4-14**, and click **Deploy Service**.

Table 4-14 Parameters required for deploying a service

Parameter	Description
Service Name	Name of the service to be deployed. You can click ✎ to modify the default service name.
Description	Brief description of the service to be deployed

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Parameter	Description
Deployed As	The following two options are supported: • **Real-time service**: A service is deployed as a real-time service for use online. You can also directly call the corresponding APIs and SDKs. After selecting **Real-time service**, specify **Compute Node Specifications** and **Service Automatic Stop**. • **Edge service**: A service is deployed as an edge device. Currently, edge services can be deployed on Atlas 500. After selecting the edge service, select the Atlas 500 edge device registered with the HiLens console under the current HUAWEI CLOUD account.
Compute Node Specifications	When **Deployed As** is set to **Real-time service**, the compute node specifications can be **CPU+GPU: 2 vCPUs | 8 GiB+1 P4**, which is suitable for models requiring CPU and GPU (1 NVIDIA P4) resources.
Service Automatic Stop	Time when the service automatically stops. When **Deployed As** is set to **Real-time service**, the service will automatically stop at the time you specified and will no longer be billed after it stops.

After the deployment is successful, the system displays a message indicating **Service deployed successfully**. You can click **View Monitoring** to go to the **Monitoring** page and view the monitoring information. For details, see **Monitoring an Application**.

If the service is deployed on an edge device, go to the Huawei HiLens console. Choose **Skill Development** > **Models** on the Huawei HiLens console to view the deployed model, and choose **Skill Development** > **Skills** to view the deployed skills. In addition, skills are automatically deployed on devices. You can go to the Huawei HiLens console to manage the cloud type recognition skills deployed on edge devices. For details, see **Skill Management Overview**.

4.7 Disc Brake Recognition Workflow

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4.7.1 Introduction

Workflow Overview

- Functions
  - This workflow allows you to upload images of different disc brakes to build disc brake recognition models that can quickly and accurately recognize disc brakes.
  - Models and skills can be deployed to the edge device Atlas 500 with just a few clicks, and managed on the Huawei HiLens console.
- Application scenarios

  This workflow applies to scenarios such as car tuning.
- Advantages

  The model features high precision and quick recognition, and is easy to update.

Workflow Process

After creating a disc brake recognition application on the **ModelArts Pro** > **Vision Suite** console, you can develop this application by uploading data to train a model for recognizing disc brakes.

Figure 4-9 Process for developing a disc brake recognition application

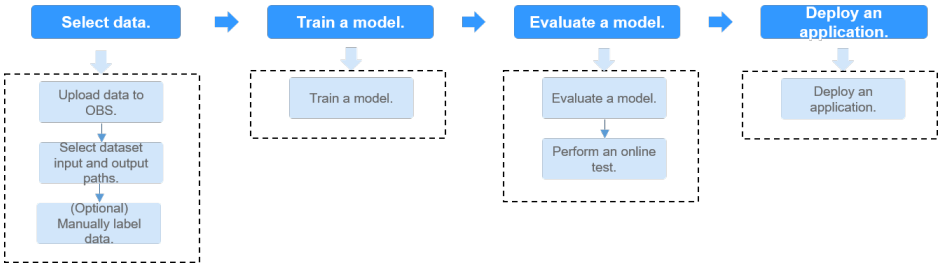

Table 4-15 Process description

Step	Description	Reference
Select data.	Select data and create a training dataset for subsequent model training. Labeled data is required during model training. If the data you upload is unlabeled, **manually label the data**.	**Selecting Data**
Train a model.	Train the disc brake recognition model, free from any parameter configuration, and view the accuracy and loss differences of the trained model.	**Training a Model**

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Step	Description	Reference
Evaluate a model.	Evaluate the model after training. Some common metrics, such as precision, recall rate, and F1 score, and also an online test service help you effectively evaluate and obtain a satisfactory model.	**Evaluating a Model**
Deploy an application.	After the model is prepared, you can deploy an application to identify disc brakes or directly call the corresponding APIs and SDKs.	**Deploying an Application**

4.7.2 Selecting Data

Select data and create a training dataset for subsequent model training.

Prerequisites

- The disc brake recognition workflow allows you to deploy the service to edge devices with just a few clicks. If you want to deploy the service to edge devices, register Atlas 500 on the Huawei HiLens console in advance.
- You have obtained permissions to access OBS. For details on how to obtain OBS permissions, see **Obtaining the Access Key and Configuring ModelArts**.
- You have created an OBS bucket and folder for storing data. The OBS bucket should be in the same region as ModelArts Pro. For details, see **Creating an OBS Bucket**.
- You have uploaded required data to OBS. See **Requirements on Datasets** for requirements on data and **How Do I Upload Data to OBS?** for guide on how to upload data to OBS.
- You have created an application using the disc brake recognition workflow on the Vision Suite console. For details, see **Creating an Application**.

Requirements on Datasets

- Unlabeled datasets

  Images must be stored in one directory, as shown in the following example.

  ```
  ├─dataset-import-example
  │      IMG_20180919_114732.jpg
  │      IMG_20180919_114745.jpg
  │      IMG_20180919_114945.jpg
  ```

  - If data is imported from an OBS path, you must have the permission to read the OBS path.
  - Images in JPG, JPEG, PNG, and BMP formats are supported.
- Labeled datasets

  The disc brake recognition workflow only supports recognition of a single label for one image.

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- Images with the same label must be stored in the same directory, and the label name is the directory name. If there are multiple levels of directories, the last level is used as the label name.

  In the following example, **Cat** and **Dog** are label names.

  ```
  dataset-import-example
  ├─Cat
  │      10.jpg
  │      11.jpg
  │      12.jpg
  │
  └─Dog
         1.jpg
         2.jpg
         3.jpg
  ```

- If **.txt** files exist in the directory, the content in the **.txt** files is used as the image label. This mode is better than the previous one.

  In the following example, **import-dir-1** and **import-dir-2** are the imported subdirectories:

  ```
  dataset-import-example
  ├─import-dir-1
  │      10.jpg
  │      10.txt
  │      11.jpg
  │      11.txt
  │      12.jpg
  │      12.txt
  └─import-dir-2
         1.jpg
         1.txt
         2.jpg
         2.txt
  ```

  The following shows a label file for a single label, for example, the **1.txt** file:

  ```
  Cat
  ```

  Images in JPG, JPEG, PNG, and BMP formats are supported. The size of a single image cannot exceed 5 MB, and the total size of all images uploaded in one attempt cannot exceed 8 MB.

Accessing the Application Development Page

- Method 1: Accessing the page for the first time

  Create an application as described in **Creating an Application** based on a preset workflow. The **Application Development** page is directly displayed.

- Method 2: Accessing the page when you have created an application before

  Log in to the **ModelArts Pro** > **Vision Suite** console. By default, the **AppDev** > **Workbench** page is displayed. Locate the target application and click **View** in the **Operation** column. The **Application Development** page is displayed.

Creating Training Datasets

Choose **Application Development** > **Select Data**. On the page that is displayed, click **Create Dataset**. On the **Create Dataset** page that is displayed on the right, set basic information about a dataset based on its storage location and labeling information and click **OK**. For details, see **Table 4-16**.

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Table 4-16 Parameters required for creating a dataset

Parameter	Description
Dataset	Name of a dataset to be created
Description	Dataset description
Upload Mode	Mode for uploading training data. Currently, data can only be uploaded to OBS. Therefore the default value is **OBS**.
Input Dataset Path	Location where training data is stored in OBS Click the text box on the right of **Input Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.
Output Dataset Path	Location where the dataset to be created is stored in OBS There is a default path for storing a dataset to be created. To modify it, click **Modify** on the right of **Output Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.

After creating training datasets, select the training dataset required for application development.

Labeled data is required during model training. For uploaded datasets, you can add or modify labels.

Click **Label** in the **Operation** column of the dataset. On the **Dashboard** page that is displayed, click **Label** in the upper right corner. On the displayed page, manually label data. For details, see **Labeling Data > Image Classification**.

Viewing Label Parsing

After creating and selecting a training dataset, you can view the statistical data of label samples in the **Label Parsing** area. The horizontal axis indicates the labels, and the vertical axis indicates the number of valid samples corresponding to the label.

Follow-up Operations

After selecting the training dataset, click **Next** to go to step **Train Model**. For details, see **Training a Model**.

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4.7.3 Training a Model

Train a model based on the labeled training data. You can view the accuracy and loss differences of the training model.

Prerequisites

You have created an application using the disc brake recognition workflow and created a dataset on the Vision Suite console. For details, see **Selecting Data**.

Training a Model

Choose **Application Development** > **Train Model** and click **Train**.

Generally, model training takes a period of time. After the training is complete, the training details are displayed in the lower part of the **Application Development** > **Train Model** page. See **Viewing Training Details**.

Viewing Training Details

After the model training is complete, view the training details on the **Application Development** > **Train Model** page, such as accuracy and loss differences.

Figure 4-10 Training a model



Follow-up Operations

After the model training is complete, click **Next** to go to step **Evaluate Model**. For details, see **Evaluating a Model**.

4.7.4 Evaluating a Model

Evaluate the model after training. Typically, you cannot obtain a satisfactory model after the first evaluation, and may need to repeatedly adjust algorithm parameters and data to further optimize the model.

Some common metrics, such as precision, recall rate, and F1 score, help you effectively evaluate and obtain a satisfactory model.

Prerequisites

You have created an application using the disc brake recognition workflow and trained a model on the Vision Suite console. For details, see **Training a Model**.

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Evaluating a Model

On the **Application Development** > **Evaluate Model** page, you can evaluate the model of the current version by viewing parameters and detailed evaluation data, and conducting online test.

- **Evaluate Model**

  Under the **Evaluate Model** area display the version, number of labels, and number of test sets of the current model.

- **Parameter Comparison**

  Under the **Parameter Comparison** area display evaluation parameter values of the current model, such as precision, recall rate, and F1 score. You can click ▾ in the upper part of the page to select an evaluation scope and click ⊕ to add a version for comparison.

- **Detailed Evaluation**

  Under the **Detailed Evaluation** area display the proportion of samples under different labels. You can click a label to view images that are incorrectly identified under this label.

Follow-up Operations

After the model evaluation, if the model needs to be further optimized based on service requirements, click **Previous** to return to the model training step. For details, see **Training a Model**.

If the model meets service requirements, click **Deploy Service** to go to step **Deploy Service**. For details, see **Deploying an Application**.

4.7.5 Deploying an Application

After evaluating the model, you can deploy and develop your own disc brake recognition application. This application is used to recognize disc brakes. You can also directly call the corresponding APIs and SDKs.

Prerequisites

- You have created an application using the disc brake recognition workflow and evaluated a model on the Vision Suite console. For details, see **Evaluating a Model**.
- Ensure that the account is not in arrears. Resources are consumed during application deployment.
- The disc brake recognition workflow allows you to deploy the service to edge devices with just a few clicks. If you want to deploy the service to edge devices, register Atlas 500 on the Huawei HiLens console in advance.

Procedure

Choose **Application Development** > **Deploy Service**, set related parameters by referring to **Table 4-17**, and click **Deploy Service**.

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Table 4-17 Parameters required for deploying a service

Parameter	Description
Service Name	Name of the service to be deployed. You can click to modify the default service name.
Description	Brief description of the service to be deployed
Deployed As	The following two options are supported: • **Real-time service**: A service is deployed as a real-time service for use online. You can also directly call the corresponding APIs and SDKs. After selecting **Real-time service**, specify **Compute Node Specifications** and **Service Automatic Stop**. • **Edge service**: A service is deployed as an edge device. Currently, edge services can be deployed on Atlas 500. After selecting the edge service, select the Atlas 500 edge device registered with the HiLens console under the current HUAWEI CLOUD account.
Compute Node Specifications	When **Deployed As** is set to **Real-time service**, the compute node specifications can be **CPU+GPU: 2 vCPUs | 8 GiB+1 P4**, which is suitable for models requiring CPU and GPU (1 NVIDIA P4) resources.
Service Automatic Stop	Time when the service automatically stops. When **Deployed As** is set to **Real-time service**, the service will automatically stop at the time you specified and will no longer be billed after it stops.

After the deployment is successful, the system displays a message indicating **Service deployed successfully**. You can click **View Monitoring** to go to the **Monitoring** page and view the monitoring information. For details, see **Monitoring an Application**.

If the service is deployed on an edge device, go to the Huawei HiLens console. Choose **Skill Development** > **Models** on the Huawei HiLens console to view the deployed model, and choose **Skill Development** > **Skills** to view the deployed

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skills. In addition, skills are automatically deployed on devices. You can go to the Huawei HiLens console to manage the cloud type recognition skills deployed on edge devices. For details, see **Skill Management Overview**.

4.8 Updating an Application Version

During model building, you may need to frequently tune the data, training parameters, or the model based on the training results to obtain a satisfactory model.

You can edit the model configuration information to match service changes. Specifically, ModelArts Pro generates a version each time when a modification is performed. You can compare different versions to quickly get the difference.

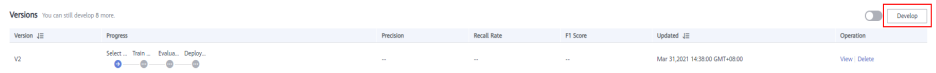
Prerequisites

You have created an application using a preset workflow on the Vision Suite console. For details, see **Creating an Application**.

Updating an Application Version

1. Log in to the ModelArts Pro console, click **Access** on the Vision Suite card.
   The Vision Suite console is displayed.
2. In the navigation pane on the left, choose **AppDev** > **Workbench**.
   The **My Applications** page is displayed by default.
3. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.
   The application details page is displayed.
4. Click **Develop** on the right of **Versions**.
   The version development page is displayed.
   If the development of an earlier version is not complete, the **Develop Version** dialog box is displayed. Click **OK**. The page for developing a new version is displayed.

   Figure 4-11 Developing a version

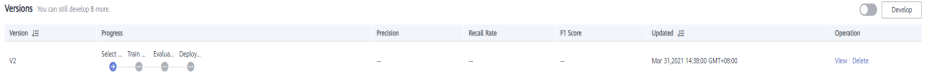
   

5. On the application development page of the new version, you can update the workflow configurations based on those of the previous version and deploy the service again.

Follow-up Operations

After updating the version, in the **Versions** area of the application details page, you can view the version name, progress, model precision, recall rate, F1 score, update time, and operations that can be performed on the current application.

Figure 4-12 Versions



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4.9 Viewing Application Details

After creating an application, you can view the application details on the ModelArts Pro console, such as information about the application development configurations, versions, assets, and monitoring.

Prerequisites

You have created an application using a preset workflow on the Vision Suite console. For details, see **Creating an Application**.

Accessing the Application Details Page

1. Log in to the ModelArts Pro console, click **Access** on the Vision Suite card.

   The Vision Suite console is displayed.

2. In the navigation pane on the left, choose **AppDev** > **Workbench**.

   The **My Applications** page is displayed by default.

3. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   The application details page is displayed. By default, the **Application Development** page is displayed.

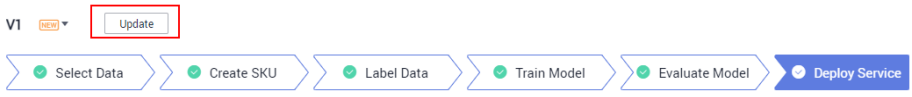
   On the application details page, you can switch to any tab page to view the **application development**, **application versions**, **application assets** (datasets), and **application monitoring**.

Viewing the Application Development Configurations

On the application details page, the **Application Development** page is displayed by default. You can view the configuration information of each step during application development, including **Select Data**, **Label Data**, **Train Model**, **Evaluate Model**, and **Deploy Service**.

Alternatively, you can edit the configuration on the **Application Development** page and click **Update** on the right of the version in the upper left corner to update the current application into a new version.

Figure 4-13 Updating a version



Viewing Application Versions

After updating the version, you can click **Versions** on the application details page. On the **Versions** page, you can view the version name, progress, model precision, recall rate, F1 score, update time, and operations that can be performed of the current application. Available operations include **View** and **Delete**.

- **View**: View the application development configurations of the current version.

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- **Delete**: Delete the current application version.

Viewing Application Assets

On the **Assets** page of the application details page, you can view the asset information of the current application. For example, the asset information using the retail goods recognition workflow is information about a training dataset. You can view the dataset name, description, number of data records, labeling progress, total number of labels, creation time, and operation. You can perform **View** and **Delete** operations in the **Operation** column.

View: Click **View** to go to the datasets details page. Click **Label** to manually label data. For details on how to label data, see the following as required:

- Retail goods recognition workflow: **Labeling Data - Object Detection**
- Hot-rolled steel sheet surface defect recognition workflow: **Labeling Data - Object Detection**
- Image label recognition workflow: **Labeling Data - Image Classification**
- Cloud type recognition workflow: **Labeling Data - Image Classification**
- Disc brake recognition workflow: **Labeling Data - Image Classification**

Delete: Click **Delete**. The **Delete Dataset** dialog box is displayed. Click **OK** to delete the current dataset.

Viewing Application Monitoring

On the **Monitoring** page of the application details page, you can view the basic information, historical versions, and API calling guide of the current application version, and test it online. For details, see **Monitoring an Application**.

4.10 Monitoring an Application

After developing and deploying an application, you can monitor the application, view its basic information, historical versions, and API calling guide, and test it online.

Prerequisites

You have developed and deployed an application. For details, see **Deploying an Application**.

Accessing the Monitoring Page

1. Log in to the ModelArts Pro console, click **Access** on the Vision Suite card.
   The Vision Suite console is displayed.
2. In the navigation pane on the left, choose **AppDev** > **Workbench**.
   The **My Applications** page is displayed by default.
3. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.
   The application details page is displayed. By default, the **Application Development** page is displayed.

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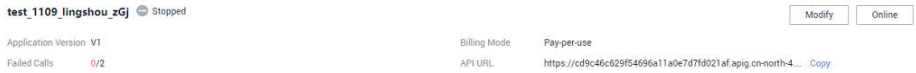
4. In the upper part of the page, click **Monitoring**.

   On the **Monitoring** page, you can view the basic information, historical versions, and API calling guide of the current application version, and test it online.

Basic Information

On the **Monitoring** page, you can view the basic information about the application. If the information is incorrect, you can click **Modify** to change the deployment information in the displayed dialog box on the right.

Figure 4-14 Basic information about an application



Testing an Application Online

On the **Monitoring** page, you can test a running application online. Click **Select File** on the right of **Upload Test Image** to upload a test image. The prediction result is displayed on the lower part.

Viewing Versions

On the **Monitoring** page, you can view the version information about the current application, such as update time, update status, application version, traffic splitting (%), compute node specifications, and number of compute nodes.

Figure 4-15 Versions



Viewing the API Calling Guide

On the **Monitoring** page, you can view the API calling information of the current application.

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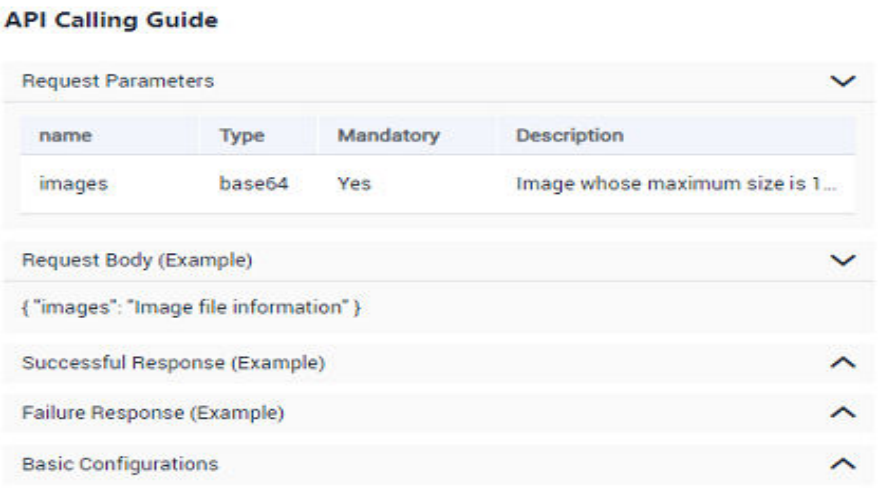
Figure 4-16 API calling guide



4.11 Deleting an Application

If an application is no longer in use, you can delete it to release resources.

Procedure

1. Log in to the ModelArts Pro console, click **Access** on the Vision Suite card.
   The Vision Suite console is displayed.
2. In the navigation pane on the left, choose **AppDev** > **Workbench**.
   The **My Applications** page is displayed by default.
3. On the **My Applications** page, locate the desired application and click **Delete** in the **Operation** column.
   The **Delete Application** dialog box is displayed.
4. In the displayed dialog box, click **OK**.

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5 HiLens Suite

5.1 Introduction

Huawei HiLens features device-cloud synergy and enables you to develop AI applications. In addition to allowing connections with multiple types of computing devices, it provides you with an easy-to-use development framework and out-of-the box development environment. It offers a skill market that has extensive sets of AI skills, and a cloud-based platform that allows you to manage purchased skills, deliver skills to HiLens devices, and write inference code.

Preset Trainable Templates

HiLens Suite allows you to use trainable skill templates to develop skills without coding. You only need to upload training data, quickly train high-precision algorithm models, and deploy the models on devices with one click.

HiLens Suite delivers a safety helmet detection skill that allows you to build a high-precision safety helmet detection model by uploading images. With this model, a skill can be developed to automatically detect workers who do not wear safety helmets in the campus.

- Functions

  The safety helmet detection skill is designed for smart campuses. It allows you to upload images to build a high-precision safety helmet detection model. With this model, you can quickly develop a safety helmet detection skill to automatically detect workers who do not wear safety helmets.

- Application scenarios

  Smart campus

- Advantages
  - The model features high precision and quick detection, and is easy to update.
  - Devices collaborate with the cloud platform to update models online to quickly improve the device precision.
  - AI skills can be created and delivered to devices through the Huawei HiLens console with a few clicks.

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Prerequisites

- You have completed the preparations as described in **Preparations**.
- You have applied for HiLens Suite as described in **Enabling HiLens Suite** if you use it for the first time.

Enabling HiLens Suite

HiLens Suite is in the OBT phase. If you are a first-time HiLens Suite user, apply for the OBT permission first.

Log in to the ModelArts Pro console and click **Apply for OBT** on the **HiLens Suite** card. On the page that is displayed, enter the required information as prompted.

After the application is submitted, click **Go to Open Beta Tests**, and the **My Open Beta Tests** page is displayed. If **Audit Status** is **Approved**, you have obtained the OBT permission for HiLens Suite.

Process for Using a Preset Workflow to Develop an Application

HiLens Suite provides a safety helmet detection workflow. You can upload data to train models, improve model precision, quickly create skills, and deploy them to devices with a few clicks.

Figure 5-1 Process for using a preset workflow to develop an application

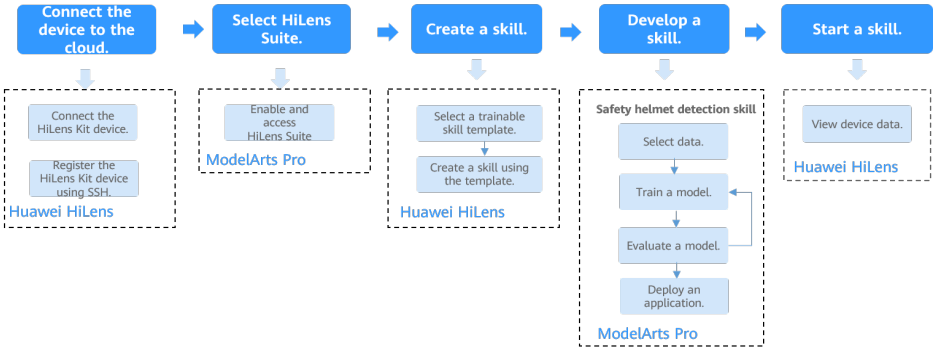

Table 5-1 Process description

Step	Description	Reference
Connect the device to the cloud.	Connect the HiLens Kit device that you purchased and register the HiLens Kit device with the Huawei HiLens console.	**Registering HiLens Kit**
Select HiLens Suite.	Select HiLens Suite based on you needs. Alternatively, you can view the workflow to locate the required suite.	On the ModelArts Pro console, click **Access** on the **HiLens Suite** card to access the HiLens Suite console.

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Step	Description	Reference
Create a skill using a trainable skill template.	Create a skill based on a preset trainable skill template.	**Creating a Skill Using a Trainable Skill Template**
Develop a safety helmet detection skill.	Develop the safety helmet detection skill based on the workflow, generate the safety helmet detection model through training based on the uploaded training data, update and adjust the model precision to implement the high-precision safety helmet detection function, and install the skill to the HiLens Kit device with just one click.	**Safety Helmet Detection Workflow**
Start a skill.	Start the skill in HiLens Studio and view the skill running effect.	**Starting or Stopping Skills**

5.2 Configuring the OBS Storage Location

The training and test data uploaded when you use ModelArts Pro are stored in OBS. Therefore, you need to configure the OBS storage location before using HiLens Suite.

Prerequisites

You have registered a HUAWEI CLOUD account, authorized related services, created OBS buckets, and completed other preparations. For details, see **Preparations**.

Procedure

1. On the ModelArts Pro console, click **Access** on the **HiLens Suite** card.

   The HiLens Suite console is displayed.

2. In the navigation pane on the left, choose **Configuration Center** > **Basic Configuration**.

   The **Basic Configuration** page is displayed.

3. Click **Modify** next to **Default Storage Location** under **Storage**.

   The **Default Storage Location** dialog box is displayed.

4. In the dialog box that is displayed, select an OBS bucket and folder and click **OK**.

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The OBS storage location is configured.

Follow-up Operations

You can create a skill as described in **Creating a Skill Using a Trainable Skill Template** and develop it based on the workflow on the **ModelArts Pro** > **HiLens Suite** console.

5.3 Creating a Skill Using a Trainable Skill Template

This section describes how to create a skill using a trainable skill template. You can use a trainable skill template to create a skill, upload data to train a model, quickly create a skill, and deploy the skill to a device with one click.

Prerequisites

- Ensure that the HUAWEI CLOUD account is not in arrears. Developing applications on the ModelArts Pro console may occupy OBS resources and incur fees. For details about the billing rules, see **OBS Pricing Details**.
- Developing skills using trainable skill templates occupies ModelArts training resources and incurs charges. For details about the ModelArts pricing, see **Product Pricing Details**.

Procedure

1. On the ModelArts Pro console, click **Access** on the **HiLens Suite** card.

   The **All** tab page is displayed by default.
2. Click the **Trainable Templates (Beta)** tab.
3. Click **Create Skill** on the desired skill template card to create a skill.
4. If you use trainable skill templates for the first time, you need to authorize ModelArts.

   Figure 5-2 Adding authorization

   

   Carefully read the ModelArts service statement, select **I have read and agree to the ModelArts Service Statement**, and click **Agree**.

   If it is not your first time to use trainable skill templates, skip this step and proceed with the next step.
5. In the **Create Skill** dialog box, enter the skill name, skill owner, and skill description, select the industry, and read and agree to the *OBT Trial Use Agreement*.

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6. Confirm the information and click **OK**.

   The **Application Development** page is displayed, on which you can start to develop the skill. For details, see **Safety Helmet Detection Workflow**.

Follow-up Operations

Develop the application based on the selected workflow.

Introduction to Trainable Skill Templates

5.4 Safety Helmet Detection Workflow

5.4.1 Introduction to Trainable Skill Templates

Safety Helmet Detection Skill

- Functions

  The safety helmet detection skill is designed for smart campuses. It allows you to upload images to build a high-precision safety helmet detection model. With this model, you can quickly develop a safety helmet detection skill to automatically detect workers who do not wear safety helmets.

- Application scenarios

  Smart campus

- Advantages
  - The model features high precision and quick recognition, and is easy to update.
  - Devices collaborate with the cloud platform to update models online to quickly improve the device precision.
  - AI skills can be created and delivered to devices through the Huawei HiLens console with a few clicks.

More trainable skill templates will be available soon.

Process for Creating a Safety Helmet Detection Skill

After creating a skill using the safety helmet detection skill template on the Huawei HiLens console, you can develop this safety helmet detection model, upload a data training model, and deploy the safety helmet detection skill on a device with one click.

Figure 5-3 Process for creating a safety helmet detection skill

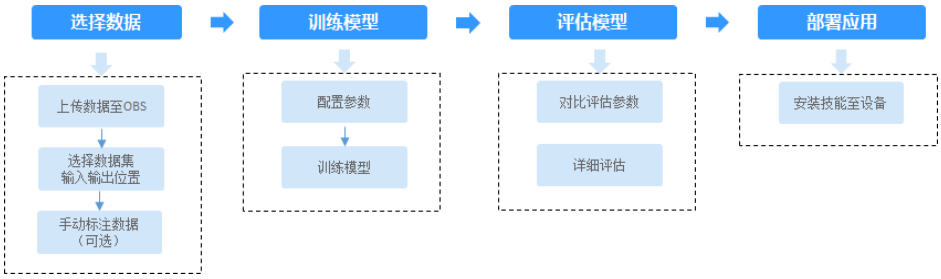

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Table 5-2 Process description

Step	Description	Reference
Select data.	Select data and create a training dataset for subsequent model training.	**Selecting Data**
Train a model.	Select a pre-trained model and configure parameters based on the labeled training data to train a safety helmet detection model.	**Training a Model**
Evaluate a model.	Evaluate the model after training. Some common metrics, such as precision, recall, and F1 score, help you effectively evaluate and obtain a satisfactory model.	**Evaluating a Model**
Deploy an application.	After the model is prepared, you can quickly create a skill and install the skill on a device with one click. You can also access HiLens Studio to automatically create and debug the skill.	**Deploying an Application**

5.4.2 Selecting Data

When using the safety helmet detection workflow to train a model, you need to create a training dataset for subsequent model training.

Prerequisites

- You have created an OBS bucket and folder for storing data. The OBS bucket and ModelArts Pro are in the same region. For details, **Creating a Bucket** and **Creating a Folder**.
- You have uploaded required data to OBS. See **Requirements on Datasets** for requirements on data and **How Do I Upload Data to OBS** for guide on how to upload data to OBS.
- You have created a skill using the trainable safety helmet detection skill template on the ModelArts Pro console. For details, see **Creating a Skill Using a Trainable Skill Template**.

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Requirements on Datasets

- Unlabeled datasets

  Images must be stored in one directory, as shown in the following example.

  ```
  ├─dataset-import-example
  │      IMG_20180919_114732.jpg
  │      IMG_20180919_114745.jpg
  │      IMG_20180919_114945.jpg
  ```

  – If data is imported from an OBS path, you must have the permission to read the OBS path.

  – Images in JPG, JPEG, PNG, and BMP formats are supported.

- Labeled datasets

  Labeled objects and their labeling files (in one-to-one relationship with the labeled objects) must be in the same directory. For example, if the name of the labeled object file is **IMG_20180919_114745.jpg**, the name of the labeling file must be **IMG_20180919_114745.xml**.

  The labeling files must be in PASCAL VOC format. For details about the format, see **Table 5-3**.

  Example:

  ```
  ├─dataset-import-example
  │      IMG_20180919_114732.jpg
  │      IMG_20180919_114732.xml
  │      IMG_20180919_114745.jpg
  │      IMG_20180919_114745.xml
  │      IMG_20180919_114945.jpg
  │      IMG_20180919_114945.xml
  ```

  A labeling file example is as follows:

  ```
  <?xml version="1.0" encoding="UTF-8" standalone="no"?>
  <annotation>
     <folder>NA</folder>
     <filename>bike_1_1593531469339.png</filename>
     <source>
        <database>Unknown</database>
     </source>
     <size>
        <width>554</width>
        <height>606</height>
        <depth>3</depth>
     </size>
     <segmented>0</segmented>
     <object>
        <name>Dog</name>
        <pose>Unspecified</pose>
        <truncated>0</truncated>
        <difficult>0</difficult>
        <occluded>0</occluded>
        <bndbox>
           <xmin>279</xmin>
           <ymin>52</ymin>
           <xmax>474</xmax>
           <ymax>278</ymax>
        </bndbox>
     </object>
     <object>
        <name>Cat</name>
        <pose>Unspecified</pose>
        <truncated>0</truncated>
        <difficult>0</difficult>
        <occluded>0</occluded>
        <bndbox>
           <xmin>279</xmin>
  ```

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```
        <ymin>198</ymin>
        <xmax>456</xmax>
        <ymax>421</ymax>
      </bndbox>
   </object>
</annotation>
```

– Images in JPG, JPEG, PNG, and BMP formats are supported. The size of a single image cannot exceed 5 MB, and the total size of all images uploaded in one attempt cannot exceed 8 MB.

Table 5-3 PASCAL VOC format description

Parameter	Mandatory	Description
folder	Yes	Directory where the data source is located
filename	Yes	Name of the file to be labeled
size	Yes	Image pixel • **width**: image width. This parameter is mandatory. • **height**: image height. This parameter is mandatory. • **depth**: number of image channels. This parameter is mandatory.
segmented	Yes	Segmented or not
object	Yes	Object detection information. Multiple **object{}** functions are generated for multiple objects. • **name**: class of the labeled object. This parameter is mandatory. • **pose**: shooting angle of the labeled object. This parameter is mandatory. • **truncated**: whether the labeled object is truncated (**0** indicates that the object is not truncated). This parameter is mandatory. • **occluded**: whether the labeled object is occluded (**0** indicates that the object is not occluded). This parameter is mandatory. • **difficult**: whether the labeled object is difficult to identify (**0** indicates that the object is easy to identify). This parameter is mandatory. • **confidence**: confidence score of the labeled object. The value range is 0 to 1. This parameter is optional. • **bndbox**: bounding box type. This parameter is mandatory. For details about the possible values, see **Table 5-4**.

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Table 5-4 Description of bounding box types

type	Shape	Labeling Information
point	Point	Coordinates of a point <x>100<x> <y>100<y>
line	Line	Coordinates of points <x1>100<x1> <y1>100<y1> <x2>200<x2> <y2>200<y2>
bndbox	Rectangle	Coordinates of the upper left and lower right points <xmin>100<xmin> <ymin>100<ymin> <xmax>200<xmax> <ymax>200<ymax>
polygon	Polygon	Coordinates of points <x1>100<x1> <y1>100<y1> <x2>200<x2> <y2>100<y2> <x3>250<x3> <y3>150<y3> <x4>200<x4> <y4>200<y4> <x5>100<x5> <y5>200<y5> <x6>50<x6> <y6>150<y6>
circle	Circle	Center coordinates and radius <cx>100<cx> <cy>100<cy> <r>50<r>

Accessing the Application Development Page

- Method 1: Accessing the page for the first time

  You can directly access the **Application Development** page after you create a skill using a trainable skill template following instructions in **Creating a Skill Using a Trainable Skill Template**.

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- Method 2: Creating a skill and then accessing it
  a. Log in to the Huawei HiLens console. In the left navigation pane, choose **Skill Development > Skills**.
  b. Click the **Trainable Skills** tab.
  c. Locate the target skill and click **View** in the **Operation** column. The **Application Development** page is displayed.

Creating Training Datasets

Choose **Application Development** > **Select Data**. On the page that is displayed, click **Create Dataset**. On the **Create Dataset** page that is displayed on the right, set basic information about a dataset based on its storage location and labeling information and click **OK**. For details, see **Table 5-5**.

Table 5-5 Parameters required for creating a dataset

Parameter	Description
Dataset	Name of a dataset to be created
Description	Dataset description
Dataset Status	Whether the dataset is labeled. The options are **Labeled** and **Unlabeled**. For details about data formats, see **Requirements on Datasets**.
Upload From	Mode for uploading training data. Currently, data can only be uploaded to OBS. Therefore the default value is **OBS**.
Input Dataset Path	Location where training data is stored in OBS Click the text box on the right of **Input Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.
Output Dataset Path	Location where the dataset to be created is stored in OBS There is a default path for storing a dataset to be created. To modify it, click **Modify** on the right of **Output Dataset Path**. In the displayed dialog box, select an OBS bucket and folder, and click **OK**.

After creating training datasets, select the training dataset required for application development.

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Labeling Data

Labeled data is required during model training. For uploaded datasets, you can add or modify labels. Each label should have at least five data records.

- Viewing labeling examples: Click **Labeling Example** on the right of **Create Dataset** to view the labeling example.
- Accessing the labeling page: Click **Label** in the **Operation** column of the dataset. On the **Dashboard** page that is displayed, click **Label** in the upper right corner. On the displayed page, manually label data. For details, see **Labeling Data > Object Detection**.

Viewing Label Parsing

After creating and selecting a training dataset, you can view the statistical data of label samples in the **Label Parsing** area. The horizontal axis indicates the labels, and the vertical axis indicates the number of valid samples corresponding to the label.

Follow-up Operations

On the **Application Development** > **Select Data** page, select a training dataset, label the data that is not labeled, and click **Next** to go to step **Train Model**. For details, see **Training a Model**.

5.4.3 Training a Model

After you select data for training, select a pre-trained model and configure parameters based on the labeled training data to train a safety helmet detection model.

Prerequisites

- You have created an OBS bucket and folder for storing data. The OBS bucket should be in the same region as ModelArts Pro. For details, see **Creating an OBS Bucket**.
- You have created a skill based on the trainable safety helmet detection template on the ModelArts Pro console and selected a dataset. For details, see **Selecting Data**.

Training a Model

Choose **Application Development > Train Model** and specify parameters.

- **Output Path**

  OBS path for storing the output model and data after model training. Click the text box, select the OBS bucket and folder, and click **OK**.

- **Pre-trained Model**

  Safety helmet detection pre-trained model. Select **saved_model.pb**.

Confirm the information and click **Train**.

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Figure 5-4 Training a model



Generally, model training takes a period of time. After training is complete, **the training details** are displayed in the lower part of the **Application Development** > **Train Model** page.

Viewing Training Details

After the model training is complete, view the training details on the **Application Development** > **Train Model** page.

Figure 5-5 Training details



5.4.4 Evaluating a Model

Evaluate the model after training. Typically, you cannot obtain a satisfactory model after the first evaluation, and may need to repeatedly adjust algorithm parameters and data to further optimize the model.

Some common metrics, such as precision, recall, and F1 score, help you effectively evaluate and obtain a satisfactory model.

Prerequisites

You have created a skill based on the trainable safety helmet detection template on the ModelArts Pro console and trained a model. For details, see **Training a Model**.

Evaluating a Model

You can use the test data to evaluate the model. You can view the evaluation result on the **Application Development** > **Evaluate Model** page.

- **Evaluate Model**

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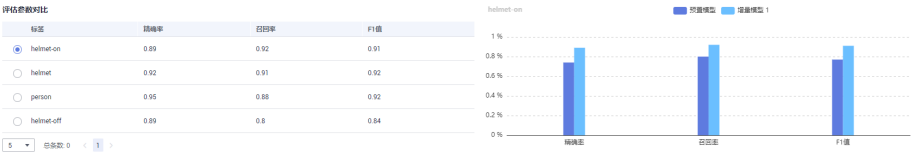
Figure 5-6 Evaluating a model



The model version, number of labels and test sets of the trained model are displayed. Click **Download** to download the evaluation result to the local PC.

- **Parameter Comparison**

Figure 5-7 Comparing evaluation parameters



The left pane displays the precision, recall, and F1 score of each label. When you select a label, the parameter comparison bar charts of the label data evaluated by the preset model and incremental model are displayed on the right.

- **Detailed evaluation**

Figure 5-8 Detailed evaluation



You can filter the label and confidence range in the upper right corner to view detailed test data.

Follow-up Operations

After the model evaluation, if the model needs to be further optimized based on service requirements, click **Previous** to return to the model training step. For details, see **Training a Model**.

If the model meets service requirements, click **Deploy Service** to go to step **Deploy Service**. For details, see **Deploying an Application**.

5.4.5 Deploying an Application

After the model is prepared, you can quickly create a skill in step **Deploy Service** and install the skill on a device with one click. You can also access HiLens Studio to automatically create and debug the skill.

Prerequisites

- You have created a skill based on the trainable safety helmet detection template on the ModelArts Pro console and evaluated a model. For details, see **Evaluating a Model**.

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- Ensure that the account is not in arrears. Resources are consumed during application deployment.
- To install the skill on a device, you need to register a HiLens Kit device with Huawei HiLens in advance. For details, see **Registering HiLens Kit**.
- If you are using HiLens Studio for the first time, you need to apply for the OBT permission. For details, see Applying for the HiLens Studio OBT and Obtaining the Access Key.

  NOTE

  Skills automatically created on the ModelArts Pro > Huawei HiLens console can be installed only on HiLens Kit devices that are registered with Huawei HiLens using the same account in the same region.

Directly Deploying an Application

On the **Application Development** > **Deploy Service** page, the workflow automatically creates a skill based on the trained model. You can install the skill on the HiLens Kit device with one click.

- **Skill Name**: default name of the skill which is automatically created by the workflow
- **Device Type**: HiLens Kit device, which is the only device allowed for a skill to install on. Before installing skills, register a HiLens Kit device on the Huawei HiLens console using the same account in the same region. For details, see **Registering HiLens Kit**.
- **Device Name**: devices registered with the Huawei HiLens console under the same account in the same region

Select an online device and click **Install** on the right of the skill name to install the skill.

The skill installation progress is displayed in the **Progress** column of the device list. After the installation is complete, **Installed** is displayed in the column.

Figure 5-9 Deploying an application



Debugging/Deploying an Application

This function is not yet available.

Follow-up Operations

After the skill is installed on a device, you can **view application details**.

5.5 Updating an Application Version

During model building, you may need to frequently tune the data, training parameters, or the model based on the training results to obtain a satisfactory model.

You can edit the model configuration information to match service changes. Specifically, ModelArts Pro generates a version each time when a modification is performed. You can compare different versions to quickly get the difference.

Prerequisites

You have created an application using a HiLens workflow on the HiLens Suite console. For details, see **Creating a Skill Using a Trainable Skill Template**.

Updating an Application Version

1. Log in to the ModelArts Pro console, click **Access** on the **HiLens Suite** card.

   The HiLens Suite console is displayed.

2. In the navigation pane on the left, choose **AppDev** > **Workbench**.

   The **My Applications** page is displayed by default.

3. On the **My Applications** page, locate the desired application and click **View** in the **Operation** column.

   The application details page is displayed. By default, the **Application Development** page is displayed.

4. To update the version, click **Update** on the right of the version on the **Application Development** page.

   Figure 5-10 Updating a version

   

5. On the **Application Development** page, you can modify the configurations of **Select Data**, **Train Model**, **Evaluate Model**, and **Deploy Service** and redeploy the service. For details, see the following sections:
   - **Selecting Data**
   - **Training a Model**
   - **Evaluating a Model**
   - **Deploying an Application**

5.6 Viewing Application Details

After creating a skill using a trainable skill template, you can view the skill details, including the skill development configuration information, historical versions, application assets, and application monitoring.

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Prerequisites

You have created a skill using the trainable safety helmet detection skill template on the ModelArts Pro console. For details, see **Creating a Skill Using a Trainable Skill Template**.

Viewing Skill Details

1. Log in to the Huawei HiLens console. In the left navigation pane, choose **Skill Development > Skills**.

   The **Basic Skills** page is displayed by default.
2. Click the **Trainable Skills** tab.
3. Locate the target skill and click **View** in the **Operation** column.

   By default, the **Application Development** page is displayed.

   You can switch to any tab page to view the **application development configurations**, **historical versions**, **application assets** (datasets), and **application monitoring**.

Viewing the Application Development Configurations

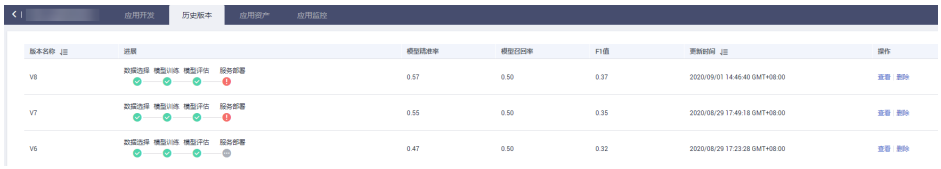
On the **Application Development** tab page, you can view the configuration information of each step during application development, including **Select Data**, **Train Model**, **Evaluate Model**, and **Deploy Service**.

In the upper left corner of the **Application Development** tab page, click **Update** on the right of the version number to update the application version and edit the configuration.

Viewing Application Versions

On the **Versions** tab page, you can view the version name, progress, model precision, recall, F1 score, update time, and operations that can be performed of the current application.

Figure 5-11 Versions



Viewing Application Assets

On the **Assets** tab page of the application details page, you can view the asset information of the current application. For example, the asset information using the general text classification workflow is information about a training dataset. You can view the dataset name, description, number of data records, labeling progress, total number of labels, creation time, and operation. You can perform **View** and **Delete** operations in the **Operation** column.

View: Click **View** to go to the datasets details page. Click **Label** to manually label data. For details, see **Labeling Data > Object Detection**.

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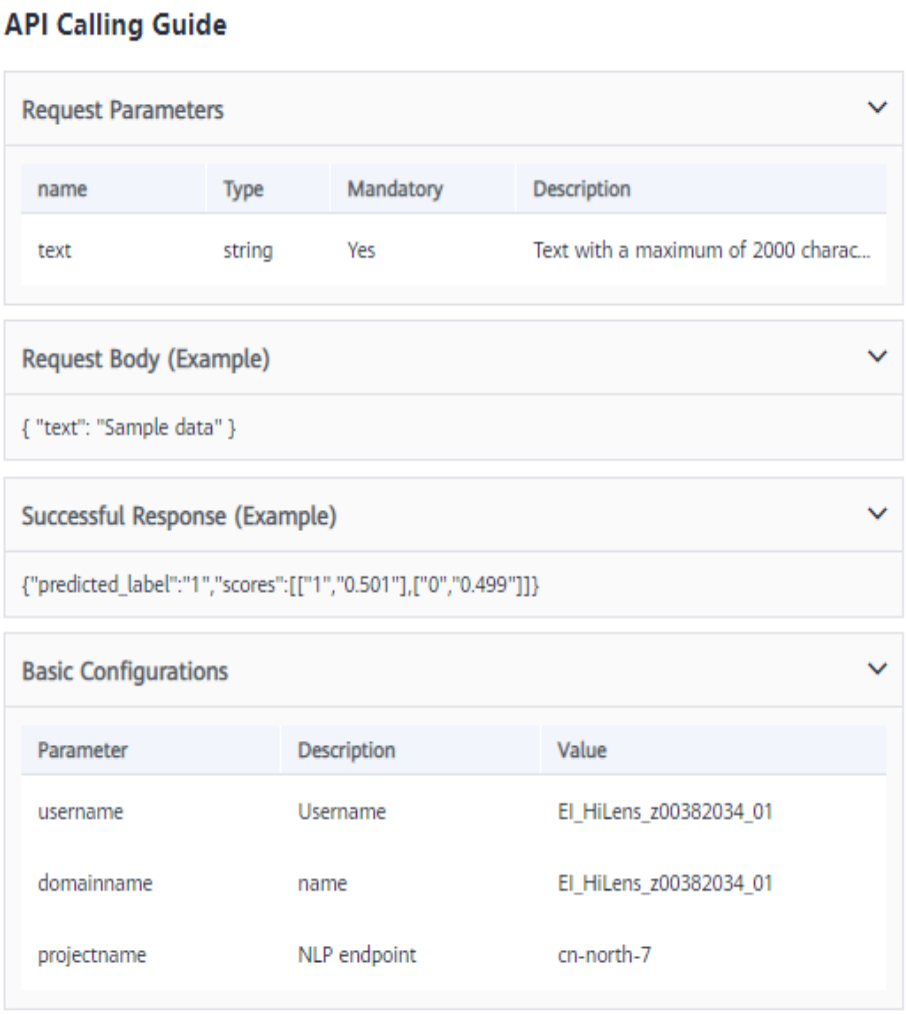
Delete: Click **Delete**. The **Delete Dataset** dialog box is displayed. Click **OK** to delete the current dataset.

Viewing Application Monitoring

On the **Monitoring** tab page, you can view the basic information, historical versions, and API calling guide of the current application version, and test it online.

Figure 5-12 API calling guide



5.7 Deleting a Skill

If an application is no longer in use, you can delete it to release resources.

Procedure

1. Log in to the Huawei HiLens console. In the left navigation pane, choose **Skill Development > Skills**.

   The **Basic Skills** page is displayed by default.

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2. Click the **Trainable Skills** tab.
3. Click **Delete** in the **Operation** column of the skill to be deleted, and click **OK**.

   NOTE

   Deleted skills cannot be recovered.

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