



# Classify Images with Pre-built ML Models using Cloud Vision API and AutoML

2 hours 50 minutes

1 Credit



## Overview

In this lab you will upload images to Cloud Storage and use them to train a custom model to recognize different types of clouds (cumulus, cumulonimbus, etc.).

## What you learn

In this lab, you learn how to:

- Upload a labeled dataset to Google Cloud Storage and connect it to AutoML Vision with a CSV label file.
- Train a model with AutoML Vision and evaluate its accuracy.
- Generate predictions on your trained model.

## Setup and requirements

### Qwiklabs setup

**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 Cloud resources will be made available to you.

This Qwiklabs 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 the Google Cloud Platform for the duration of the lab.

### What you need

To complete this lab, you need:

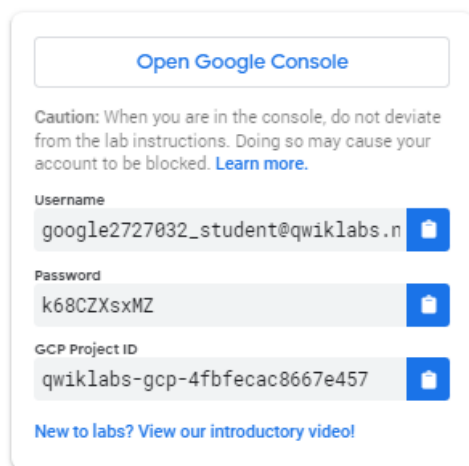
- Access to a standard internet browser (Chrome browser recommended).
- Time to complete the lab.

**Note:** If you already have your own personal GCP account or project, do not use it for this lab.

## Google Cloud Platform Console


### How to start your lab and sign in to the 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 a panel populated with the temporary credentials that you must use for this lab.




Open Google Console

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. [Learn more.](#)

Username  
google2727032\_student@qwiklabs.n 

Password  
k68CZxsMZ 

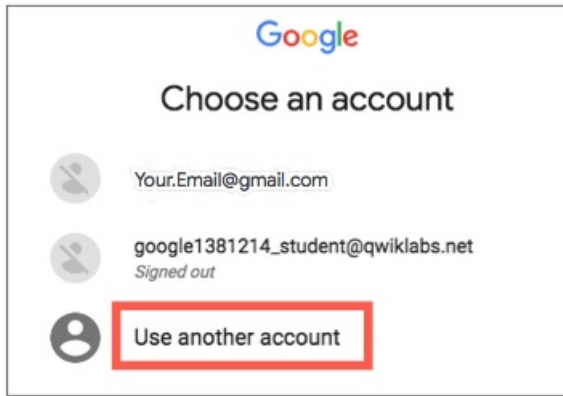
GCP Project ID  
qwiklabs-gcp-4fbfecac8667e457 

[New to labs? View our introductory video!](#)

2. Copy the username, and then click **Open Google Console**. The lab spins up resources, and then opens another tab that shows the **Choose an account** page.

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

3. On the Choose an account page, click **Use Another Account**.



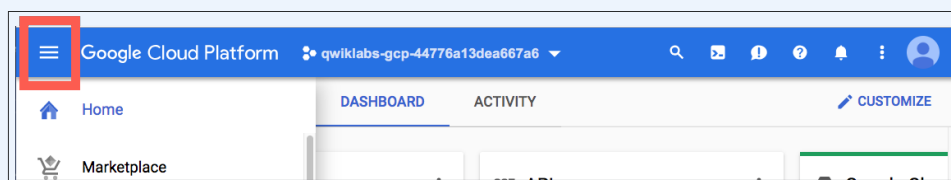
4. The Sign in page opens. Paste the username that you copied from the Connection Details panel. Then copy and paste the password.

**Important:** You must use the credentials from the Connection Details panel. Do not use your Qwiklabs credentials. If you have your own GCP account, do not use it for this lab (avoids incurring 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 GCP console opens in this tab.

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

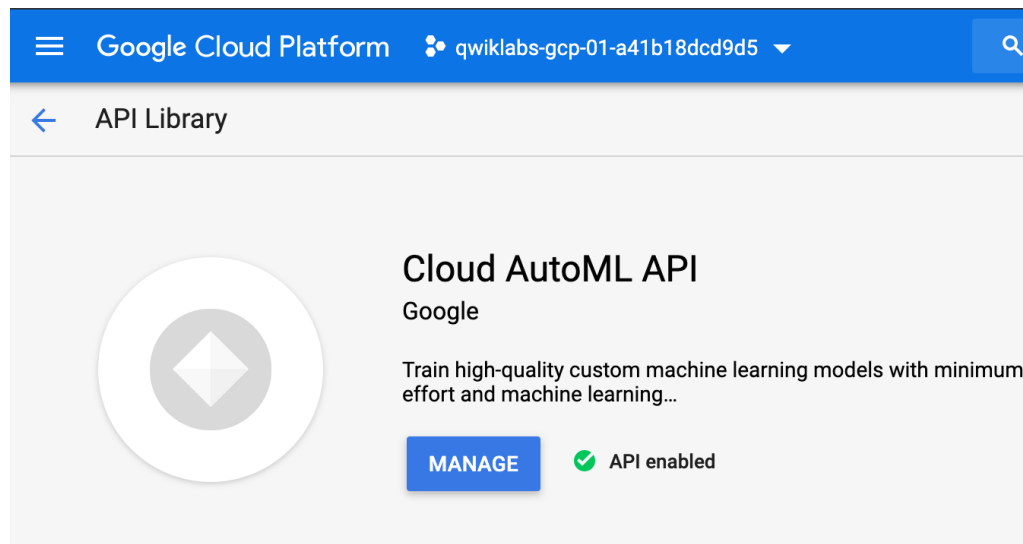


## Set up AutoML Vision

AutoML Vision 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.

Open the navigation menu and select **APIs & Services > Library**. In the search bar type in "Cloud AutoML API". Click on the **Cloud AutoML API** result and then click **ENABLE**.

This may take a minute. You should now be on the following page (ensure that the **MANAGE** button appears and **API enabled** is also displayed):



Next you will need to issue each of the commands that below appear in the GCP Console. In Cloud Shell paste these commands to create environment variables for your Project ID and Qwiklabs Username, replacing `<QWIKLABS_USERNAME>` with the user name you logged into the lab with:

```
export PROJECT_ID=$DEVSHHELL_PROJECT_ID
export QWIKLABS_USERNAME=<QWIKLABS_USERNAME>
```

Now, create a Storage Bucket for the images you will use in testing. Create one by running the following command:

```
gsutil mb -p $PROJECT_ID \
  -c regional \
  -l us-central1 \
  gs://$PROJECT_ID-vcml/
```

Leave your Cloud Shell window open for additional steps to follow.

Now open a new browser tab and navigate to the [AutoML UI](#). Select your lab credentials and click **Allow** to log in.

 Sign in with Google

## Choose an account from qwiklabs.net

to continue to [AutoML](#)



**student afddf709**

student-00-9d742ca5cccf@qwiklabs.net



**Use another account**

To continue, Google will share your name, email address, language preference, and profile picture with AutoML.

English (United States) ▼

[Help](#)


[Privacy](#)

[Terms](#)

**Note for Chrome users:** If you have trouble seeing this page, log out of your current Chrome user profile and try to open it again.

You are prompted to specify a Google Cloud project. Select your Qwiklabs Project ID from the dropdown menu and click **CONTINUE**:

## Specify Google Cloud project

 Please select a valid project id to continue

Project ID

qwiklabs-gcp-bc50c97901e31a4b

Make sure to use your project's ID, and not its name or number. [Learn more](#)

Need to create a new Google Cloud Platform project? [Get started](#)

CONTINUE


Click the **SET UP NOW** button. This step will take from 1 to 3 minutes.

You will be taken to the AutoML Vision Datasets page once the APIs are verified.

AutoML Vision BETA

qwiklabs-gcp-a72bb992d2b8a597

Finish setting up your Google Cloud project

 Let's grant AutoML Vision access to your project. Due to recent changes on our side, you may notice we also require roles/serviceusage.serviceUsageAdmin. This allows us to check your project is setup ahead of time correctly.

You'll only have to do these steps once for your project.

**1. Enable billing**  
You'll need to enable billing for your Google Cloud project to create custom models.

[GO TO BILLING](#)

**2. Enable the required APIs and modify permissions**  
Clicking "Set up now" will also create a bucket on Google Cloud Storage to store your models' images. You can also do this process manually.

[SET UP NOW](#) [MANUAL SETUP](#)

[CHECK AGAIN](#) [SELECT DIFFERENT PROJECT](#)

Google Cloud Platform

qwiklabs-gcp-7fd67230331c5679

Google Cloud Platform

Vision

Datasets BETA

[+ NEW DATASET](#)

Name	Type	Total Images	Labeled Images	Last updated	Status
No rows to display					

Dashboard

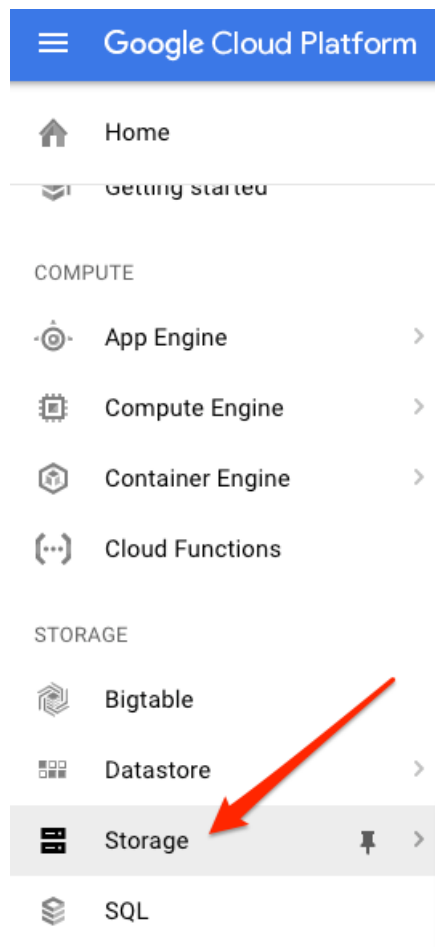
Datasets

Models

# Upload training images to Google Cloud Storage

In order to train a model to classify images of clouds, you need to provide labeled 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 Vision you need to put your training images in Google Cloud Storage.

In the GCP console, open the **Navigation menu** and select **Storage > Browser**:



Once there, you should see the bucket from the last step.

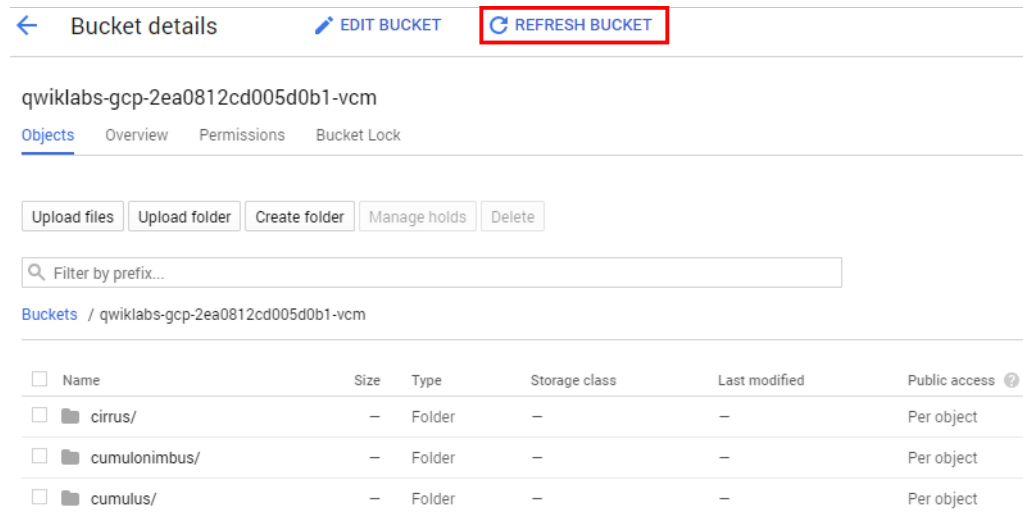
Before you add the cloud images, create an environment variable with the name of your bucket by running the following command in Cloud Shell, replacing `YOUR_BUCKET_NAME` in the command below with the name of your bucket:

```
export BUCKET=YOUR_BUCKET_NAME
```

The training images are publicly available in a Cloud Storage bucket. Use the `gsutil` command line utility for Cloud Storage to copy the training images into your bucket:

```
gsutil -m cp -r gs://automl-codelab-clouds/* gs://{BUCKET}
```

When the images finish copying, click the **Refresh** button at the top of the Cloud 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, and then click once more when you see the URL, you can see the photos you'll be using to train your model for each type of cloud.

## Create a dataset

Now that your training data is in Cloud Storage, you need a way for AutoML Vision 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.

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

```
gsutil cp gs://automl-codelab-metadata/data.csv .
```

Then update the CSV with the files in your project:

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

Now you're ready to upload this file to your Cloud Storage bucket:

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



Once that comand completes, click the **Refresh bucket** button. Confirm that you see the `data.csv` file in your bucket.

[←](#) **Bucket details** [EDIT BUCKET](#) [REFRESH BUCKET](#)

qwiklabs-gcp--93ecb14d64c3-vcn

[Objects](#) [Overview](#) [Permissions](#) [Bucket Lock](#)

[Upload files](#) [Upload folder](#) [Create folder](#) [Manage holds](#) [Delete](#)

[Buckets](#) / quiklabs-gcp--93ecb14d64c3-vcn

<input type="checkbox"/>	Name	Size	Type	Storage class	Last modified	Public access <a href="#">?</a>
<input type="checkbox"/>	cirrus/	—	Folder	—	—	Per object
<input type="checkbox"/>	cumulonimbus/	—	Folder	—	—	Per object
<input type="checkbox"/>	cumulus/	—	Folder	—	—	Per object
<input type="checkbox"/>	<b>data.csv</b>	3.59 KB	text/csv	Regional	10/17/19, 3:10:54 PM UTC-5	Not public

Navigate back to the [AutoML Vision](#) Datasets page.

Google Cloud Platform quiklabs-gcp-7f667230331c5679

[Vision](#) **Datasets** [NEW DATASET](#)

[Dashboard](#) [Datasets](#) [Models](#)

Name	Type	Total images	Labeled images	Last updated	Status
No rows to display					

At the top of the console, click **+ NEW DATASET**.

Type "clouds" for the Dataset name.

Leave "Single-label Classification" checked.

Click **CREATE DATASET** to continue

## Create new dataset

Dataset name \*  
clouds

Use letters, numbers and underscores up to 32 characters.

Select your model objective

☒ **Single-Label Classification**  
Predict the one correct label that you want assigned to an image.

☐ **Multi-Label Classification**  
Predict all the correct labels that you want assigned to an image.

☐ **Object detection**  
Predict all the locations of objects that you're interested in.

CANCEL CREATE DATASET

On the next screen you will choose the location of your training images (the ones you uploaded in the previous step)

Choose **Select a CSV file on Cloud Storage** and add the file name to the URL for the file you just uploaded - `gs://your-project-name-vcm/data.csv`. You may also use the browse function to find the csv file. Once you see the white in green checkbox you may select **CONTINUE** to proceed.

Google Cloud Platform qwiklabs-gcp-7fd67230331c5679

Vision clouds BETA LABEL STATS EXPORT DATA

IMPORT IMAGES TRAIN EVALUATE TEST & USE

### Select files to import

To build a custom model, you first need to import a set of images to train it. Each image should be categorized with a label. (Labels are essential for telling the model how to identify an image.)

- Each label should have at least 100 images for best results.

☐ Upload images from your computer

☒ Select a CSV file on Cloud Storage

### Select a CSV file on Cloud Storage

If you haven't already, upload your files to [Cloud storage](#). The CSV file should be a list of GCS paths to your images. Images can be in JPG, PNG, GIF, BMP or ICO formats. Optionally, you can specify the TRAIN, VALIDATE, or TEST split.

Sample CSV format

```
[set, ]image_path[, label]
TRAIN,gs://My_Bucket/sample1.jpg,cat
TEST,gs://My_Bucket/sample2.jpg,dog
```

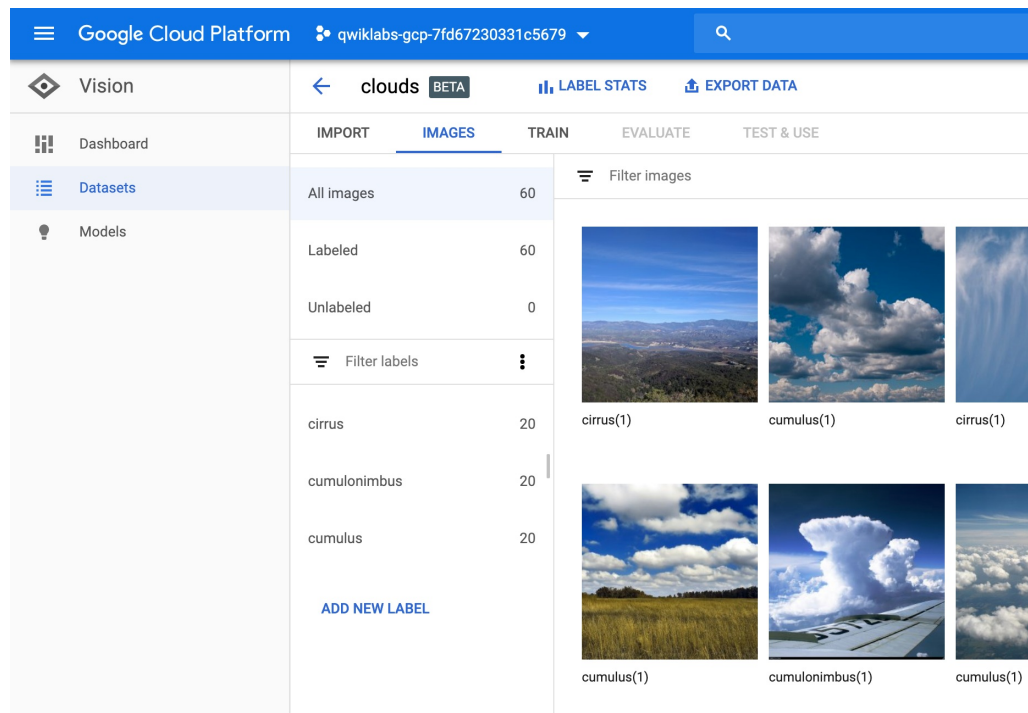
gs:// \*  
✓ -your-project-name>-vcm/data.csv BROWSE

CONTINUE

It will take around 15 to 25 minutes for your images to import and be aligned with their categories. Once the import has completed you'll be returned to the "Select files to import page", click the **IMAGES** tab to see the images in your dataset.

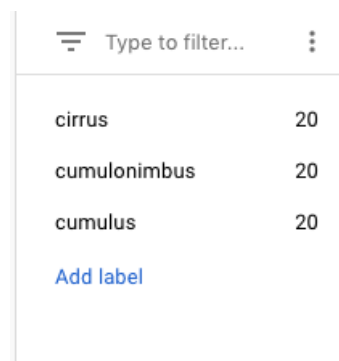
# Inspect images

Next proceed with a brief examination of the images.



The screenshot shows the Google Cloud Platform Vision API interface. The top bar indicates the project is 'qwiklabs-gcp-7fd67230331c5679'. The left sidebar has 'Vision' selected. The main area shows the 'clouds' dataset with 60 images. The 'All images' section shows 60 images, with 60 labeled and 0 unlabeled. The 'Filter labels' section lists three labels: 'cirrus' (20), 'cumulonimbus' (20), and 'cumulus' (20). A grid of six images is displayed, each labeled with its type and count (e.g., 'cirrus(1)', 'cumulus(1)', 'cumulonimbus(1)').

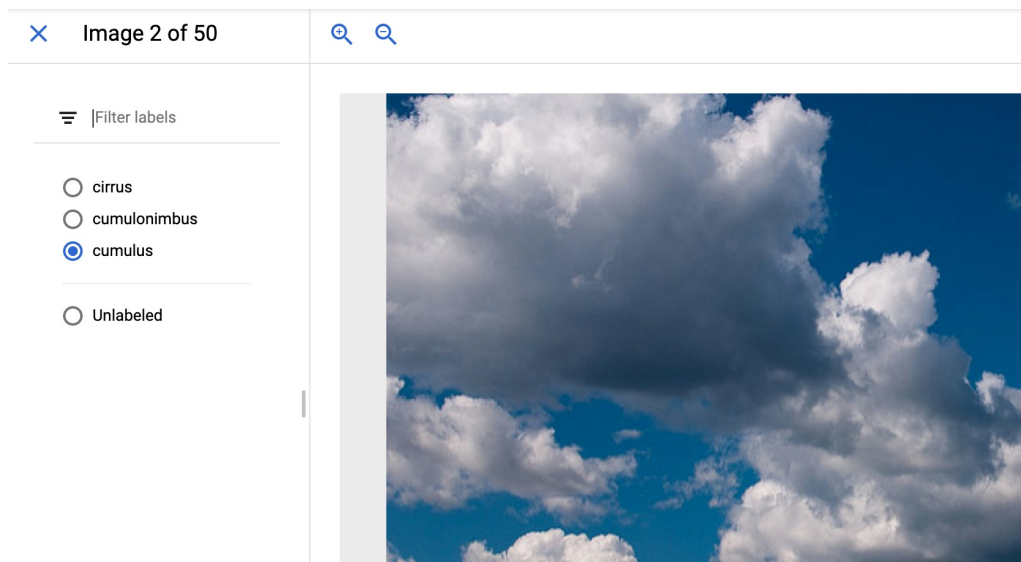
Try filtering by different labels in the left menu (i.e. click cumulus) to review the training images:



The screenshot shows the 'Filter labels' section in the Google Cloud Platform Vision API interface. It features a search bar labeled 'Type to filter...' and a list of labels: 'cirrus' (20), 'cumulonimbus' (20), and 'cumulus' (20). At the bottom, there is a blue link labeled 'Add label'.

**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 of each type were used so the model could train quickly.

If any images are labeled incorrectly you can click on them to switch the label or delete the image from your training set:



To see a summary of how many images you have for each label, click on **LABEL STATS**. You should see the following pop-out box show up on the right side of your browser. Press **DONE** after reviewing the list.

## Label Stats

Unlabeled images aren't used. Your dataset will be automatically split into [Train, Validation and Test sets](#).

Ideally, each label should have at least **10 images**. Fewer images often result in inaccurate precision and recall. You must also have at least **8, 1, 1 images** each assigned to your Train, Validation and Test sets.

Labels	Images		Train	Validation	Test
cirrus	<div><div></div></div>	20	16	2	2
cumulonimbus	<div><div></div></div>	20	16	2	2
cumulus	<div><div></div></div>	20	16	2	2

**DONE**

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

## Train your model

You're ready to start training your model! AutoML Vision handles this for you

automatically, without requiring you to write any of the model code.

To train your clouds model, go to the **TRAIN** tab and click **START TRAINING**.

[←](#) clouds BETA [LABEL STATS](#) [EXPORT DATA](#)

IMPORTIMAGES**TRAIN**EVALUATETEST & USE

### Try labeling more images before training

Unlabeled images aren't used. Your dataset will be automatically split into [Train, Validation, and Test sets](#).

Ideally, each label should have at least **10 images**. Fewer images often result in inaccurate precision and recall. You must have at least **8, 1, 1 images** each assigned to your Train, Validation and Test sets.

Labels	Images	Train	Validation	Test
cirrus	<div><div></div></div> 20	16	2	2
cumulonimbus	<div><div></div></div> 20	16	2	2
cumulus	<div><div></div></div> 20	16	2	2

START TRAINING

Enter a name for your model, or use the default auto-generated name.

Leave **Cloud hosted** selected and click **CONTINUE**.

## Train new model

### 1 Define your model

Model name \*

clouds\_20191017015319



**Cloud hosted**

Host your model on Google Cloud for online predictions



**Edge**

Download your model for offline/mobile use

CONTINUE

### 2 Set a node hour budget

START TRAINING

CANCEL

For the next step, type the value "8" into the **Budget \*** box and check "**Deploy model to 1 node after training**." This process (auto-deploy) will make your model immediately available for predictions after testing is complete.

Click **START TRAINING**.

---

## Train new model


---

### Define your model

### Set a node hour budget

Specify the maximum number of node hours to spend training your model. If your model stops improving before then, AutoML Vision will stop training and you'll only be charged for the actual node hours used.

For cloud-hosted model. You can train for 40 node hours (per billing account) for free. Standard pricing applies afterwards. [Pricing guide](#)

 Note to beta users: AutoML Vision has updated its pricing for node hours.

**Budget \***  
8 maximum node hours 

16 node hours is recommended for this dataset

**Estimated completion time:** 2 hours

☒ **Deploy model to 1 node after training**

Make your model available for REST API requests immediately after training.  
Deployment pricing applies.

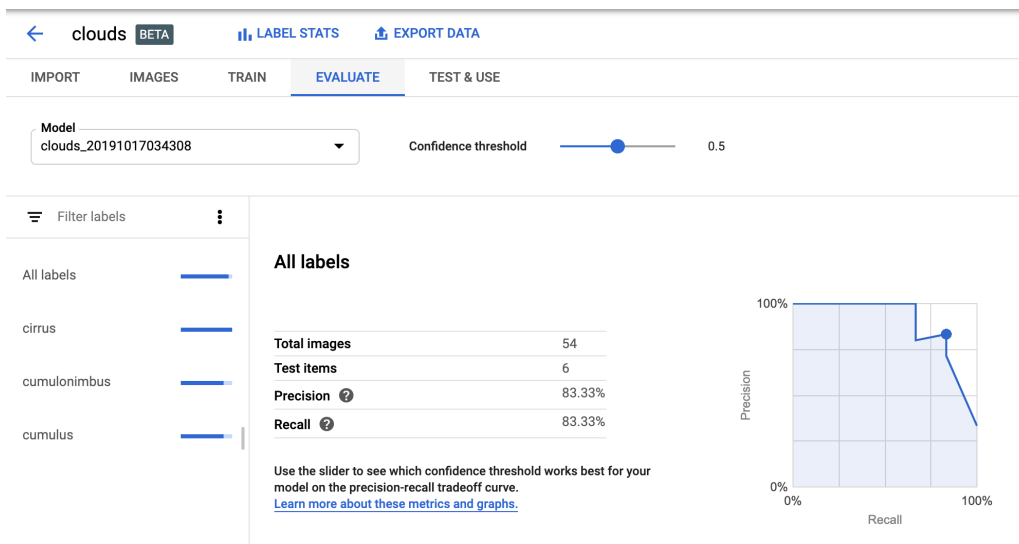
**START TRAINING**

CANCEL

Training this dataset will take around **55 to 90 minutes** to complete. The total training time includes node training time as well as infrastructure set up and tear down.

## Evaluate your model

After training is complete, click on the **EVALUATE** tab. Here you'll see information about Precision and Recall of the model. It should resemble the following:



You can also adjust the **Confidence threshold** slider to see its impact.

Finally, scroll down to take a look at the **Confusion matrix**.

## Confusion matrix

True Label	Predicted Label		
	cumulus	cumulonimbus	cirrus
cumulus	50%	50%	-
cumulonimbus	-	100%	-
cirrus	-	-	100%

This tab provides some common machine learning metrics to evaluate your model accuracy and see where you can improve your training data. Since the focus for this lab was not on accuracy, move on to the next section about predictions section. Feel free to browse the accuracy metrics on your own.

## Generate predictions

Now it's time for the most important part: generating predictions on your trained model using data it hasn't seen before.

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).

First, download these images to your local machine by right-clicking on each of them (**Note:** You may want to assign a simple name like 'Image1' and 'Image2' to assist with uploading later):







Navigate to the **TEST & USE** tab in the AutoML UI:

On this page you will see that the model you just trained and deployed is listed in the "Model" pick list.

Click **UPLOAD IMAGES** and upload the cloud sample images you just saved to your local disk (you may select both images at the same time).

clouds BETA LABEL STATS EXPORT DATA

IMPORT IMAGES TRAIN EVALUATE TEST & USE

Model  
clouds\_20191022095815

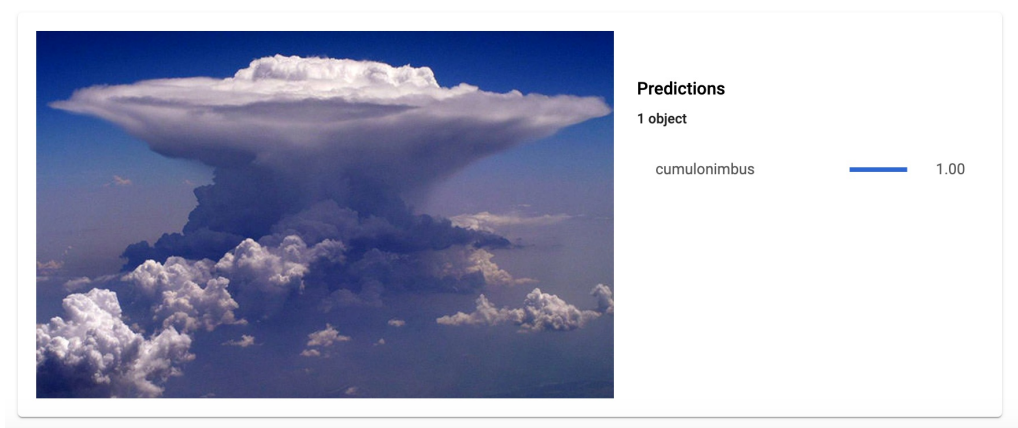
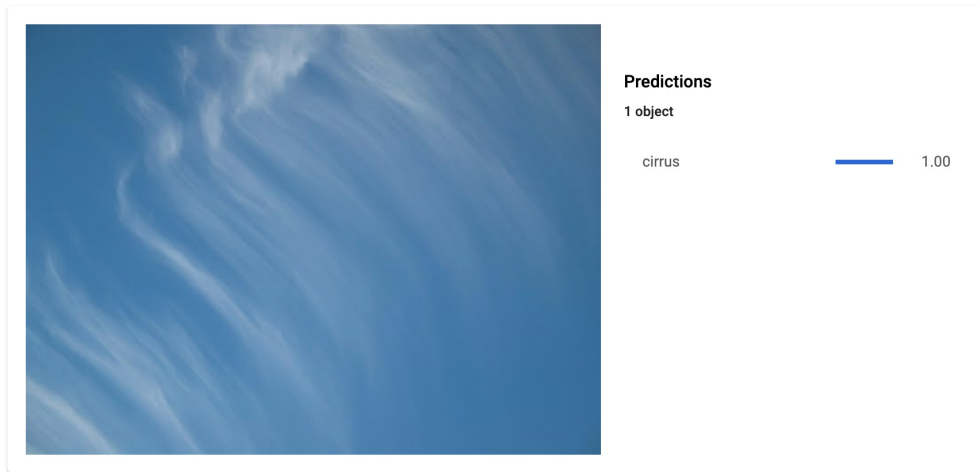
✓ Your model is deployed and is available for online prediction requests. [Learn more](#)

**Test your model**

UPLOAD IMAGES

Up to 10 images can be uploaded at a time

When the prediction request completes you should see something like the following:



Excellent - the model classified each type of cloud correctly!

## 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 was covered

- Uploading training images to Cloud Storage and creating a CSV for AutoML Vision to find these images.
- Reviewing labels and training a model in the AutoML Vision UI.
- Generating predictions on new cloud images.

Next steps / learn more

- Watch the [intro video](#)
- Learn more about how AutoML Vision works by listening to the [GCP Podcast episode](#)
- Read the announcement [blog post](#)
- Learn how to [perform each step with the API](#)

## End your lab

When you have completed your lab, click **End Lab**. Qwiklabs removes the resources you've used and cleans the account for you.

You will be given an opportunity to rate the lab experience. Select the applicable number of stars, type a comment, and then click **Submit**.

The number of stars indicates the following:

- 1 star = Very dissatisfied
- 2 stars = Dissatisfied
- 3 stars = Neutral
- 4 stars = Satisfied
- 5 stars = Very satisfied

You can close the dialog box if you don't want to provide feedback.

For feedback, suggestions, or corrections, please use the **Support** tab.

Manual Last Updated: December 13, 2019

Lab Last Tested: December 13, 2019

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