

# Classify Images of Clouds in the Cloud with AutoML Images

2 hours      Free

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**GSP223**



Google Cloud Self-Paced Labs

## Overview

AutoML helps developers with limited ML expertise train high quality image recognition models. Once you upload images to the AutoML UI, you can train a model that will be immediately available on Google Cloud for generating predictions via an easy to use REST API.

In this lab, you upload images to Cloud Storage and use them to train a custom model to recognize

different types of clouds (cumulus, cumulonimbus, etc.).

## What you'll learn

In this lab, you do the following:

- Uploading a labeled dataset to Cloud Storage and connecting it to AutoML with a CSV label file.
- Training a model with AutoML and evaluating its accuracy.
- Generating predictions on your trained model.

## Setup and requirements

### Before you click the Start Lab button

Read these instructions. Labs are timed and you cannot pause them. The timer, which starts when you click **Start Lab**, shows how long Google Cloud resources will be made available to you.

This hands-on lab lets you do the lab activities yourself in a real cloud environment, not in a simulation or demo environment. It does so by giving you new, temporary credentials that you use to sign in and access Google Cloud for the duration of the lab.

To complete this lab, you need:

- Access to a standard internet browser (Chrome browser recommended).

**Note:** Use an Incognito or private browser window to run this lab. This prevents any conflicts between your personal account and the Student account, which may cause extra charges incurred to your personal account.

Time to complete the lab---remember, once you start, you cannot pause a lab.

**Note:** If you already have your own personal Google Cloud account or project, do not use it for this lab to avoid extra charges to your account.

## How to start your lab and sign in to the Google Cloud Console

1. Click the **Start Lab** button. If you need to pay for the lab, a pop-up opens for you to select your payment method. On the left is the **Lab Details** panel with the following:
  - The **Open Google Console** button
  - Time remaining
  - The temporary credentials that you must use for this lab
  - Other information, if needed, to step through this lab
2. Click **Open Google Console**. The lab spins up resources, and then opens another tab that shows the **Sign in** page.

**Tip:** Arrange the tabs in separate windows, side-by-side.

**Note:** If you see the **Choose an account** dialog, click **Use Another Account**.

3. If necessary, copy the **Username** from the **Lab Details** panel and paste it into the **Sign in** dialog. Click **Next**.
4. Copy the **Password** from the **Lab Details** panel and paste it into the **Welcome** dialog. Click **Next**.

**Important:** You must use the credentials from the left panel. Do not use your Google Cloud Skills Boost credentials.

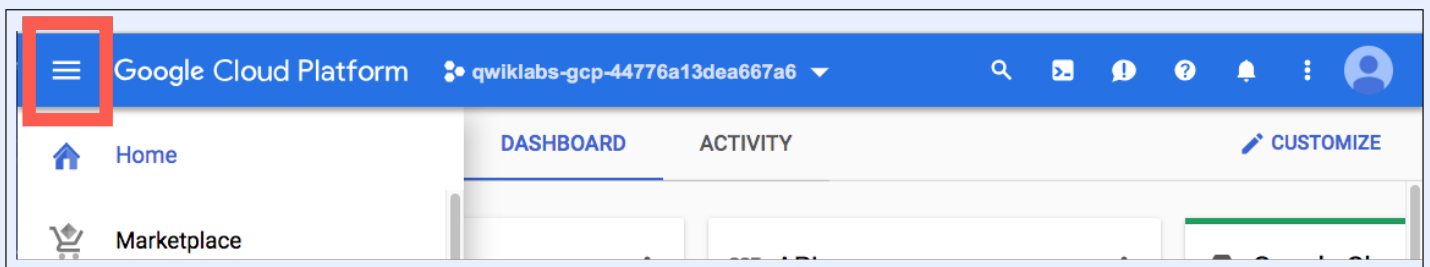
**Note:** Using your own Google Cloud account for this lab may incur extra charges.

5. Click through the subsequent pages:

- Accept the terms and conditions.
- Do not add recovery options or two-factor authentication (because this is a temporary account).
- Do not sign up for free trials.

After a few moments, the Cloud Console opens in this tab.

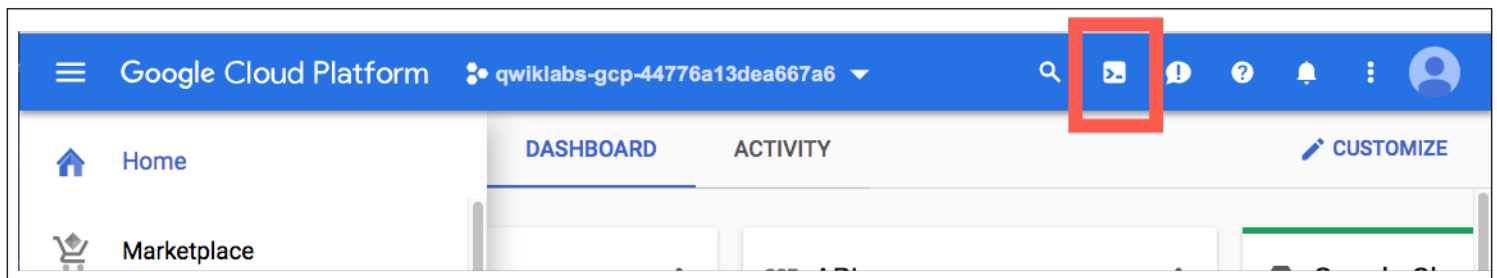
**Note:** You can view the menu with a list of Google Cloud Products and Services by clicking the **Navigation menu** at the top-left.



## Activate Cloud Shell

Cloud Shell is a virtual machine that is loaded with development tools. It offers a persistent 5GB home directory and runs on the Google Cloud. Cloud Shell provides command-line access to your Google Cloud resources.

1. In the Cloud Console, in the top right toolbar, click the **Activate Cloud Shell** button.



2. Click **Continue**.

It takes a few moments to provision and connect to the environment. When you are connected, you are already authenticated, and the project is set to your **PROJECT\_ID**. The output contains a line that

declares the **PROJECT\_ID** for this session:

```
Your Cloud Platform project in this session is set to YOUR_PROJECT_ID
```

**gcloud** is the command-line tool for Google Cloud. It comes pre-installed on Cloud Shell and supports tab-completion.

3. (Optional) You can list the active account name with this command:

```
gcloud auth list
```

conten

(Output)

```
ACTIVE: *  
ACCOUNT: student-01-xxxxxxxxxxxx@qwiklabs.net  
To set the active account, run:  
$ gcloud config set account `ACCOUNT`
```

4. (Optional) You can list the project ID with this command:

```
gcloud config list project
```

conten

(Output)

```
[core]  
project = <project_ID>
```

(Example output)

```
[core]  
project = qwiklabs-gcp-44776a13dea667a6
```

For full documentation of **gcloud**, in Google Cloud, Cloud SDK documentation, see the [gcloud command-line tool overview](#).

# Task 1. Set up AutoML

AutoML provides an interface for all the steps in training an image classification model and generating predictions on it. Start by enabling the Cloud AutoML API.

1. From the **Navigation menu**, select **APIs & Services > Library**.
2. In the search bar type in "Cloud AutoML".
3. Observe the **Cloud AutoML API** is in the **Enable** state.
4. In a new browser, open the [AutoML UI](#).

## Create storage bucket

1. Now create a storage bucket by running the following:

```
gsutil mb -p $GOOGLE_CLOUD_PROJECT \
  -c standard \
  -l us-central1 \
  gs://$GOOGLE_CLOUD_PROJECT-vcml/
```

conten

4. In the Google Cloud console, open the **Navigation menu** and click on **Cloud Storage** to see it.

Click **Check my progress** to verify the objective.



Create a Cloud Storage Bucket

Check my progress

## Task 2. Upload training images to Cloud Storage

In order to train a model to classify images of clouds, you need to provide labelled training data so the model can develop an understanding of the image features associated with different types of clouds. In this example your model will learn to classify three different types of clouds: cirrus, cumulus, and cumulonimbus. To use AutoML you need to put your training images in Cloud Storage.

1. Before adding the cloud images, create an environment variable with the name of your bucket.

Run the following command in Cloud Shell:

```
export BUCKET=$GOOGLE_CLOUD_PROJECT-vcn
```

conten

The training images are publicly available in a Cloud Storage bucket.

2. Use the `gsutil` command line utility for Cloud Storage to copy the training images into your bucket:

```
gsutil -m cp -r gs://spls/gsp223/images/* gs://${BUCKET}
```

conten

3. When the images finish copying, click the **Refresh** button at the top of the Storage browser, then click on your bucket name. You should see 3 folders of photos for each of the 3 different cloud types to be classified.

If you click on the individual image files in each folder you can see the photos you'll be using to train your model for each type of cloud.

## Task 3. Create a dataset

Now that your training data is in Cloud Storage, you need a way for AutoML to access it. You'll create a

CSV file where each row contains a URL to a training image and the associated label for that image. This CSV file has been created for you; you just need to update it with your bucket name.

1. Run the following command to copy the file to your Cloud Shell instance:

```
gsutil cp gs://splis/gsp223/data.csv .
```

conten

2. Then update the CSV with the files in your project:

```
sed -i -e "s/placeholder/${BUCKET}/g" ./data.csv
```


conten


3. Now upload this file to your Cloud Storage bucket:


```
gsutil cp ./data.csv gs://${BUCKET}
```


conten


4. Once that command completes, click the **Refresh** button at the top of the Storage browser. Confirm that you see the `data.csv` file in your bucket.
5. Open the [Vertex AI Dataset tab](#). Your page should now resemble the following:


**Vertex AI**


 Dashboard

 **Datasets**

 Features

 Labeling tasks


 Workbench

**Datasets**  **CREATE**

Managed datasets contain data used to train a machine learning model. [Learn more](#)

Region

us-central1 (Iowa) ▼ ⓘ

 **Filter** Enter a property name

| <input type="checkbox"/> | Name | ID | Status | Region | Type | Items |
|--------------------------|------|----|--------|--------|------|-------|
| No results to display    |      |    |        |        |      |       |

6. At the top of the console, click **+ CREATE**.
7. Type "clouds" for the Dataset name.
8. Select **Single-Label Classification**.

Note: In your own projects, you may want to use [multi-class classification]



(<https://cloud.google.com/vision/automl/docs/datasets>).

9. Click **CREATE DATASET**.

10. Choose **Select a CSV file on Cloud Storage** and add the file name to the URL for the file you just uploaded - `gs://your-bucket-name/data.csv`

An easy way to get this link is to go back to the Cloud Console, click on the `data.csv` file. Click on the **copy** icon in the URI field.

11. Click **CONTINUE**.

It will take 2 - 5 minutes for your images to import. Once the import has completed, you'll be brought to a page with all the images in your dataset.

Click **Check my progress** to verify the objective.



Create a Dataset

Check my progress

## Task 4. Inspect images

After the import completes, click on the **Images** tab to see the images you uploaded.

Vision
clouds LABEL STATS EXPORT DATA




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**Dashboard**

Datasets

Models

IMPORT IMAGES TRAIN EVALUATE TEST & USE
Single-Label Classification

| All images                    | 60 |                          | Filter Filter images   |
|-------------------------------|----|--------------------------|--|
| Labeled                       | 60 | <input type="checkbox"/> | Select all   |
| Unlabeled                     | 0  |                          |  |
| Filter Filter labels +        |    |                          |  |
| cirrus                        | 20 |                          |  cirrus(1)  |
| cumulonimbus                  | 20 |                          |  cumulus(1) |
| cumulus                       | 20 |                          |  cirrus(1) |
| <a href="#">ADD NEW LABEL</a> |    |                          |  |

  
cumulonimbus(1)
  
cumulus(1)
  
cumulonimbus(1)
  
cirrus(1)
  
cumulus(1)
  
cumulonimbus(1)

**Note:** If you were building a production model, you'd want *at least* 100 images per label to ensure high accuracy. This is just a demo so only 20 images were used so the model could train quickly.

Image 12 of 50


Filter labels

☐ cirrus

☒ cumulonimbus

☐ cumulus

☐ Unlabeled



**Note:** If you are working with a dataset that isn't already labeled, AutoML provides an in-house [human labeling service](#) .

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## Task 5. Train your model

You're ready to start training your model! AutoML handles this for you automatically, without requiring you to write any of the model code.

1. To train your clouds model, click **TRAIN NEW MODEL**
2. On the **Training method** tab click **Continue**
3. On the **Model details** tab click **Continue**
4. On the **Explainability** tab click **Continue**
5. On the **Compute and pricing** tab set the node hours to **8**.
6. Click **Start Training**.

Since this is a small dataset, it will only take around **25-30 minutes** to complete. In the meantime, proceed to the next section to use a pre-trained model.

## Task 6. Generate predictions

There are a few ways to generate predictions. In this lab you'll use the UI to upload images. You'll see how your model does classifying these two images (the first is a cirrus cloud, the second is a cumulonimbus).

1. Return to the **Cloudshell** terminal

## 2. Download these images to your local machine

```
gsutil cp gs://spls/gsp223/examples/* .
```

conten

## 3. View the example file `CLOUD1-JSON` and `CLOUD2-JSON` to see the content

```
{
  "instances": [{
    "content": "YOUR_IMAGE_BYTES"
  }],
  "parameters": {
    "confidenceThreshold": 0.5,
    "maxPredictions": 5
  }
}
```

conten

## 4. Copy the Endpoint value from the Qwiklabs Panel to an environment variable

```
ENDPOINT=$(gcloud run services describe automl-service --
platform managed --region us-central1 --format
'value(status.url)')
```

conten

## 5. Enter the following command to request a prediction

```
curl -X POST -H "Content-Type: application/json" $ENDPOINT/v1 -d
"@${INPUT_DATA_FILE}" | jq
```

conten

The above call will ask AutoML for a prediction. However there is no input data specified, so the request will fail. The 400 HTTP error code indicates the expected data is not present.

## Expected Output:

```
{
  "error": {
    "code": 400,
    "message": "Empty instances.",
    "status": "INVALID_ARGUMENT"
  }
}
```

conten

# Pop Quiz

Test your understanding of AutoML by completing the short quiz on the topics covered in this lab. Use the knowledge you have gained in the lab to generate predictions.



What type of cloud is in the above image?

- ☒ cirrus
- ☐ cumulus
- ☐ cumulonimbus

Submit

Lets check if our model can predict the type of Cloud in the image:

1. Set `CLOUD1-JSON` as the input file

```
INPUT_DATA_FILE=CLOUD1-JSON
```

conten

2. Enter the following command to request a prediction

```
curl -X POST -H "Content-Type: application/json" $ENDPOINT/v1 -d  
"@${INPUT_DATA_FILE}" | jq
```

conten



What type of cloud is in the above image?

- ☒ cumulus
- ☐ cirrus



cumulonimbus

Submit

Lets check if our model can predict the type of Cloud in the image:

3. Set `CLOUD1-JSON` as the input file

```
INPUT_DATA_FILE=CLOUD2-JSON
```

conten

4. Enter the following command to request a prediction

```
curl -X POST -H "Content-Type: application/json" $ENDPOINT/v1 -d  
"@${INPUT_DATA_FILE}" | jq
```

conten

## Congratulations!

You've learned how to train your own custom machine learning model and generate predictions on it through the web UI. Now you've got what it takes to train a model on your own image dataset.

What you did:

- Uploaded training images to Cloud Storage and created a CSV for AutoML to find these images.
- Reviewed labels and trained a model in the AutoML UI.

Generated predictions on new cloud images.

## Finish your quest

This self-paced lab is part of the [Machine Learning APIs](#) and [Intro to ML: Image Processing](#) quests. A quest is a series of related labs that form a learning path. Completing a quest earns you a badge to recognize your achievement. You can make your badge or badges public and link to them in your online resume or social media account. [Enroll in this quest](#) or any quest that contains this lab and get immediate completion credit. See the [Google Cloud Skills Boost catalog](#) to see all available quests.

## Take your next lab

Continue your Quest with [Detect Labels, Faces, and Landmarks in Images with the Cloud Vision API](#), or check out these suggestions:

- [Awwvision: Cloud Vision API from a Kubernetes Cluster](#)
- [Entity and Sentiment Analysis with the Natural Language API](#)

## Next steps / Learn more

- Watch [Introducing Cloud AutoML](#)
- Learn more about how AutoML works by listening to the [Google Cloud Podcast episode](#)
- Read the announcement [blog post](#)
- Learn how to perform each step with the API, see [Introduction to Vertex](#)

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