

# Part 1: AutoML

Image



DASHBOARD

ACTIVITY

RECOMMENDATIONS

CUSTOMIZE

How Google Cloud is helping during COVID-19. [Learn more](#)

DISMISS

### Project info

Project name  
My First Project

Project ID  
round-dreamer-304721

Project number  
881504960654

[ADD PEOPLE TO THIS PROJECT](#)[Go to project settings](#)

### Resources

This project has no resources



CLOUD SHELL

Terminal

(round-dreamer-304721) x + ▾

[Open Editor](#)

Welcome to Cloud Shell! Type "help" to get started.

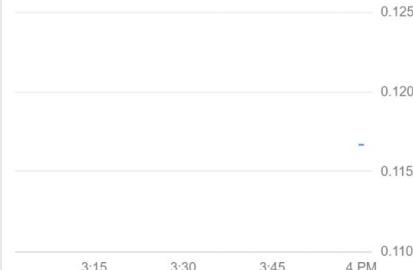
Your Cloud Platform project in this session is set to **round-dreamer-304721**.

Use "gcloud config set project [PROJECT\_ID]" to change to a different project.

```
shannon_phu@cloudshell:~ (round-dreamer-304721)$ gsutil mb -p round-dreamer-304721 -l us-central1 gs://round-dreamer-304721-vcm/
```

### API APIs

Requests (requests/sec)

[Go to APIs overview](#)

### Google Cloud Platform status

All services normal

[Go to Cloud status dashboard](#)

### Monitoring

[Set up alerting policies](#)[Create uptime checks](#)[View all dashboards](#)[Go to Monitoring](#)



AI Platform (Unified)



test-dataset



test-dataset\_icn



Dashboard



Datasets



Labeling tasks



Notebooks



Training



Models



Endpoints



Batch predictions

IMPORT

BROWSE

ANALYZE

Import in progress

This can take several minutes or more. You will be emailed once processing completes.

## AI Platform (Unified)

test-dataset

test-dataset\_icn



## Dashboard

## Datasets

## Labeling tasks

## Notebooks

## Training

## Models

## Endpoints

## Batch predictions

IMPORT

BROWSE

ANALYZE

All 3,667

Labeled 3,667

Unlabeled 0

Filter items

&gt;|

① Unable to import data due to errors.

DETAILS DISMISS

 Select all

roses

ADD NEW LABEL



daisy



## Training jobs and models

Use this dataset to train a new machine learning model with AutoML or custom code

TRAIN NEW MODEL

## Labeling tasks

If your data still needs to be labeled, create a labeling task to have others label it for you

CREATE LABELING TASK



Items per page: 10 ▾ 1 ▾



AI Platform (Unified)

← test-dataset

test-dataset\_icn



IMPORT

BROWSE

ANALYZE

All 3,667

Labeled 3,667

Unlabeled 0

Filter labels



daisy 633

dandelion 898

roses 641

sunflowers 697

tulips 798

ADD NEW LABEL

roses



Filter items



Unable to import data due to errors.

DETAILS

DISMISS

 Select all

## Training jobs and models

test-dataset\_20212160186

Training model...

TRAIN NEW MODEL

## Labeling tasks

If your data still needs to be labeled, create a labeling task to have others label it for you

CREATE LABELING TASK

## AI Platform (Unified)

Training

PREVIEW

+ CREATE

REFRESH

## Dashboard

TRAINING PIPELINE

CUSTOM JOB

HYPERPARAMETER TUNING

## Datasets

Training jobs build machine learning models from your datasets (or specify your own training inputs). Training pricing is based on the computing resources required.

## Labeling tasks

## Notebooks

## Training

## Models

## Endpoints

## Batch predictions

Region

us-central1 (Iowa)



Filter training pipelines...



Name	ID	Job type	Model type	Status	Created	Elapsed time
test-dataset_20212160186	3480279757352861696	Training pipeline	Image classification (Single-label)	Succeeded	Feb 15, 2021, 4:19:11 PM	24 min 2 sec



## AI Platform (Unified)

## Models

PREVIEW

+ CREATE

IMPORT

REFRESH

## Dashboard

## Datasets

## Labeling tasks

## Notebooks

## Training

## Models

## Endpoints

## Batch predictions

Models are built from your datasets or unmanaged data sources. There are many different types of machine learning models available on AI Platform, depending on your use case and level of experience with machine learning. [Learn more](#)

## Region

us-central1 (Iowa)



## Filter models...



Name	ID	Data	Region	Type	Created	Notifications	Metadata
test-dataset_20212160186	1137457973073805312	test-dataset_icn	us-central1	Image classification	Feb 15, 2021, 4:19:11 PM		⋮

## AI Platform (Unified)

← test-dataset\_20212160186

VIEW DATASET

EVALUATE

DEPLOY &amp; TEST

BATCH PREDICTIONS

MODEL PROPERTIES

Filter labels

Confidence threshold 0.5

All labels

0

dandelion

0.99975

sunflowers

0.99901

daisy

0.99721

tulips

0.99520

roses

0.99126

## All labels

Average precision

0.996

Precision

97.3%

Recall

97%

Created

Feb 15, 2021, 4:44:52 PM

Total images

3,667

Training images

2,933

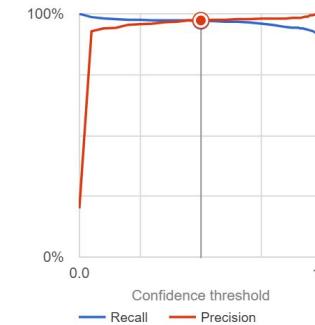
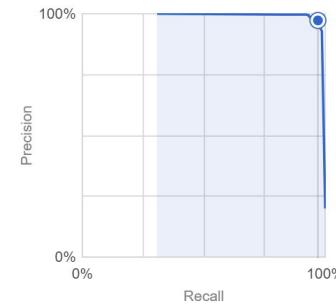
Validation images

367

Test images

367

Use the slider to see which score threshold works best for your model on the precision-recall tradeoff curve. [Learn more about these metrics and graphs](#)



## Confusion matrix

Item counts 

This table shows how often the model classified each label correctly (in blue), and which labels were most often confused for that label (in gray). Note that this table is limited to the 10 most confused labels. You can download the entire confusion matrix as a CSV file.

True label	Predicted label				
	roses	daisy	tulips	dandelion	sunflowers
roses	92%	—	8%	—	—
daisy	—	97%	—	—	3%
tulips	3%	—	98%	—	—
dandelion	—	1%	—	98%	1%
sunflowers	—	—	—	—	100%

## AI Platform (Unified)

← test-dataset\_20212160186

[VIEW DATASET](#)

EVALUATE

DEPLOY &amp; TEST

BATCH PREDICTIONS

MODEL PROPERTIES

## Deploy your model

Endpoints are machine learning models made available for online prediction requests. Endpoints are useful for timely predictions from many users (for example, in response to an application request). You can also request batch predictions if you don't need immediate results.

[DEPLOY TO ENDPOINT](#)

Endpoint	ID	Models	Region	Last updated	API	Notification	Metadata	Encryption
hello_automl_image	6031832829048913920	1	us-central1	Feb 15, 2021, 5:01:34 PM	<a href="#">Sample request</a>			Google-managed key

## Test your model

[PREVIEW](#)

Your model must be successfully deployed to an endpoint before you can test it.

[UPLOAD IMAGE](#)



## AI Platform (Unified)

← test-dataset\_20212160186

VIEW DATASET

EVALUATE

DEPLOY &amp; TEST

BATCH PREDICTIONS

MODEL PROPERTIES

Dashboard

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Models

Endpoints

Batch predictions

## Deploy your model

Endpoints are machine learning models made available for online prediction requests. Endpoints are useful for timely predictions from many users (for example, in response to an application request). You can also request batch predictions if you don't need immediate results.

DEPLOY TO ENDPOINT

Endpoint	ID	Models	Region	Last updated	API	Notification	Metadata
imageendpt	2224039344107159552	1	us-central1	Feb 17, 2021, 1:56:32 PM	<a href="#">Sample request</a>		



## AI Platform (Unified)

← test-dataset\_20212160186

[VIEW DATASET](#)

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EVALUATE

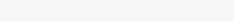
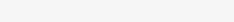
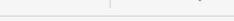
DEPLOY &amp; TEST

BATCH PREDICTIONS

MODEL PROPERTIES

Test your model

PREVIEW



Item 1 of many

Filter labels

roses	0.000
daisy	0.000
tulips	0.000
dandelion	0.000
sunflowers	1.000

Text

How Google Cloud is helping during COVID-19. [Learn more](#)

DISMISS

### Project info

## Project name

258-automl-text

## Project ID

automl-text-305000

## Project number

145538897528

[ADD PEOPLE TO THIS PROJECT](#)[Go to project settings](#)

### Resources

This project has no resources

### Trace

No trace data from the past 7 days

[Get started with Trace](#)

### CLOUD SHELL

Terminal (automl-text-305000) x

+ v

[Open Editor](#)

```
Welcome to Cloud Shell! Type "help" to get started.  
Your Cloud Platform project in this session is set to my-project-304722.  
Use "gcloud config set project [PROJECT_ID]" to change to a different project.  
shannon phu@cloudshell:~ (my-project-304722)$ gcloud config set project automl-text-305000  
Updated property [core/project].  
shannon phu@cloudshell:~ (automl-text-305000)$ export PROJECT_ID=automl-text-305000  
shannon phu@cloudshell:~ (automl-text-305000)$ export BUCKET=${PROJECT_ID}-lcm  
shannon phu@cloudshell:~ (automl-text-305000)$ gsutil mb -p ${PROJECT_ID} -l us-central1 gs://${BUCKET}/  
Creating gs://automl-text-305000-lcm/...  
shannon phu@cloudshell:~ (automl-text-305000)$ gsutil -m cp -R gs://cloud-ml-data/NL-classification/happiness.csv gs://${BUCKET}/text/  
Copying gs://cloud-ml-data/NL-classification/happiness.csv [Content-Type=text/csv]...  
/ [1/1 files] 1.3 MiB/ 1.3 MiB 100% Done  
Operation completed over 1 objects/1.3 MiB.  
shannon phu@cloudshell:~ (automl-text-305000)$
```

## AI Platform (Unified)

text\_classifica...

text\_classificationTutorial... ▾



TRAIN NEW MODEL

CREATE LABELING TASK

## Dashboard

IMPORT

BROWSE

ANALYZE

## Datasets

All

11,947

Filter items

Labeled

11,947

Unlabeled

0

! Unable to import data due to errors.

DETAILS

DISMISS

## Labeling tasks

## Notebooks

## Training

## Models

## Endpoints

## Batch predictions

Filter labels



achievement

3,791

affection

4,232

bonding

1,303

enjoy\_the\_moment

1,343

exercise

172

leisure

832

nature

274

ADD NEW LABEL

 Text ▼ My eldest son who is 27 just got word he has a new job after finishing his bache... ▼ I visited my best friend at her school on St. Patrick's day. ▼ My mom cooked some delicious rice for me with curd. ▼ Today I make Eye contact with my crush. She Also look into my Eyes For a Seco... ▼ I was dropping off my son for a sleepover. He was really excited to go. I droppe... ▼ Dinner tonight was really good. ▼ I WENT TO MEENAKSHI AMMAN TEMPLE WITH MY FAMILY MEMBERS. ▼ I got the test results back from my father's echo and neck arteries taken at the ... ▼ I was selected as the winner for a random lottery drawing from an mturk hit. It ... ▼ My brother told me he got into med school!

Items per page:

10 ▾

1 – 10 of many

&lt; &gt;



## AI Platform (Unified)

Training

PREVIEW

+ CREATE

REFRESH

## Dashboard

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## Labeling tasks

## Notebooks

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## Batch predictions

## TRAINING PIPELINE

## CUSTOM JOB

## HYPERPARAMETER TUNING

Training jobs build machine learning models from your datasets (or specify your own training inputs). Training pricing is based on the computing resources required.

## Region

us-central1 (Iowa)



Filter training pipelines...



Name	ID	Job type	Model type	Status	Created	Elapsed time
text_classification_tutorial_202121605323	1867991090754224128	Training pipeline	Text classification (Single-label)	Pending	Feb 15, 2021, 4:53:43 PM	11 sec

## AI Platform (Unified)

← text\_classification\_tutorial\_202121605323

VIEW DATASET

EVALUATE DEPLOY &amp; TEST BATCH PREDICTIONS MODEL PROPERTIES

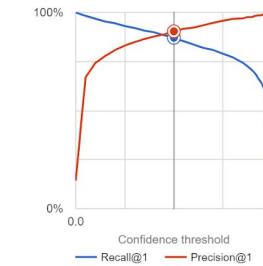
Filter labels

Confidence threshold 0.5

## All labels

All labels	0
affection	0.99388
bonding	0.97413
achievement	0.95873
nature	0.92524
enjoy_the_moment	0.84273
leisure	0.83728
exercise	0.82584

Use the slider to see which score threshold works best for your model on the precision-recall tradeoff curve. [Learn more about these metrics and graphs](#)



## Confusion matrix

 Item counts 

This table shows how often the model classified each label correctly (in blue), and which labels were most often confused for that label (in gray). Note that this table is limited to the 10 most confused labels. You can download the entire confusion matrix as a CSV file.

True label	Predicted label						
	bonding	achievement	nature	enjoy_the_moment	affection	exercise	leisure
bonding	90%	4%	—	1%	5%	—	1%
achievement	1%	90%	1%	3%	4%	1%	1%
nature	—	12%	85%	—	4%	—	—
enjoy_the_moment	1%	20%	—	73%	3%	1%	2%
affection	—	1%	—	1%	97%	0%	—
exercise	—	10%	5%	—	—	80%	5%

Google Cloud Platform 258-automl-text Search products and resources

Navigation menu Platform (Unified)

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text\_classificationTutorial\_202121605323 VIEW DATASET

EVALUATE DEPLOY & TEST BATCH PREDICTIONS MODEL PROPERTIES

### Deploy your model

Endpoints are machine learning models made available for online prediction requests. Endpoints are useful for timely predictions from many users (for example, in response to an application request). You can also request batch predictions if you don't need immediate results.

DEPLOY TO ENDPOINT

Endpoint	ID	Models	Region	Last updated	API	Notification	Metadata	Encryption
<a href="#">textendpt</a>	6313307805759569920	1	us-central1	Feb 17, 2021, 2:09:20 PM	<a href="#">Sample request</a>			Google-managed key
<a href="#">text_hello_endpoint</a>	3286888856166596608	1	us-central1	Feb 15, 2021, 9:37:29 PM	—			Google-managed key

### Test your model

PREVIEW

I want to relax at the beach

PREDICT

Filter labels

affection	0.002
achievement	0.038
enjoy_the_moment	0.171
bonding	0.001
leisure	0.781
nature	0.005
exercise	0.003

# Video

APIs & Services  
Cloud AI Platform API

Overview



Metrics



Quotas



Credentials

## Overview

■ DISABLE API

To use this API, you may need credentials. Click 'Create credentials' to get started.

[CREATE CREDENTIALS](#)

## Details

## Name

Cloud AI Platform API

## By

Google

## Service name

aiplatform.googleapis.com

## Overview

Train high-quality custom machine learning models with minimal machine learning expertise and effort.

## Activation status

Enabled

## Traffic by response code

Request/sec (2 hr average)

No data is available for the selected time frame.

1.0/s

0.8/s

0.6/s

0.4/s

0.2/s

0

Jan 24

Jan 31

Feb 07

Feb 14



## Tutorials and documentation

[Learn more](#)

View metrics

## AI Platform (Unified)

## Create dataset

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Dataset name \*

untitled\_1613435738614

Can use up to 128 characters.

## Select a data type and objective

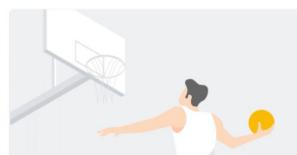
First select the type of data your dataset will contain. Then select an objective, which is the outcome that you want to achieve with the trained model. [Learn more about model types](#)

IMAGE

TABULAR

TEXT

VIDEO

 Video action recognition

Identify the action moments in your videos.

 Video classification

Get label predictions for entire videos, shots, and frames.

 Video object tracking

Get labels, tracks, and timestamps for objects you want to track in a video.

Region

us-central1 (Iowa)





## AI Platform (Unified)

untitled\_1613435738614

untitled\_1613435738614...



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IMPORT

BROWSE

ANALYZE

## Add videos to your dataset

Before you begin, read the [data guide](#) to learn how to prepare your data. Then choose an import method.

## Select an import method

- Upload videos: Recommended if you don't have labels yet
- Import files: Recommended if you already have labels. An import file is a list of Cloud Storage URIs to your videos and optional data, like labels. [Learn how to create an import file](#)

- Upload videos from your computer  
 Upload import files from your computer  
 Select import files from Cloud Storage

## Select import files from Cloud Storage

Videos referenced in the import files will be preprocessed and stored in a new Cloud Storage bucket ([charges apply](#))

Import file path \*

 gs:// automl-video-demo-data/hmdb\_split1\_5cl [BROWSE](#) [?](#) Data split [Automatic](#) [?](#)[ADD ANOTHER FILE](#)

## What happens next?

You will be emailed once your videos are imported and your dataset is ready

[CONTINUE](#)

Video classification models let you predict labels for segments.

If you want to recognize a vast number of objects and actions in your videos with Google's pre-trained models, try the Video Intelligence API. [Learn more](#)

## AI Platform (Unified)

untitled\_1613435738614

untitled\_1613435738614... ?

## Dashboard

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## Batch predictions

IMPORT

BROWSE

ANALYZE

All 500

Labeled 500

Unlabeled 0

Filter items



&gt;|

 Select all

Filter labels



Videos ▾

cartwheel 100

golf 100

kick\_ball 100

pullup 100

ride\_horse 100

ADD NEW LABEL



## Training jobs and models

Use this dataset to train a new machine learning model with AutoML or custom code

TRAIN NEW MODEL

## Labeling tasks

If your data still needs to be labeled, create a labeling task to have others label it for you

CREATE LABELING TASK



Google Cloud Platform

258-automl-video ▾



Search products and resources

Navigation menu  
All Platform (Unified)

Training

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TRAINING PIPELINE

CUSTOM JOB

HYPERPARAMETER TUNING

Training jobs build machine learning models from your datasets (or specify your own training inputs). Training pricing is based on the computing resources required.

Region

us-central1 (Iowa)



Filter training pipelines...



Name	ID	Job type	Model type	Status	Created	Elapsed time
hello-automl-video-model	6479677109181612032	Training pipeline	Video classification	Pending	Feb 15, 2021, 4:55:52 PM	11 sec

## AI Platform (Unified)

← hello-automl-video-model

VIEW DATASET

EVALUATE

TEST

BATCH PREDICTIONS

MODEL PROPERTIES

Filter labels

Confidence threshold 0.5

All labels 0

cartwheel 1

ride\_horse 1

kick\_ball 1

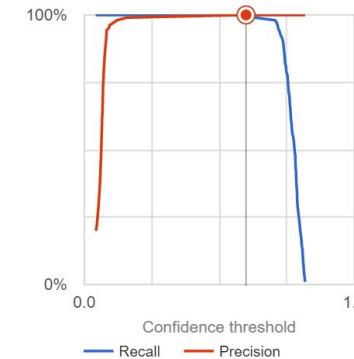
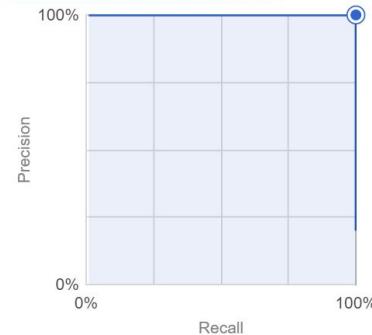
golf 1

pullup 1

## All labels

Average precision	1
Precision	100%
Recall	100%
Created	Feb 15, 2021, 6:56:50 PM
Training videos	400
Test videos	100

Use the slider to see which confidence threshold works best for your model on the precision-recall tradeoff curve. [Learn more about these metrics and graphs](#)



## Confusion matrix

Item counts 

This table shows how often the model classified each label correctly (in blue), and which labels were most often confused for that label (in gray). Note that this table is limited to the 10 most confused labels. You can download the entire confusion matrix as a CSV file.

True label	Predicted label					
		ride_horse	golf	cartwheel	pullup	kick_ball
ride_horse	100%	—	—	—	—	—
golf	—	100%	—	—	—	—
cartwheel	—	—	100%	—	—	—
pullup	—	—	—	100%	—	—
kick_ball	—	—	—	—	100%	—

 AI Platform (Unified)[hello-automl-video-model](#)[VIEW DATASET](#)

EVALUATE

TEST

BATCH PREDICTIONS

MODEL PROPERTIES

## Batch predictions

Batch prediction intakes a group of prediction requests and outputs the results to a specified location. Use batch prediction when you don't require an immediate response and want to process accumulated data with a single request. Batch prediction can be used with [AutoML models](#) and [custom-trained models](#).

[CREATE BATCH PREDICTION](#) Filter batch predictions 

	Batch prediction	Last updated	Status	
	hello-video-batch	February 15, 2021	Pending	



## AI Platform (Unified)

## Batch predictions

PREVIEW

+ CREATE

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Dashboard

Region

us-central1 (Iowa)



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Filter batch predictions



	Batch prediction	Model	Objective	Last updated	Status	Actions
<input checked="" type="checkbox"/>	hello-video-batch	hello-automl-video-model	Video classification	February 15, 2021	Done	

Google Cloud Platform 258-automl-video Search products and resources

Storage Bucket details cloud-ai-platform-078dafdc-b032-4787-9f68-9a280ae1c2bc

REFRESH LEARN

OBJECTS CONFIGURATION PERMISSIONS RETENTION LIFECYCLE

Buckets > cloud-ai-platform-078dafdc-b032-4787-9f68-9a280ae1c2bc > 258-automl-video > output > prediction-hello-automl-video-model-2021-02-16T03:33:29.924208Z

UPLOAD FILES UPLOAD FOLDER CREATE FOLDER MANAGE HOLDS DOWNLOAD DELETE

Filter by name prefix only ▾ Filter objects and folders

	Name	Size	Type	Created time	Storage class	Last modified	Public access	Encryption
<input type="checkbox"/>	predictions_1.j	3.4 KB	application/octet-stream	Feb 15, 2021, 7...	Regional	Feb 15, 20...	Not public	Google-managed ke
<input type="checkbox"/>	predictions_2.j	2.6 KB	application/octet-stream	Feb 15, 2021, 7...	Regional	Feb 15, 20...	Not public	Google-managed ke
<input type="checkbox"/>	predictions_5.json	2.6 KB	application/octet-stream	Feb 15, 2021, 7...	Regional	Feb 15, 20...	Not public	Google-managed ke
<input type="checkbox"/>	predictions_5.j	3.4 KB	application/octet-stream	Feb 15, 2021, 7...	Regional	Feb 15, 20...	Not public	Google-managed ke

```

1  {
2    "instance": {
3      "content": "gs://automl-video-demo-data
4        /hmdb51/CrossCountry_ride_horse_f_cm_np1_le
5        _med_2.mp4",
6        "mimeType": "mp4",
7        "timeSegmentStart": "0.0s",
8        "timeSegmentEnd": "2.366667s"
9    },
10   "prediction": [
11     {
12       "id": "729074065750360064",
13       "displayName": "ride_horse",
14       "type": "segment-classification",
15       "timeSegmentStart": "0s",
16       "timeSegmentEnd": "2.366667s",
17       "confidence": 0.78461576
18     },
19     {
20       "id": "729074065750360064",
21       "displayName": "ride_horse",
22       "type": "shot-classification",
23       "timeSegmentStart": "0s",
24       "timeSegmentEnd": "0.080s",
25       "confidence": 0.78461576
26     },
27     {
28       "id": "729074065750360064",
29       "displayName": "ride_horse",
30       "type": "one-sec-interval-classification",
31       "timeSegmentStart": "1.280s",
32       "timeSegmentEnd": "1.280s",
33       "confidence": 0.78461576
34     },
35     {
36       "id": "8223063845694865408",
37       "displayName": "kick_ball",
38       "type": "segment-classification",
39       "timeSegmentStart": "0s",
40       "timeSegmentEnd": "2.366667s",
41       "confidence": 0.06653118
42     }
43   ]
44 }
```

Ln: 40 Col: 7

# Custom

Google Cloud Platform 258-automl-custom Search products and resources CUSTOMIZE

DASHBOARD ACTIVITY RECOMMENDATIONS

How Google Cloud is helping during COVID-19. [Learn more](#) DISMISS

**Project info**

Project name: 258-automl-custom  
Project ID: automl-custom-305000  
Project number: 256243604088

[ADD PEOPLE TO THIS PROJECT](#)

[Go to project settings](#)

**API APIs**

Requests (requests/sec)

No data is available for the selected time frame.

3:45 4 PM 4:15 4:30

[Go to APIs overview](#)

**Google Cloud Platform status**

All services normal

[Go to Cloud status dashboard](#)

**Billing**

Estimated charges: USD \$0.00  
For the billing period Feb 1 – 15, 2021

[Take a tour of billing](#)

[View detailed charges](#)

CLOUD SHELL Terminal (automl-custom-305000) + Open Editor

```
$ gcloud config set project PROJECT_ID
or to unset it, run:
$ gcloud config unset project
shannon_phu@cloudshell:~ (automl-text-305000)$ gcloud config set project ${PROJECT_ID}
Updated property [core/project].
shannon_phu@cloudshell:~ (automl-custom-305000)$ gsutil mb -p ${PROJECT_ID} -l us-central1 gs://hello_custom_${PROJECT_ID}
Creating gs://hello_custom_automl-custom-305000...
shannon_phu@cloudshell:~ (automl-custom-305000)$ gsutil cp gs://cloud-samples-data/ai-platform/hello-custom/hello-custom-sample-v1beta1.tar.gz - | tar -xvv
hello-custom-sample/
hello-custom-sample/webapp/
hello-custom-sample/function/
hello-custom-sample/setup.py
hello-custom-sample/trainer/
hello-custom-sample/trainer/task.py
hello-custom-sample/trainer/_init_.py
hello-custom-sample/function/requirements.txt
hello-custom-sample/function/main.py
hello-custom-sample/webapp/.index.html
hello-custom-sample/webapp/index.html
hello-custom-sample/webapp/image-list.txt
hello-custom-sample/webapp/index.css
hello-custom-sample/webapp/main.js
hello-custom-sample/webapp/function-url.js
shannon_phu@cloudshell:~ (automl-custom-305000)$ cd hello-custom-sample/
```

```
shannon_phu@cloudshell:~/hello-custom-sample (automl-custom-305000)$ gsutil cp dist/hello-custom-training-2.0.tar.gz gs://hello_custom_${PROJECT_ID}/training/
Copying file://dist/hello-custom-training-2.0.tar.gz [Content-Type=application/x-tar]...
/ [1 files] [ 1.9 KiB/ 1.9 KiB]
Operation completed over 1 objects/1.9 KiB.
```

## Train new model

Choose training method

Define your model

**3** Training container

**4** Hyperparameter tuning  
(Optional)

**5** Compute and pricing

**6** Prediction container  
(Optional)

**START TRAINING**

CANCEL

Dataset \*  ?

Annotation set  ?

Objective  ▼

Please refer to the pricing guide for more details (and available deployment options) for each method.

ⓘ AutoML options are only available when you train with a managed dataset.

AutoML

Train high-quality models with minimal effort and machine learning expertise. Just specify how long you want to train. [Learn more](#)

AutoML Edge

Train a model that can be exported for on-prem/on-device use. Typically has lower accuracy. [Learn more](#)

Custom training (advanced)

Run your TensorFlow, scikit-learn, and XGBoost training applications in the cloud. Train with one of Google Cloud's pre-built containers or use your own. [Learn more](#)

**CONTINUE**

# Train new model

Choose training method

Define your model

**3** Training container

**4** Hyperparameter tuning  
(Optional)

**5** Compute and pricing

**6** Prediction container  
(Optional)

**START TRAINING**

CANCEL

Model name \*

hello\_custom



▼ ADVANCED OPTIONS

**CONTINUE**

Define your model

**3** Training container

**4** Hyperparameter tuning  
(Optional)

**5** Compute and pricing

**6** Prediction container  
(Optional)

**START TRAINING**

CANCEL

## Select folder

< hello\_custom\_automl-custom-305000 ▾



output/ >

training/ >



## AI Platform (Unified)

Training

PREVIEW

+ CREATE

REFRESH



Dashboard

TRAINING PIPELINE

CUSTOM JOB

HYPERPARAMETER TUNING



Datasets

Training jobs build machine learning models from your datasets (or specify your own training inputs). Training pricing is based on the computing resources required.



Labeling tasks



Notebooks

Region

us-central1 (Iowa)



Training

Filter training pipelines...



Models



Endpoints



Batch predictions

Name	ID	Job type	Model type	Status	Created	Elapsed time
hello_custom	674537189501042688	Training pipeline	Custom	Running	Feb 15, 2021, 4:49:38 PM	4 sec



## Operations Logging

[Logs Explorer](#)[Logs Dashboard](#)[Logs-based Metrics](#)[Logs Router](#)[Logs Storage](#)

## Logs Explorer



QUERY SPECIFIED RANGE

PAGE LAYOUT

SHARE LINK

LEARN

*i* New features are available in the Logs Explorer.

[Dismiss](#)[Learn more](#)

### Query preview

`resource.labels.job_id="5348710652758196224" timestamp>="202...`[Save](#)[Stream logs](#)[Run query](#)

### Log fields

 Search fields and values

#### RESOURCE TYPE

Cloud ML Job

1

#### SEVERITY

Info

1

### Histogram



### Query results

[Jump to now](#)[Actions](#)[Configure](#)

SEVERITY

TIMESTAMP

PST

SUMMARY

Showing logs for time specified in query. To view more results update your query.



2021-02-15 16:49:55.806 PST

service Waiting for jo...



## AI Platform (Unified)

## Models

PREVIEW

+ CREATE

IMPORT

REFRESH

## Dashboard

## Datasets

## Labeling tasks

## Notebooks

## Training

## Models

## Endpoints

## Batch predictions

## Region

us-central1 (Iowa)



## Filter models...

Name	ID	Data	Region	Type	Created	Notifications	Metadata
hello_custom	4382301504594247680	—	us-central1	Custom trained	Feb 15, 2021, 4:49:38 PM		⋮

## AI Platform (Unified)

← hello\_custom

 EXPORT

DEPLOY &amp; TEST

BATCH PREDICTIONS

MODEL PROPERTIES

## Deploy your model

Endpoints are machine learning models made available for online prediction requests. Endpoints are useful for timely predictions from many users (for example, in response to an application request). You can also request batch predictions if you don't need immediate results.

DEPLOY TO ENDPOINT

Endpoint	ID	Models	Region	Last updated	API	Notification	Metadata	Encryption
 <a href="#">customendptt</a>	4621643195728527360	1	us-central1	Feb 17, 2021, 2:53:10 PM	<a href="#">Sample request</a>			Google-managed key



CLOUD SHELL

Terminal

(automl-custom-305000) x +

```
Welcome to Cloud Shell! Type "help" to get started.  
Your Cloud Platform project in this session is set to my-project-304722.  
Use "gcloud config set project [PROJECT ID]" to change to a different project.  
shannon_phu@cloudshell:~ (my-project-304722)$ gcloud config set project automl-custom-305000  
Updated property [core/project].  
shannon_phu@cloudshell:~ (automl-custom-305000)$ ENDPOINT_ID="4621643195728527360"  
shannon_phu@cloudshell:~ (automl-custom-305000)$ PROJECT_ID="256243604088"  
shannon_phu@cloudshell:~ (automl-custom-305000)$ INPUT_DATA_FILE="INPUT-JSON"  
shannon_phu@cloudshell:~ (automl-custom-305000)$ gcloud functions deploy classify_flower --region us-central1 --source=~/hello-custom-sample/function --runtime=python37 --memory=2048MB --trigger-http  
Deploying function (may take a while - up to 2 minutes)...#  
For Cloud Build Stackdriver Logs, visit: https://console.cloud.google.com/logs/viewer?project=automl-custom-305000&advancedFilter=resource.type%3Dbuild%0Aresource.labels.build\_id%3Da93058db-be9d-4738-8d6d-a9a1d  
Deploying function (may take a while - up to 2 minutes)...#  
  
shannon_phu@cloudshell:~ (automl-custom-305000)$ gcloud functions deploy classify_flower --region us-central1 --source=~/hello-custom-sample/function --runtime=python37 --memory=2048MB  
Deploying function (may take a while - up to 2 minutes)...#  
For Cloud Build Stackdriver Logs, visit: https://console.cloud.google.com/logs/viewer?project=automl-custom-305000&advancedFilter=resource.type%3Dbuild%0Aresource.labels.build\_id%3Da93058db-be9d-4738-8d6d-a9a1d  
Deploying function (may take a while - up to 2 minutes)...done.  
availableMemoryMb: 2048  
buildId: a93058db-be9d-4738-8d6d-a9a338c91414  
entryPoint: classify_flower  
environmentVariables:  
  ENDPOINT_ID: '4621643195728527360'  
httpsTrigger:  
  securityLevel: SECURE_OPTIONAL  
  url: https://us-central1-automl-custom-305000.cloudfunctions.net/classify\_flower  
ingressSettings: ALLOW_ALL  
labels:  
  deployment-tool: cli-gcloud  
name: projects/automl-custom-305000/locations/us-central1/functions/classify_flower  
runtime: python37  
serviceAccountEmail: automl-custom-305000@appspot.gserviceaccount.com  
sourceUploadUrl: https://storage.googleapis.com/gcf-upload-us-central1-6e0e311b-9673-4518-8048-673a1202e803/99fb662b-0682-43c4-af64-04b3635c86b0.zip?GoogleAccessId=service-256243604088@gcf-ad  
Z2sceQv9U0o5qx8Ee5d09%2F43asV1Oos01GjzBg1DroZ5s69FnB1A1lkS0YNM8aLg4iD94BXq7atfqce xu%2BknMcKQt3S2TYUdEe7IkyWzxKsqQ3uYaBgW6kz4ZQ0b0x4nZR0bS12%2Bp80oBwqSNtCxR7snYR0Uj8d9zcru9Lso5TN0JSp1c44eq9Y  
WPxD0%2FEChYwG0bXwRa2Nb3QXYMPPXtvqoDksj01ObY3G4F8vSPSQ%3D%3D  
status: ACTIVE  
timeout: 60s  
updateTime: '2021-02-18T00:16:33.003Z'  
versionId: '3'  
shannon_phu@cloudshell:~ (automl-custom-305000)$
```

# Hello custom training

Click on any of the following images to request a prediction from your image classification model.

**GET SIX NEW IMAGES**



roses



daisy



## dandelion



## sunflowers



## dandelion



## **sunflowers**

# Hello custom training

Click on any of the following images to request a prediction from your image classification model.

[GET SIX NEW IMAGES](#)



**roses**

Prediction (probabilities):

- roses: 0.804759264
- tulips: 0.19376719
- sunflowers: 0.00141986075
- dandelion: 0.0000430706
- daisy: 0.0000105542604

# Tabular

## AI Platform (Unified)

Dashboard

Datasets

Labeling tasks

Notebooks

Training

Models

Endpoints

Batch predictions

 [Structured\\_AutoML\\_Tutorial](#)

SOURCE

ANALYZE

## Dataset Info

Created: Feb 17, 2021 2:38 PM

Dataset format: CSV

Dataset location: <gs://cloud-ml-datasets/bank-marketing.csv>

## Summary

Total columns: 17

Total rows: 45,211

Filter table

Field Name	Missing % (count)	Distinct values
Age	-	77
Balance	-	7168
Campaign	-	48
Contact	-	3
Day	-	31
Default	-	2
Deposit	-	2
Duration	-	1573
Education	-	4
Housing	-	2
Job	-	12
Loan	-	2
MaritalStatus	-	3
Month	-	12
PDays	-	559
POutcome	-	4
Previous	-	41

AI Platform (Unified)

Training PREVIEW + CREATE

REFRES

TRAINING PIPELINE CUSTOM JOB HYPERPARAMETER TUNING

Training jobs build machine learning models from your datasets (or specify your own training inputs). Training pricing is based on the computing resources required.

Region us-central1 (Iowa) ?

Filter training pipelines...

Name	ID	Job type	Model type	Status	Created	Elapsed time
Structured_AutoML_Tutorial	8413128724207108096	Training pipeline	Tabular classification	Running	Feb 17, 2021, 3:03:50 PM	1 sec

Navigation menu

AI Platform (Unified)

Models PREVIEW + CREATE IMPORT

Dashboard

Datasets

Labeling tasks

Notebooks

Training

Models

Models are built from your datasets or unmanaged data sources. There are many different types of machine learning models available on AI Platform, depending on your use case and level of experience with machine learning. [Learn more](#)

Region us-central1 (Iowa) ?

Filter models...

Name	ID	Data	Endpoints	Region	Type	Created
Structured_AutoML_Tutorial	3787826353781342208	Structured_AutoML_Tutorial	0	us-central1	Tabular	Feb 17, 2021, 3:03:50 PM

## AI Platform (Unified)

Structured\_AutoML\_Tutorial

VIEW DATASET

EXPORT

Dashboard

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Labeling tasks

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Training

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Batch predictions

EVALUATE

DEPLOY &amp; TEST

BATCH PREDICTIONS

MODEL PROPERTIES

Filter labels

All labels	0
1	0.99166
2	0.61451

## All labels

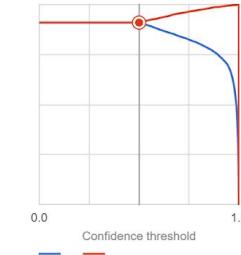
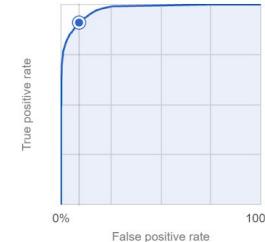
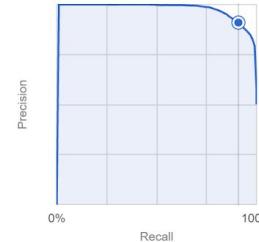
PR AUC	0.978
ROC AUC	0.976
Log loss	0.191
F1 score	0.90933514
Precision	90.9%
Recall	90.9%
Created	Feb 17, 2021, 4:16:59 PM

Use the slider to see which confidence threshold works best for your model on the precision-recall tradeoff curve. [Learn more about these metrics and graphs](#)

Confidence threshold



0.5

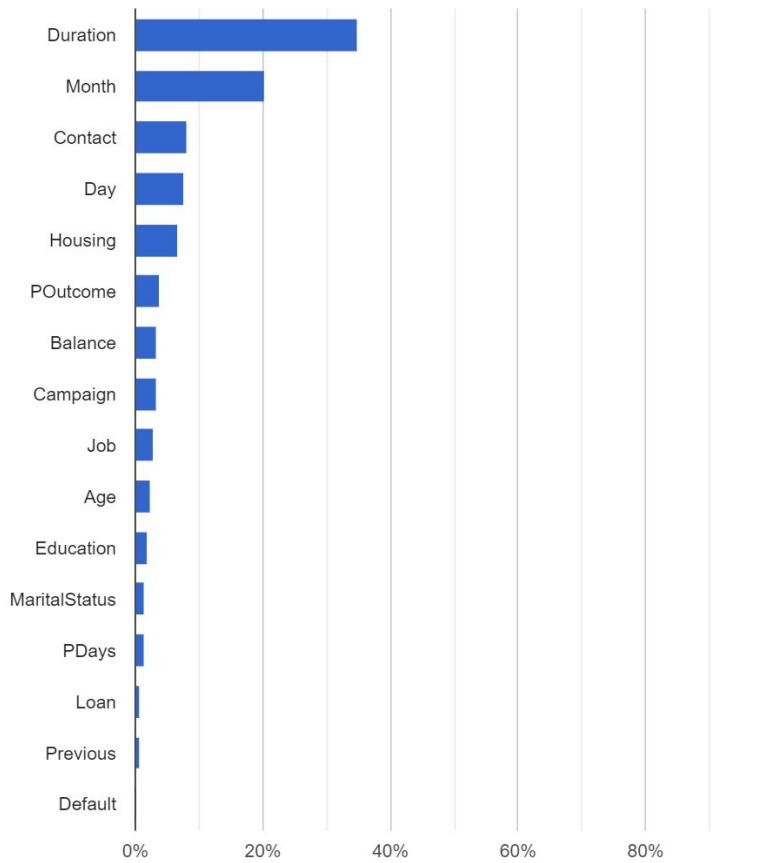


## Confusion matrix

This table shows how often the model classified each label correctly (in blue), and which labels were most often confused for that label (in gray). Note that this table is limited to the 10 most confused labels. You can download the entire

True label	Predicted label	
	1	2
1	97%	3%
2	52%	48%

## Feature Importance



## Navigation menu

## Cloud Platform (Unified)

Structured\_AutoML\_Tutorial

VIEW DATASET

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DEPLOY &amp; TEST

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MODEL PROPERTIES

Dashboard

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Endpoints

Batch predictions

Endpoint	ID	Models	Region	Last updated	API	Notification	Metadata	Encryption
Structured_AutoML_Tutorial	3738937668763910144	1	us-central1	Feb 17, 2021, 4:38:40 PM	Sample request			Google-managed key

## Test your model

PREVIEW

Feature column name	Type	Required or optional	Value	Local feature importance
Age	Text	Required	38.000000	0
Balance	Text	Required	389.000000	0
Campaign	Text	Required	2.000000	0
Contact	Text	Required	cellular	0
Day	Text	Required	15.000000	0
Default	Text	Required	no	0
Duration	Text	Required	165.000000	0
Education	Text	Required	secondary	0
Housing	Text	Required	yes	0
Job	Text	Required	blue-collar	0

Predict label

Prediction result

1

Confidence score: 0.993143618106842

# Part 2: iOS Deploy

 Vision[Flowers](#)[LABEL STATS](#)[EXPORT DATA](#) Dashboard[IMPORT](#)[IMAGES](#)[TRAIN](#)[EVALUATE](#)[TEST & USE](#) Datasets Models

## 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

## Upload images from your computer

Supports JPG, PNG, GIF, BMP, ICO, ZIP. Maximum 500 files per upload. Uploaded files will be stored on Cloud Storage.

flower\_photos.zip

1 file

[SELECT FILES](#)

Destination on Cloud Storage

 gs://cloud-ai-platform-91507f72-3075-45fc-8750-ff5c73f5aa44/flow [BROWSE](#)[CONTINUE](#)

## AI Platform (Unified)

## ← test-dataset

test-dataset\_icn



TRAIN NEW MODEL

CREATE LABELING TASK

## Dashboard

## Datasets

## Labeling tasks

## Notebooks

## Training

## Models

## Endpoints

## Batch predictions

IMPORT

BROWSE

ANALYZE

All 3,667

Labeled 3,667

Unlabeled 0

Filter labels



daisy 633

dandelion 898

roses 641

sunflowers 697

tulips 798

Filter items

! Unable to import data due to errors.

DETAILS

DISMISS

 Select all

roses



daisy



tulips



daisy



sunflowers



## AI Platform (Unified)

← test-dataset\_20212160186

VIEW DATASET

EVALUATE

DEPLOY &amp; TEST

BATCH PREDICTIONS

MODEL PROPERTIES

Filter labels

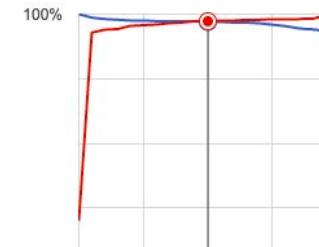
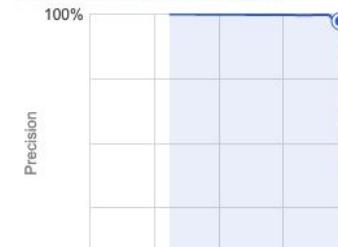
Confidence threshold 0.5

All labels	0
dandelion	0.99975
sunflowers	0.99901
daisy	0.99721
tulips	0.99520
roses	0.99126

## All labels

Average precision	0.996
Precision	97.3%
Recall	97%
Created	Feb 15, 2021, 4:44:52 PM
Total images	3,667
Training images	2,933
Validation images	367
Test images	367

Use the slider to see which score threshold works best for your model on the precision-recall tradeoff curve. [Learn more about these metrics and graphs](#)



```
mlkit-automl — shannon@Shannons-MacBook-Air — -zsh — 80x36
./mlkit-automl
[mlkit-automl] % pod install --verbose --no-repo-update
Preparing

Analyzing dependencies

Inspecting targets to integrate
Using `ARCHS` setting to build architectures of target `Pods-MLVisionExample`:
( `` )

Finding Podfile changes
- FirebaseMLCommon
- FirebaseMLVision
- FirebaseMLVisionAutoML

Resolving dependencies of `Podfile`
No Editor No Selection
Comparing resolved specification to the sandbox manifest
A FirebaseCore
A FirebaseInstanceID
A FirebaseMLCommon
A FirebaseMLVision
A FirebaseMLVisionAutoML
A GTMSessionFetcher
A GoogleAPIClientForREST
A GoogleMobileVision
A GoogleToolboxForMac
A GoogleUtilities
A Protobuf
A TensorFlowLite

Downloading dependencies

-> Installing FirebaseCore (6.0.0)
> Git download
> Git download
$ /usr/local/bin/git clone https://github.com/firebase/firebase-ios-sdk.git
```



# Part 2: Time Series



AI Platform

Notebooks

NEW INSTANCE

REFRESH

START

STOP

RESET

UPGRADE

DELETE

HIDE INFO PANEL

Dashboard

Create and use Jupyter Notebooks with a notebook instance. Notebook instances have JupyterLab pre-installed and are configured with GPU-enabled machine learning frameworks. [Learn more](#)

AI Hub

Data Labeling

Notebooks

Pipelines

Jobs

Models

Filter table

Instance name	Zone	Environment	Machine type	GPUs	Permission	Labels
tensorflow-2-1-20210219-200805	us-west1-b	TensorFlow:2.1	4 vCPUs, 15 GB RAM	None	Service account	No labels

Setting up proxy to JupyterLab

Info panel

DOCUMENTATION

LABELS

Notebook instances

Notebook API

[7765e84c98dfc01c-dot-us-west1.notebooks.googleusercontent.com/lab?authuser=1](https://7765e84c98dfc01c-dot-us-west1.notebooks.googleusercontent.com/lab?authuser=1)[Apps](#) [searchstc-svc-c09 |...](#) [SVMT Menu](#) [Scope](#) [Satori](#) [U3](#) [Tansa](#) [日本語](#) [Commute Calendar...](#) [OneDrive](#) [Masters](#) [MSR AI Seminars |...](#) [Eugene Yan](#) [Related Categories.](#)

File Edit View Run Kernel Git Tabs Settings Help AI Platform Notebooks

Name	Last Modified
src	3 minutes ago
training-data-analyst	seconds ago
tutorials	3 minutes ago
Untitled.ipynb	seconds ago

Untitled.ipynb Terminal 1

```
(base) jupyter@tensorflow-2-1-20210219-200805:~$ git clone https://github.com/GoogleCloudPlatform/training-data-analyst
Cloning into 'training-data-analyst'...
remote: Enumerating objects: 45287, done.
remote: Total 45287 (delta 0), reused 0 (delta 0), pack-reused 45287
Receiving objects: 100% (45287/45287), 477.96 MiB | 31.51 MiB/s, done.
Resolving deltas: 100% (28483/28483), done.
Checking out files: 100% (9153/9153), done.
(base) jupyter@tensorflow-2-1-20210219-200805:~$
```

Name	Last Modified
data	3 minutes ago
01-explore.ipynb	seconds ago
02-model.ipynb	3 minutes ago
03-cloud-training.ipynb	3 minutes ago
cta_ridership.csv	a minute ago

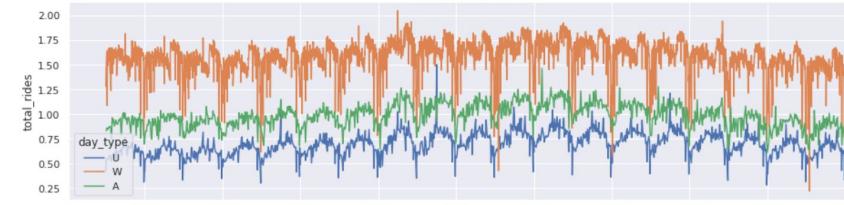
Untitled.ipynb Terminal 1 01-explore.ipynb

[15]: # Initialize plotting  
register\_matplotlib\_converters() # Addresses a warning  
sns.set(rc={'figure.figsize':(16,4)})

[16]: # Explore total rides over time  
  
sns.lineplot(data=df, x=df.index, y=df[target]).set\_title('Total Rides')  
fig = plt.show()



[17]: # Explore rides by day type: Weekday (W), Saturday (A), Sunday/Holiday (U)  
  
sns.lineplot(data=df, x=df.index, y=df[target], hue=df['day\_type']).set\_title('Total Rides by Day Type')  
fig = plt.show()



[18]: # Explore rides by transportation type

## BigQuery

[FEATURES & INFO](#) [SHORTCUT](#) [HIDE PREVIEW FEATURES](#)[SQL workspace](#)[Explorer](#) [+ ADD DATA](#)[Data transfers](#)[Scheduled queries](#)[Reservations](#)[BI Engine](#)[round-dreamer-304721](#)[demo](#)[MORE RESULTS](#)[EDITOR](#) 2 × [ROUND...](#) × [DEMO](#) × [DEMO](#) ×

round-dreamer-304721:demo

[+ CREATE TABLE](#) [SHARE DATASET](#) [AUTHORIZE ROUTINES](#) [COPY DATASET](#) [DELETE DATASET](#) [COMPOSE NEW QUERY](#)

## Description

None

## Labels

None

## Dataset info

Dataset ID	round-dreamer-304721:demo
Created	Feb 19, 2021, 8:16:49 PM
Default table expiration	5 days 0 hr
Last modified	Feb 19, 2021, 8:16:49 PM
Data location	US

## JOB HISTORY

## QUERY HISTORY

## SAVED QUERIES

## Job history

[REFRESH](#)[Personal history](#) [Project history](#)[Filter queries](#)

## Today

8:17 PM



Load uploaded file to round-dreamer-304721:demo.cta\_ridership

## BigQuery

FEATURES &amp; INFO SHORTCUT HIDE PREVIEW FEATURES

SQL workspace

Explorer + ADD DATA

Data transfers

Scheduled queries

Reservations

BI Engine

Viewing pinned projects.

round-dreamer-304721

demo

cta\_ridership

cta\_ridership\_model

MORE RESULTS

MORE RESULTS

EDITOR 2 ROUND... DEMO DEMO CTA\_RID... \*UNSAVE... 3 CTA\_RID... CTA\_RID... COMPOSE NEW QUERY

 RUN SAVE SCHEDULE MORE  

```
1 CREATE OR REPLACE MODEL
2   `demo.cta_ridership_model` OPTIONS(MODEL_TYPE='ARIMA',
3     TIME_SERIES_TIMESTAMP_COL='service_date',
4     TIME_SERIES_DATA_COL='total_rides',
5     HOLIDAY_REGION='us') AS
6   SELECT
7     service_date, total_rides
8   FROM
9     `demo.cta_ridership`
```

This query will process 108.4 KiB (ML) when run.

## Query results

Query complete (39.9 sec elapsed, 4.4 MB (ML) processed)

Job information Results Execution details

This statement will create a new model named round-dreamer-304721.demo.cta\_ridership\_model. Depending on the type of model, this may take several hours to complete.

Go to model

## BigQuery

FEATURES &amp; INFO SHORTCUT HIDE PREVIEW FEATURES

## SQL workspace

Explorer + ADD DATA

## Data transfers

## Scheduled queries

## Reservations

## BI Engine

round-dreamer-304721

demo

cta\_ridership

cta\_ridership\_model

MORE RESULTS

MORE RESULTS

Type to search

cta\_ridership\_model

QUERY MODEL DELETE MODEL EXPORT MODEL

DETAILS TRAINING EVALUATION SCHEMA

Non Seasonal P	Non Seasonal D	Non Seasonal Q	Has Drift	Log Likelihood	AIC	Variance	Seasonal Period
1	1	4	True	-84,343.913	168,701.826	2,121,476,632.467	Weekly, Yearly
1	1	4	False	-84,345.763	168,703.526	2,122,628,259.179	Weekly, Yearly
4	1	1	True	-84,346.869	168,707.738	2,123,285,308.131	Weekly, Yearly
1	1	3	True	-84,347.973	168,707.946	2,123,959,900.714	Weekly, Yearly
4	1	1	False	-84,348.833	168,709.666	2,124,511,101.972	Weekly, Yearly
1	1	3	False	-84,349.844	168,709.688	2,125,133,805.121	Weekly, Yearly
3	1	2	True	-84,349.466	168,712.932	2,124,875,662.833	Weekly, Yearly
2	1	2	True	-84,351.446	168,714.892	2,126,093,471.221	Weekly, Yearly
2	1	2	False	-84,352.879	168,715.758	2,126,992,389.241	Weekly, Yearly
0	1	5	True	-84,351.067	168,716.134	2,125,867,126.489	Weekly, Yearly
0	1	5	False	-84,352.172	168,716.343	2,126,558,119.381	Weekly, Yearly
3	1	2	False	-84,352.526	168,717.053	2,126,777,555.452	Weekly, Yearly
2	1	3	True	-84,354.875	168,723.749	2,128,191,178.209	Weekly, Yearly
2	1	3	False	-84,357.564	168,727.128	2,129,867,036.91	Weekly, Yearly
3	1	1	True	-84,366.456	168,744.913	2,135,328,985.565	Weekly, Yearly
3	1	1	False	-84,367.982	168,745.963	2,136,287,297.784	Weekly, Yearly
2	1	1	False	-84,407.403	168,822.807	2,160,766,577.274	Weekly, Yearly
2	1	1	True	-84,406.65	168,823.3	2,160,286,811.78	Weekly, Yearly
0	1	4	False	-84,416.093	168,842.186	2,166,260,904.36	Weekly, Yearly
0	1	4	True	-84,415.732	168,843.463	2,166,031,399.586	Weekly, Yearly
0	1	3	False	-84,433.324	168,874.648	2,177,098,384.353	Weekly, Yearly
0	1	3	True	-84,433.107	168,876.215	2,176,960,425.757	Weekly, Yearly

## BigQuery

FEATURES & INFO SHORTCUT HIDE PREVIEW FEATURES

## SQL workspace

Explorer + ADD DATA

## Data transfers

## Scheduled queries

## Reservations

## BI Engine

round-dreamer-304721

demo

cta\_ridership

cta\_ridership\_model

MORE RESULTS

MORE RESULTS

MORE RESULTS

RUN SAVE SCHEDULE MORE

```
1 SELECT
2   *
3   FROM
4   | ML.EVALUATE(MODEL `demo.cta_ridership_model`)
```

This query will process 0 B when run.

Query results

SAVE RESULTSEXPLORE DATA

Query complete (0.2 sec elapsed, 0 B processed)

Job information Results JSON Execution details

Row	non_seasonal_p	non_seasonal_d	non_seasonal_q	has_drift	log_likelihood	AIC	variance	seasonal_periods
1	1	1	4	true	-84343.91298029698	168701.82596059397	2.1214766324672794E9	WEEKLY YEARLY
2		1	1	4	false	-84345.76278035615	168703.5255607123	2.1226282591786644E9 WEEKLY YEARLY
3		4	1	1	true	-84346.86918283005	168707.7383656601	2.1232853081307085E9 WEEKLY YEARLY
4		1	1	3	true	-84347.97278479983	168707.94556959966	2.1239599007139666E9 WEEKLY YEARLY
5		4	1	1	false	-84348.83291975319	168709.66583950637	2.124511101972134E9 WEEKLY YEARLY
6		1	1	3	false	-84349.84391557962	168709.68783115924	2.1251338051213825E9 WEEKLY

Rows per page: 100 1 - 42 of 42 First page ▲ ▼ Last page ▶

"anon04fe69279440cfb354852927cb6abdacf03ee851"

created. Go to table

## BigQuery

FEATURES &amp; INFO SHORTCUT HIDE PREVIEW FEATURES

## SQL workspace

Explorer + ADD DATA

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## Scheduled queries

## Reservations

## BI Engine

round-dreamer-304721

demo

cta\_ridership

cta\_ridership\_model

MORE RESULTS

MORE RESULTS

RUN SAVE SCHEDULE MORE

```
1 SELECT
2 *
3 FROM
4 | ML.FORECAST(MODEL `demo.cta_ridership_model`,
5 | STRUCT(7 AS horizon))
```

This query will process 23.4 KiB when run.

Query results SAVE RESULTS EXPLORE DATA

Query complete (0.2 sec elapsed, 23.4 KB processed)

Job information Results JSON Execution details

Row	forecast_timestamp	forecast_value	standard_error	confidence_level	prediction_interval_lower_bound	prediction_interval_upper_bound	confidence_interval_lower_bound	confidence_interval_upper_bound
1	2020-01-01 00:00:00 UTC	662436.4424369269	46059.49014554253	0.95	572322.980240453	752549.9046334007	572322.980240453	752549.9046334007
2	2020-01-02 00:00:00 UTC	1029641.4669424891	46276.328347693256	0.95	939103.76989082	1120179.1639941582	939103.76989082	1120179.1639941582
3	2020-01-03 00:00:00 UTC	1201660.2034356925	47233.43871922012	0.95	1109249.9600529654	1294070.4468184195	1109249.9600529654	1294070.4468184195
4	2020-01-04 00:00:00 UTC	651095.9776391207	48157.99332862347	0.95	556876.8819095747	745315.0733686666	556876.8819095747	745315.0733686666
5	2020-01-05 00:00:00 UTC	467394.91846646497	48621.50963880497	0.95	372268.97250121285	562520.8644317171	372268.97250121285	562520.8644317171
6	2020-01-06 00:00:00 UTC	1158999.319539823	48869.23710364581	0.95	1063388.705171438	1254609.9339082083	1063388.705171438	1254609.9339082083
7	2020-01-07 00:00:00 UTC	1127789.5651062205	49011.66149084522	0.95	1031900.3033930386	1223678.8268194026	1031900.3033930386	1223678.8268194026

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Name	Last Modified
cnn_export	a minute ago
data	18 minutes ago
lstm_export	2 minutes ago
01-explore.ipynb	3 minutes ago
02-model.ipynb	2 minutes ago
03-cloud-training.ipynb	6 minutes ago
cta_ridership.csv	16 minutes ago

Untitled.ipynb Terminal 1 01-explore.ipynb 02-model.ipynb 03-c

In this section, you will build models using popular neural network architectures for time-series data.

## Long Short Term Memory (LSTM)

```
[45]: # Reshape test data to match model inputs and outputs
X_train = X_train_reframed.values.reshape(-1, n_input_steps, n_features)
X_test = X_test_reframed.values.reshape(-1, n_input_steps, n_features)
y_train = y_train_reframed.values.reshape(-1, n_output_steps, 1)
y_test = y_test_reframed.values.reshape(-1, n_output_steps, 1)
```

### TODO 2: Update the LSTM architecture

Try increasing and decreasing the number of LSTM units and see if you notice any accuracy improvements.

You can use hyper-parameter tuning to search for optimal values, but that's outside the scope of this lab.

```
[46]: # Try increasing and decreasing the number of LSTM units and see if you notice any accuracy improvements.
# Run the next cell to evaluate the results in more detail.

model = Sequential([
    LSTM(64, input_shape=[n_input_steps, n_features]),
    Dense(n_output_steps)])

model.compile(optimizer='adam', loss='mae')

early_stopping = EarlyStopping(monitor='val_loss', patience=patience)
_ = model.fit(x=X_train, y=y_train, validation_data=(X_test, y_test), epochs=epochs, callbacks=[early_stopping])

Train on 5515 samples, validate on 1352 samples
Epoch 1/1000
5515/5515 [=====] - 10s 2ms/sample - loss: 0.6554 - val_loss: 0.4750
Epoch 2/1000
5515/5515 [=====] - 6s 1ms/sample - loss: 0.3387 - val_loss: 0.2568
Epoch 3/1000
5515/5515 [=====] - 7s 1ms/sample - loss: 0.2406 - val_loss: 0.2406
Epoch 4/1000
5515/5515 [=====] - 7s 1ms/sample - loss: 0.2260 - val_loss: 0.2383
Epoch 5/1000
5515/5515 [=====] - 7s 1ms/sample - loss: 0.2207 - val_loss: 0.2263
Epoch 6/1000
5515/5515 [=====] - 6s 1ms/sample - loss: 0.2156 - val_loss: 0.2218
Epoch 7/1000
5515/5515 [=====] - 6s 1ms/sample - loss: 0.2106 - val_loss: 0.2208
Epoch 8/1000
5515/5515 [=====] - 8s 1ms/sample - loss: 0.2071 - val_loss: 0.2352
Epoch 9/1000
5515/5515 [=====] - 7s 1ms/sample - loss: 0.2052 - val_loss: 0.2142
Epoch 10/1000
5515/5515 [=====] - 7s 1ms/sample - loss: 0.2025 - val_loss: 0.2181
Epoch 11/1000
5515/5515 [=====] - 7s 1ms/sample - loss: 0.2016 - val_loss: 0.2163
```

1 2 3 4 5 tensorflow-2-1-20210219-200805 | round-dreamer-304721 Git: refreshing... Python 3 | Busy

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Name	Last Modified
cnn_export	2 minutes ago
data	19 minutes ago
Lstm_export	3 minutes ago
01-explore.ipynb	4 minutes ago
02-model.ipynb	seconds ago
03-cloud-training.ipynb	6 minutes ago
cta_ridership.csv	17 minutes ago

[47]: model.save('./lstm\_export/')

WARNING:tensorflow:From /opt/conda/lib/python3.7/site-packages/tensorflow\_core/python/ops/resource\_variable\_ops.py:1786: calling `BaseConstraint` is deprecated and will be removed in a future version.  
Instructions for updating:  
If using Keras pass `_constraint` arguments to layers.  
INFO:tensorflow:Assets written to: ./lstm\_export/assets

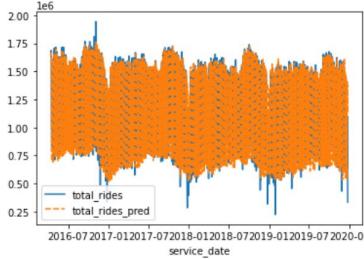
[48]: # Predict the results, and then reverse the transformation that scaled all values to a mean of 0 and std. dev. of 1  
preds = model.predict(X\_test)  
y\_pred\_lstm = inverse\_scale(preds)

# Evaluate the overall results and for each time step  
evaluate(y\_pred\_lstm)

# The plot will show the R^2 value (0 Lowest -> 1 highest) and the MAE (mean absolute error) for the entire prediction window.  
# It will also show individual plots for 1 day out, 2 days out, etc. comparing the actual vs the predicted value.

```
==== t+1 ====
R^2: 0.812
MAPE: 0.092
MAE: 81117.131

==== t+1 ====
R^2: 0.858
MAPE: 0.079
MAE: 69010.06
```



```
==== t+2 ====
R^2: 0.827
MAPE: 0.089
MAE: 78629.465
```

