



# Hands-On With Google Cloud AutoML

Building High-Quality Custom ML Models  
With Minimal Effort / **Nitya Narasimhan**



## Who am I?

- PhD (distributed systems) & Polyglot (mobile web)
- Google Developer Expert (flutter) & Google Developer Group Organizer (New York City & Hudson Valley)
- Cloud DevRel PM @Microsoft (since Oct)
- Machine learning enthusiast & beginner passionate about making complex ideas accessible to all.

---

# Introduction to Auto ML

What is Cloud AutoML

Learning2Learn

Transfer Learning

Google's Machine Learning Ecosystem

Getting Setup for Cloud AutoML

25 mins



## What is AutoML ?

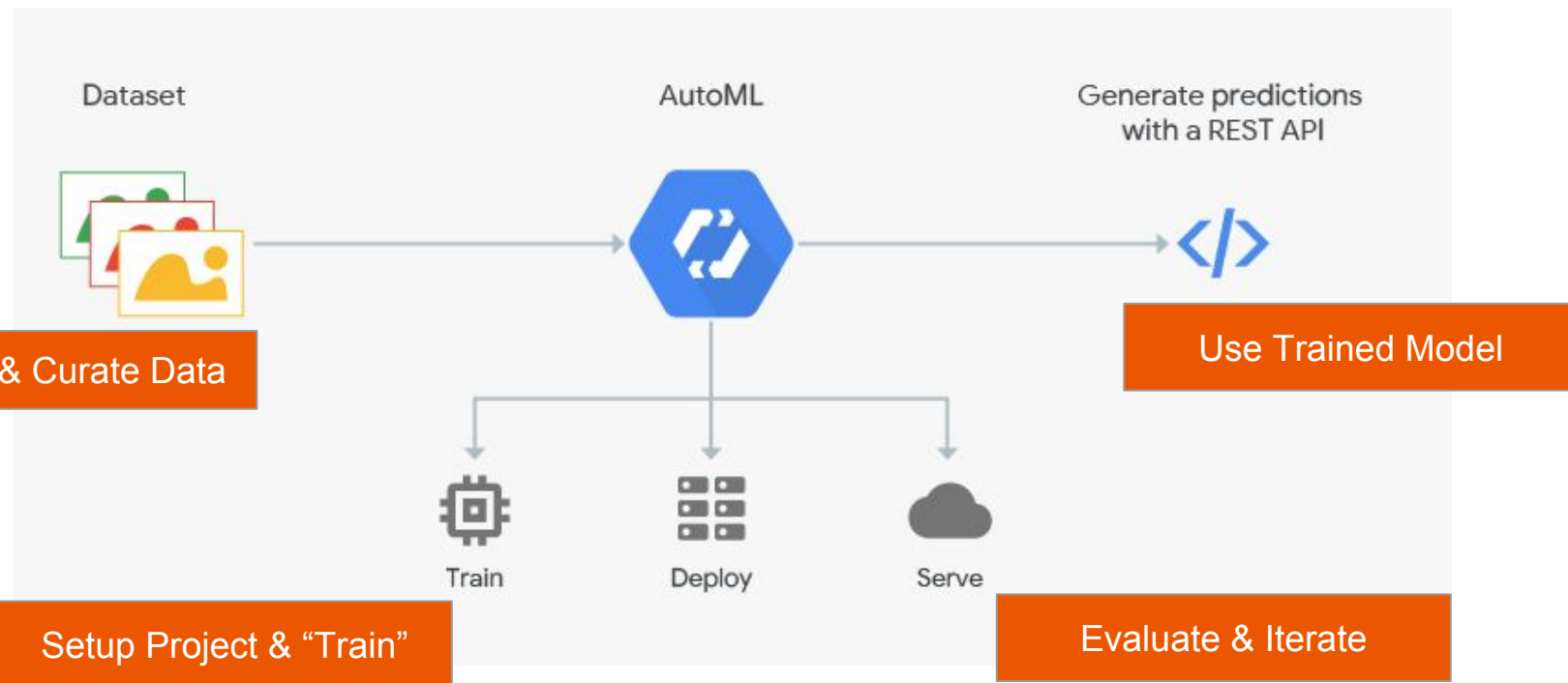
- (fast.ai) describes automated methods for *model selection* and/or *hyperparameter optimization*
- (developer) an auto-magical process that helps me build custom models from domain-specific data *without requiring machine learning expertise*
- many AutoML libraries exist; more being added every day (e.g, H2O AutoML, Azure etc.)



## What does Google AutoML Provide?

- **Seamless integration** with Google Cloud products for effortless workflows (e.g., Storage, Cloud ML APIs)
- **Custom models** for your domain-specific data or requirements (beyond pre-trained “API” services)
- **Human labeling** support (only AutoML Vision) for high-quality privacy-preserving training datasets

# How AutoML Works





## Challenges for Deep Learning Today

- **Large-scale Datasets.** How can I craft accurate models if I have insufficient data to start from?
- **Computational Resources.** Creating accurate models requires computing power & expertise
- **Art vs. Science.** Humans-in-the-loop succeed often by trial-and-error, which requires non-trivial time



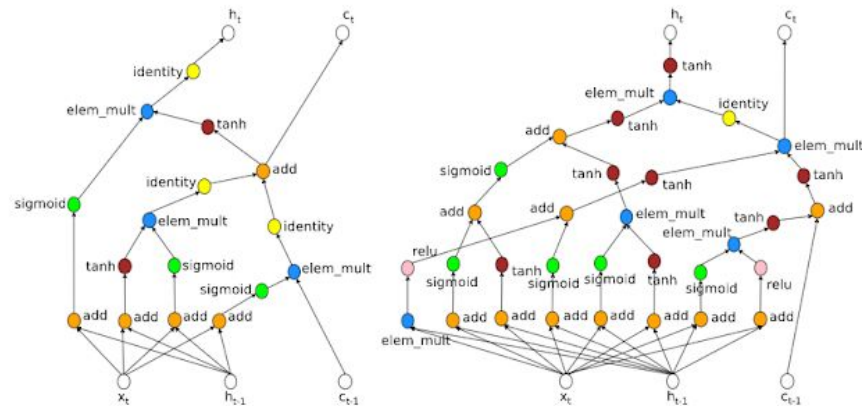
## The Transfer Learning Approach

- **Core idea.** Take advantage of pre-trained models built with larger datasets and resources, begin with those existing weights, and retrain key layers to customize it for your needs.
- **Underlying Idea.** Neural nets generalize for *similar* types of problems (that have common underlying features) and is ideal when datasets are marginally custom to facilitate “transfer” of learning.



# The Neural Architecture Search Approach

**Core idea.** Assumes each dataset is unique and tries to compute weights from scratch. Use computational power to *search & discover* neural net architectures that are beyond human cognition.





## Google's AutoML Products / currently in beta

- **AutoML Vision.** Classify your domain image dataset using custom labels. Get human labeling support. Register trained model for access via AutoML API.
- **AutoML Natural Language.** Classify *content* (text) into a set of custom categories (labels).
- **AutoML Translation.** Custom *language* translation (text) models for more domain-specific query results



## Google's ML Ecosystem / big picture

- **TensorFlow.** Open source software machine learning framework. Used by data scientists. Custom models.
- **Cloud AI “API” Building Blocks.** Pre-trained models, REST API & AutoML. Focus on easy integration and quick wins for developers with limited ML expertise.
- **Firebase MLKit.** Mobile-focused SDK that brings cloud ML expertise into Android & iOS workflows. Plus ability to store and deploy custom TensorFlow Lite models.

**Getting Ready:**

**Google Cloud Setup  
for AutoML**

—



# Google Cloud SDK Setup

- Quickstarts available for Linux, MacOS, Windows
- Quickstart Process
  - Install Python (v 2.7 recommended)
  - Install Google Cloud SDK
  - Run `./google-cloud-sdk/install.sh`
  - New terminal, verify `./gcloud --version`

```
Google Cloud SDK
221.0.0
bq 2.0.35
core 2018.10.12
gsutil 4.34
```



# Google Cloud Init

- Run: `gcloud init`
  - Log into valid gmail account when prompted
  - Use default configuration if new
  - Create a new project if new  
(or pick one with Owner, Editor or View permissions)
- Verify init succeeded: `gcloud config list`
- Get help anytime: `gcloud help`



# Google Cloud Console Setup

- GCP Console: Create or Select a Project
- Enable Billing: New users can use \$300 credit
- Enable the AutoML APIs for Project
  - [Natural Language](#)
  - [Translate](#)
  - [Vision](#)

Register your application for Google Cloud Storage, Cloud Natural Language API, Google Cloud Storage JSON API, Cloud AutoML API in Google Cloud Platform

Google Cloud Platform allows you to manage your application and monitor API usage.

**Select a project where your application will be registered**

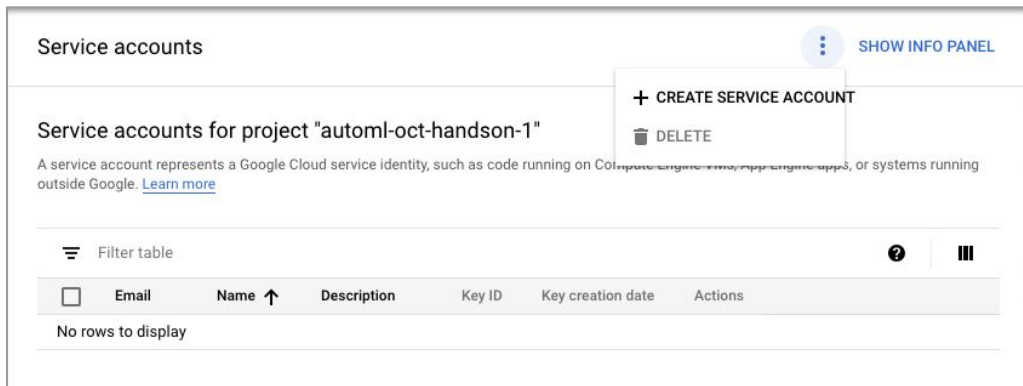
You can use one project to manage all of your applications, or you can create a different project for each application.

automl-oct-handson-1

Continue

# Google Cloud: Create Service Account & Key

- Like adding a user to your project, but representing the app
- Create key, store to filename in local filesystem
- `export GOOGLE_APPLICATION_CREDENTIALS=<filename>`







# Install the Google Cloud Client Libraries

- Provides API-specific library implementations for programmatic access to Cloud Platform APIs (including AutoML)
- Client libraries available for Java, Python, Node.JS
- I used the [Node.js client](#)

```
npm install --save @google-cloud/automl
```

- Example Usage: [Crowdsourcing Training Data](#)

Useful if you want to work with the AutoML services programmatically (vs. using the Dashboard)



## Setup environment variables for convenience

- `export PROJECT_ID="your-project-id"`
- `export REGION_NAME="us-central1"`

## Add IAM Policy Bindings

- IAM = Identity & Access Management
- Give service account **AutoML Editor** IAM role for project
- Then allow "AutoML" service accounts access to project as needed

## Service Accounts: AutoML NL access

Allow the AutoML Natural Language service accounts to access your Google Cloud project resources:

```
gcloud projects add-iam-policy-binding project-id \  
  --member="serviceAccount:custom-natural-language@appspot.gserviceaccount.com" \  
  --role="roles/ml.admin"
```

```
gcloud projects add-iam-policy-binding project-id \  
  --member="serviceAccount:custom-natural-language@appspot.gserviceaccount.com" \  
  --role="roles/storage.admin"
```

## Storage Bucket (lcm): NL datasets

```
gsutil mb -p project-id -c regional -l us-central1 gs://project-id-lcm/
```

## Service Accounts: AutoML Translate access

- 1. Allow the AutoML Translation service accounts to access your Google Cloud project resources:

```
gcloud projects add-iam-policy-binding project-id \  
  --member="serviceAccount:custom-translation@appspot.gserviceaccount.com" \  
  --role="roles/ml.admin"
```

```
gcloud projects add-iam-policy-binding project-id \  
  --member="serviceAccount:custom-translation@appspot.gserviceaccount.com" \  
  --role="roles/storage.admin"
```

## Storage Bucket (vcm): Translate datasets

```
gsutil mb -p project-id -c regional -l us-central1 gs://project-id-vcm/
```



## Service Accounts: AutoML Vision access

Allow the AutoML Vision service accounts to access your Google Cloud project resources:

```
gcloud projects add-iam-policy-binding project-id \  
  --member="serviceAccount:custom-vision@appspot.gserviceaccount.com" \  
  --role="roles/ml.admin"
```

```
gcloud projects add-iam-policy-binding project-id \  
  --member="serviceAccount:custom-vision@appspot.gserviceaccount.com" \  
  --role="roles/storage.admin"
```

## Storage Bucket (vcm): Vision datasets

```
gsutil mb -p project-id -c regional -l us-central1 gs://project-id-vcm/
```



## Desktop CLI vs. Google Cloud Shell

- **Google Cloud CLI** allows for desktop-driven access, configuration and execution of various Google Cloud interactions. It can be complex and vast in scope. *Install & Explore for experience.*
- **Google Cloud Shell** allows for browser-driven console-integrated experience that feels easier for beginners. *We'll explore this when doing AutoML walkthroughs later.*

---

# Short Break Questions?

5 mins

---

# AutoML Vision

Label Images Accurately

Vision API

AutoML Vision

Data Preparation / Model Testing / Model Evaluation

45 mins





# Cloud ML & Vision: Bringing sight



## Cloud Vision API

Image Recognition & Classification using pre-trained models for easy integration



## Cloud Video Intelligence API

Scene-level Video Annotation to facilitate rich search & discovery







## AutoML Vision





**Custom** image classification models

# What is the Vision API?

**Vision API**

			
Property 88%	Landmark 94%	House 94%	Property 92%
House 87%	Sky 93%	Home 92%	Building 84%
Architecture 85%	House 89%	Property 92%	Town 84%
Home 81%	Building 89%	Real Estate 80%	House 83%

**AutoML**

			
Tudor .5	Tudor .1	Tudor .2	Tudor .92
Neoclassical .1	Victorian .94	Neoclassical .3	Neoclassical .4
Modern .89	Modern .3	Modern .3	Modern .2
Ranch .5	Ranch .1	Ranch .93	Ranch .2

- Image labeling
- Face detection
- Landmark detection
- OCR recognition
- Explicit content
- + API & Libraries

# Cloud Vision API Pricing

FEATURE	PRICE PER 1,000 UNITS, BY MONTHLY USAGE		
	1–1,000 UNITS/MONTH	1001–5,000,000 UNITS/MONTH	5,000,001–20,000,000 UNITS/MONTH
Label Detection	Free	\$1.50	\$1.00
Text Detection	Free	\$1.50	\$0.60
Safe Search (explicit content) Detection	Free	Free with Label Detection, or \$1.50	Free with Label Detection, or \$0.60
Facial Detection	Free	\$1.50	\$0.60
Landmark Detection	Free	\$1.50	\$0.60
Logo Detection	Free	\$1.50	\$0.60
Image Properties	Free	\$1.50	\$0.60
Crop Hints	Free	Free with Image Properties, or \$1.50	Free with Image Properties, or \$0.60
Web Detection	Free	\$3.50	<a href="#">Contact Google for more information</a>
Document Text Detection	Free	\$1.50	\$0.60
Object Localizer	Free	\$2.25	\$1.50

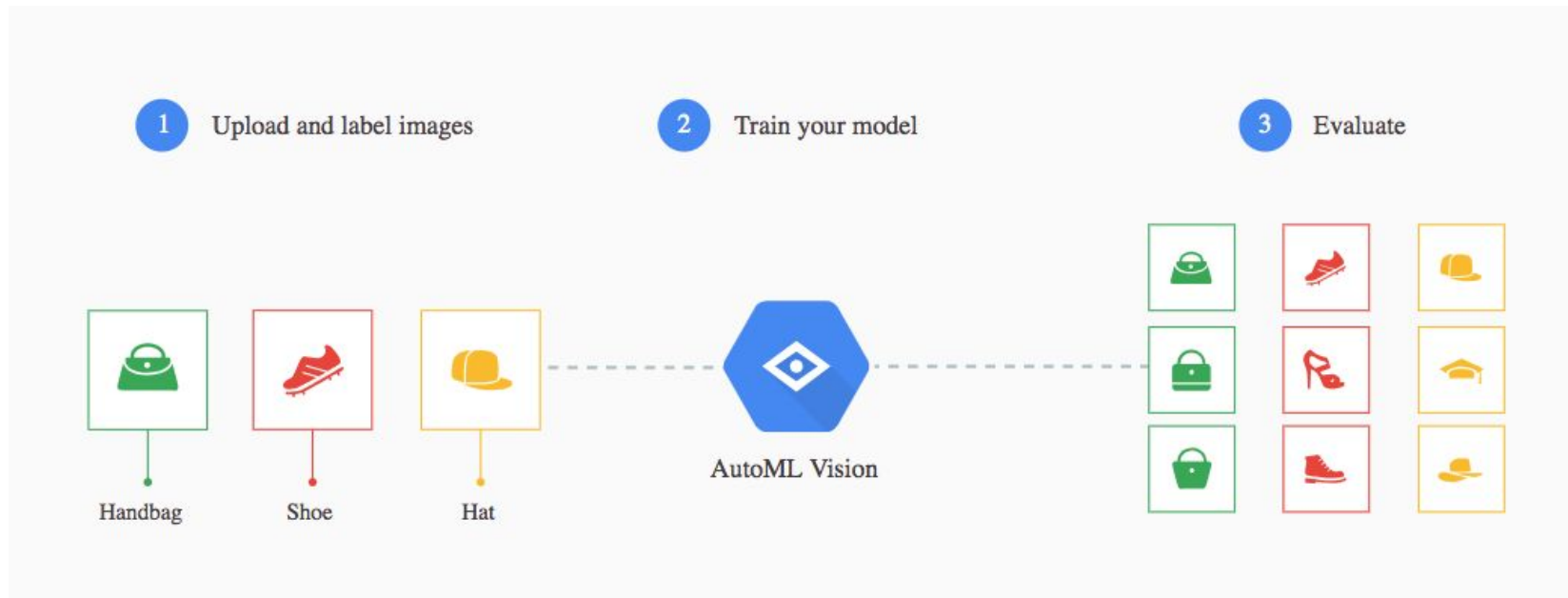
- Generous free tier for exploration
- Use Cases
  - Image Search
  - Document classification
  - Product Search

# Cloud Vision API Interactive Demo

<https://cloud.google.com/vision/>



# What is AutoML Vision?





# AutoML Vision Pricing

AutoML Vision pricing is based on Training and Prediction. The accuracy of your model generally depends on how long you allow it to train and the quality of your training dataset. You will pay only for the compute hours used.

## TRAINING

For training, you get one hour of free training per model for the first 10 models each month. Subsequent training hours are USD\$20 per hour. Many customers find that one hour is sufficient to build an experimental model and use additional training hours to increase accuracy to production level.

## PREDICTION

1–1,000 images

Free

1,001–5,000,000 images\*

\$3 per 1,000 images

# AutoML Vision Training Example

---



## A. AutoML Vision Codelab

- Follow Clouds Codelab from [Google Developers](https://codelabs.developers.google.com/codelabs/cloud-automl-vision-intro/index.html)
- **Step 1:** Create Google account, sign into Cloud Console
- **Step 2:** Activate Cloud Shell for Project
- **Step 3:** Train model using dataset
- **Step 4:** Evaluate trained model (get precision, recall)
- **Step 5:** Use trained model to make predictions
- (Delete model if not in use)




## A.1 Codelab: Create account & project

The screenshot shows the Google Cloud Platform (GCP) dashboard for the project 'automl-oct-handson-1'. The interface is divided into several sections:

- Project info:** Displays the project name 'automl-oct-handson-1', Project ID 'automl-oct-handson-1', and Project number '770744345583'. A link to 'Go to project settings' is provided.
- Resources:** Shows 'Cloud Storage' with '2 buckets'. A link to 'Go to project settings' is provided.
- Trace:** Indicates 'No trace data from the past 7 days'. A link to 'Get started with Stackdriver Trace' is provided.
- Getting Started:** Includes the instruction 'API Enable APIs and get credentials like keys'.
- API APIs:** A graph showing 'Requests (requests/sec)' over time. The y-axis ranges from 0 to 1.0, and the x-axis shows times from 5:30 to 6:15. A single data point is visible at 5:45 with a value of approximately 0.6, labeled 'Request timed out.'. A link to 'Go to APIs overview' is provided.
- Google Cloud Platform status:** States 'All services normal' and includes a link to 'Go to Cloud status dashboard'.
- Error Reporting:** States 'No sign of any errors. Have you set up Error Reporting?' and includes a link to 'Learn how to set up Error Reporting'.
- News:** Lists three news items, each dated '18 hours ago':
  - 'The Halite competition returns, to teach ML enthusiasts how to design for intelligent machines'
  - 'Never miss a beat—new integrations make it easy to insert content, trigger actions within Gmail'
  - 'Enhancing Spinnaker's Kubernetes support to ease app deployments'A link to 'Read all news' is provided.

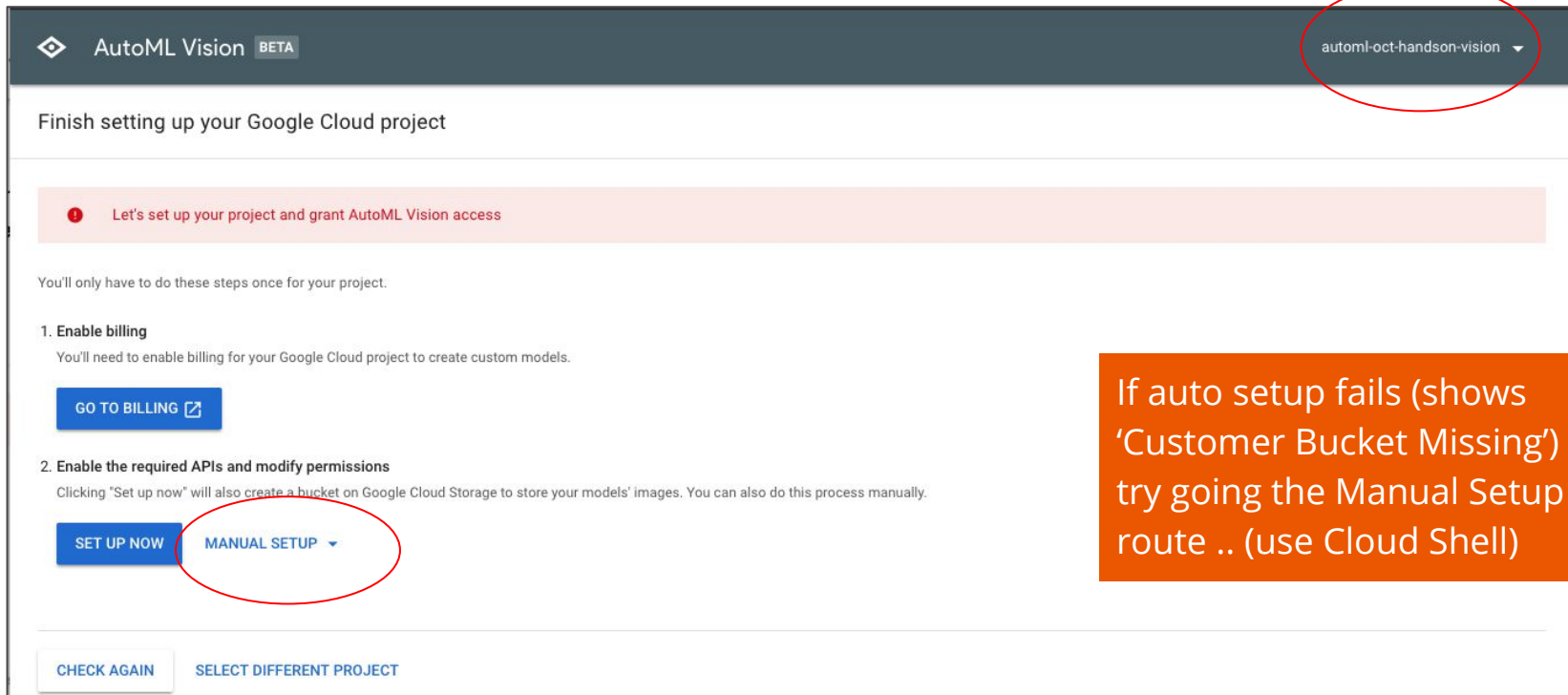
## A.2 Codelab: Activate Shell



The screenshot shows a Cloud Shell terminal window. The title bar indicates the session is named '(automl-oct-handson-1)'. The terminal text reads: 'Welcome to Cloud Shell! Type "help" to get started. Your Cloud Platform project in this session is set to automl-oct-handson-1. Use "gcloud config set project [PROJECT\_ID]" to change to a different project. flutterfyi@cloudshell:~ (automl-oct-handson-1)\$'. The prompt is '(automl-oct-handson-1)\$'. The bottom of the window shows a file explorer with a file named 'automl-oct-ha...json' and a 'Show All' button.

```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to automl-oct-handson-1.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
flutterfyi@cloudshell:~ (automl-oct-handson-1)$
```

## A.3 Codelab: Enable AutoML Vision



The screenshot shows the 'AutoML Vision BETA' interface. At the top right, a dropdown menu is circled in red, showing the selected project 'automl-oct-handson-vision'. Below the header, a message says 'Finish setting up your Google Cloud project'. A red banner with an information icon contains the text 'Let's set up your project and grant AutoML Vision access'. Below this, a note states 'You'll only have to do these steps once for your project.' The first step is '1. Enable billing', with a sub-note 'You'll need to enable billing for your Google Cloud project to create custom models.' and a 'GO TO BILLING' button. The second step is '2. Enable the required APIs and modify permissions', with a sub-note '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.' Below this, there are two buttons: 'SET UP NOW' and 'MANUAL SETUP'. The 'MANUAL SETUP' button is circled in red. At the bottom, there are two buttons: 'CHECK AGAIN' and 'SELECT DIFFERENT PROJECT'.

AutoML Vision BETA

automl-oct-handson-vision

Finish setting up your Google Cloud project

Let's set up your project and grant AutoML Vision access

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

If auto setup fails (shows 'Customer Bucket Missing') try going the Manual Setup route .. (use Cloud Shell)



## A.3 Codelab: Manual Setup

a. Manually enable the APIs by clicking this link:

```
https://console.cloud.google.com/flows/enableapi?project=automl-oct-handson-vision&apiid=st
```



## A.3 Codelab: Manual Setup

b. Launch [Google Cloud Shell](#) and run the following commands

Or, if you installed the [Cloud SDK](#), you can paste them into your command line

```
gcloud projects add-iam-policy-binding automl-oct-handson-vision \  
  --member="user:flutterfyi@gmail.com" \  
  --role="roles/automl.admin"
```

```
gcloud projects add-iam-policy-binding automl-oct-handson-vision \  
  --member="serviceAccount:custom-vision@appspot.gserviceaccount.com" \  
  --role="roles/ml.admin"
```

```
gcloud projects add-iam-policy-binding automl-oct-handson-vision \  
  --member="serviceAccount:custom-vision@appspot.gserviceaccount.com" \  
  --role="roles/storage.admin"
```

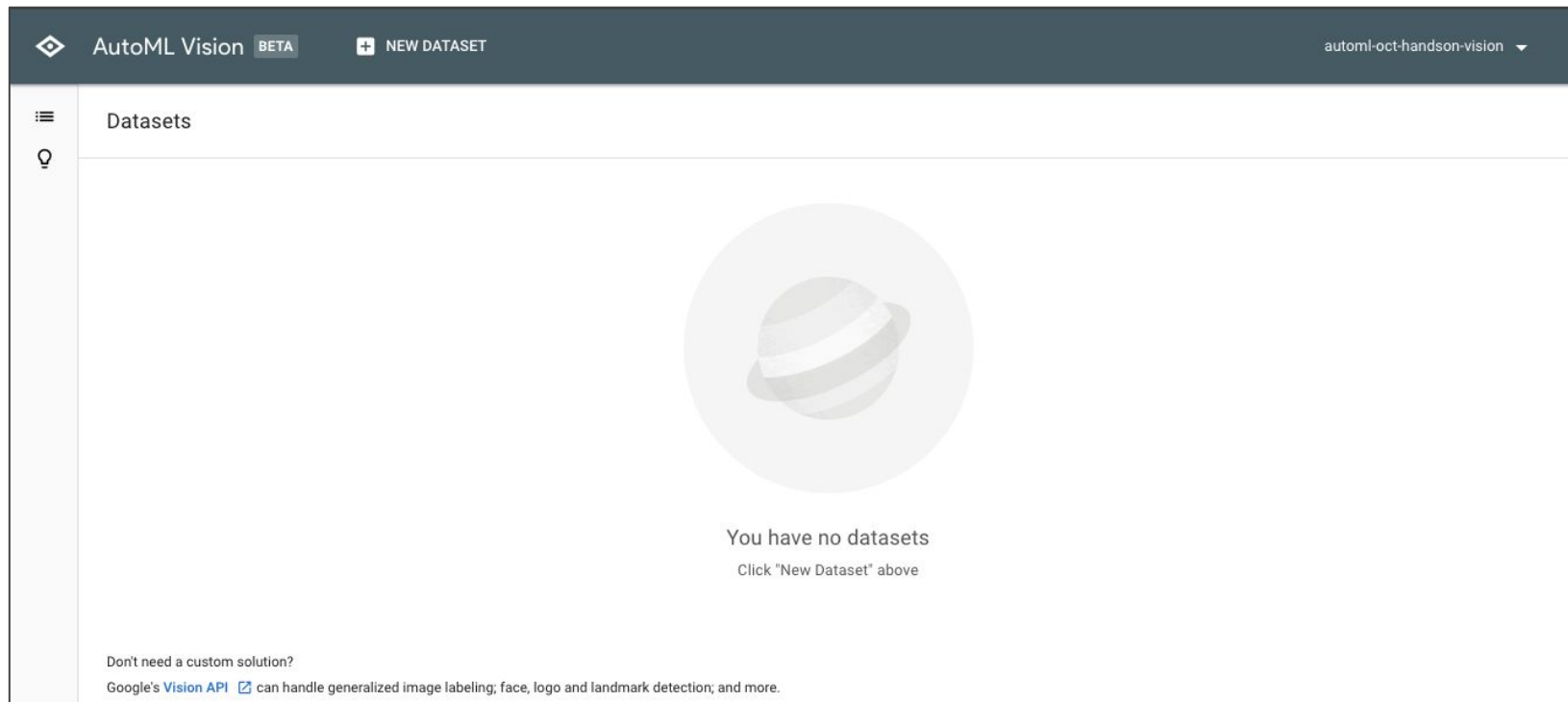


## A.3 Codelab: Manual Setup

c. Create a Google Cloud Storage bucket for storing your images

```
gsutil mb -p automl-oct-handson-vision \  
  -c regional \  
  -l us-central1 \  
  gs://automl-oct-handson-vision-vcm/
```

## A.3 Codelab: Manual Setup Success



## A.4 Codelab: Upload training images to Storage

In Cloud Shell:

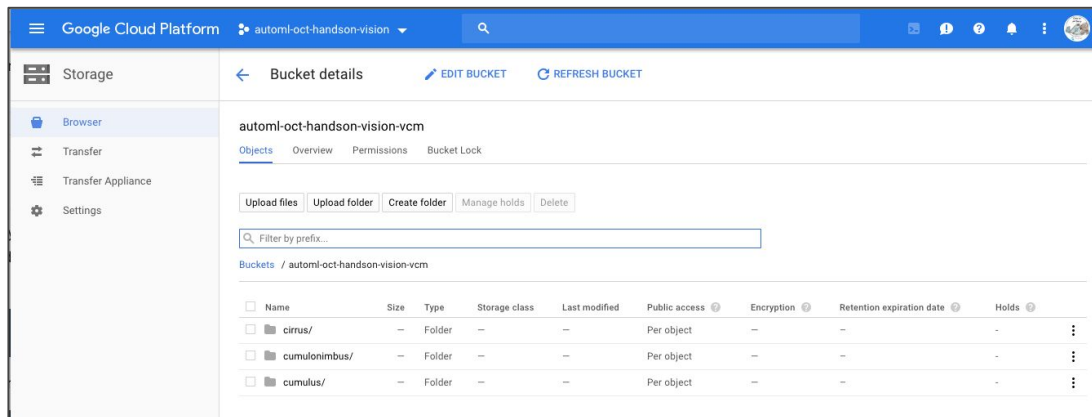
```
export BUCKET=<created-bucket-name>
```

Copies images dataset directly from source (storage) to project storage

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

In Console:

Hit Refresh





## A.5 Codelab: Create dataset (image+labels CSV)

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

```
gs://placeholder/cirrus/8.jpg,cirrus  
gs://placeholder/cirrus/9.jpg,cirrus  
gs://placeholder/cumulonimbus/1.jpg,cumulonimbus  
gs://placeholder/cumulonimbus/10.jpg,cumulonimbus
```

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

```
gs://<mybucketname>/cirrus/8.jpg,cirrus  
gs://<mybucketname>/cirrus/9.jpg,cirrus  
gs://<mybucketname>/cumulonimbus/1.jpg,cumulonimbus  
gs://<mybucketname>/cumulonimbus/10.jpg,cumulonimbus
```

## A.5 Codelab: Upload updated CSV to Storage.

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

Buckets / automl-oct-handson-vision-vc

<input type="checkbox"/>	Name	Size	Type	Storage class	Last modified	Public access ?	Encryption ?	Retention expiration date ?	Holds ?
<input type="checkbox"/>	✎ cirrus/	—	Folder	—	—	Per object	—	—	-
<input type="checkbox"/>	✎ cumulonimbus/	—	Folder	—	—	Per object	—	—	-
<input type="checkbox"/>	✎ cumulus/	—	Folder	—	—	Per object	—	—	-
<input type="checkbox"/>	📄 data.csv	3.53 KB	text/csv	Regional	10/19/18, 7:26 AM	Not public	Google-managed key	—	None

## A.6 Codelab: Create dataset

Create dataset

?

Dataset name

clouds

?

Import images

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

Processed images will be stored on Cloud Storage.

☐

Upload images from your computer ?

Supports JPG, PNG, ZIP.

SELECT FILES

☒

Select a CSV file on Cloud Storage ?

The [CSV file](#) should be a list of paths to your images on GCS and their labels, if available.

gs://automl-oct-handson-vision-vcv/data.csv

☐

Import images later

In the next step, you can add images and label them

i

Data preparation tip

Each label should have at least 100 images for best results. To help put together the best dataset for your use case, [read our data guidelines](#)

## A.6 Codelab: Create dataset

### Classification type

☐ Enable multi-label classification

If you have images that may require multiple labels, enable this setting now. Typically requires more training images per label to get good model results.

CREATE DATASET

CANCEL

This is a relatively small dataset (20 images per label for quick demo). In reality you need 100s and 1000s.

## A.7 Codelab: Inspect dataset (images)

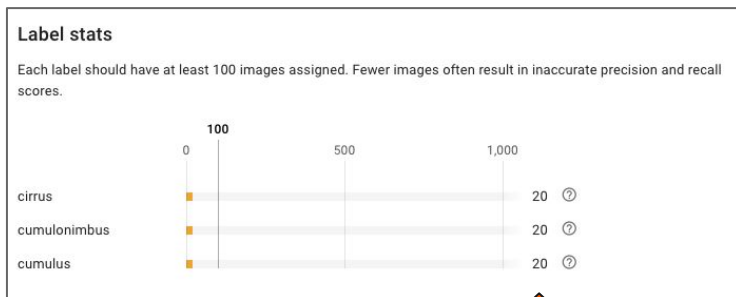
The screenshot shows the AutoML Vision interface. At the top, there's a navigation bar with 'AutoML Vision BETA', 'clouds', 'ADD IMAGES', 'LABEL STATS', and 'EXPORT DATA'. Below this, there are tabs for 'IMAGES', 'TRAIN', 'EVALUATE', and 'PREDICT'. On the left side, under the 'IMAGES' tab, there's a list of filters: 'All images' (60), 'Labeled' (60), and 'Unlabeled' (0). The 'All images' filter is circled in red. Below the filters, there's a search bar 'Type to filter...' and a list of labels: 'cirrus' (20), 'cumulonimbus' (20), and 'cumulus' (20). There's also a link 'Add label'. On the right side, there's a grid of image thumbnails. Each thumbnail is labeled 'cumulus'. One thumbnail has a tooltip that says 'Amtrak NY amtrak.com/see-new-york-and-save-15-perc...'. Above the grid, there's a search bar 'Type to filter images...' and a button 'Select all images'.

Filter	Count
All images	60
Labeled	60
Unlabeled	0

Label	Count
cirrus	20
cumulonimbus	20
cumulus	20

Verify all images have labels.  
Explore images using filters.  
Click to get details view (e.g.,  
to correct labels)

## A.7 Codelab: Inspect stats, add images/labels



Correct the dataset as needed. You will need to retrain the model ..

Free\* **Human Labeling** support ( iff 2-20 labels & 100+ unlabeled images)

AutoML Vision BETA clouds + ADD IMAGES LABEL STATS EXPORT DATA automl-oct-handson-vision

IMAGES TRAIN EVALUATE P

All images 60  
Labeled 60  
Unlabeled 0

Type to filter...

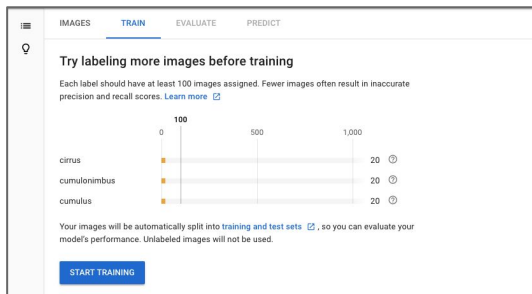
cirrus 20  
cumulonimbus 20

Label: cirrus x

Upload from your computer  
Select CSV file on Cloud Storage

cirrus cirrus cirrus cirrus cirrus cirrus

## A.8 Codelab: Train your model



IMAGES TRAIN EVALUATE PREDICT

Try labeling more images before training

Each label should have at least 100 images assigned. Fewer images often result in inaccurate precision and recall scores. [Learn more](#)

0 100 500 1,000

cirrus 20

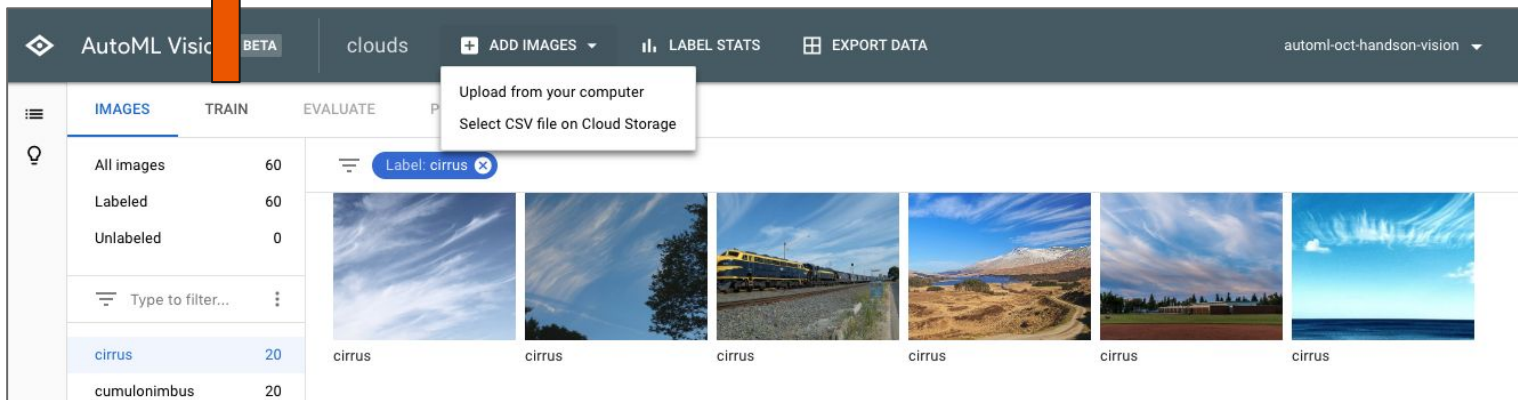
cumulonimbus 20

cumulus 20

Your images will be automatically split into [training and test sets](#), so you can evaluate your model's performance. Unlabeled images will not be used.

START TRAINING

Getting more data can be hard. Some options:  
*explore public/free resources,*  
*use crowdsourcing,*  
*capture video and extract frames,*  
*create variations of image (light, occlusion)*



AutoML Vision BETA clouds + ADD IMAGES LABEL STATS EXPORT DATA automl-oct-handson-vision

IMAGES TRAIN EVALUATE P

All images 60

Labeled 60

Unlabeled 0

Type to filter...

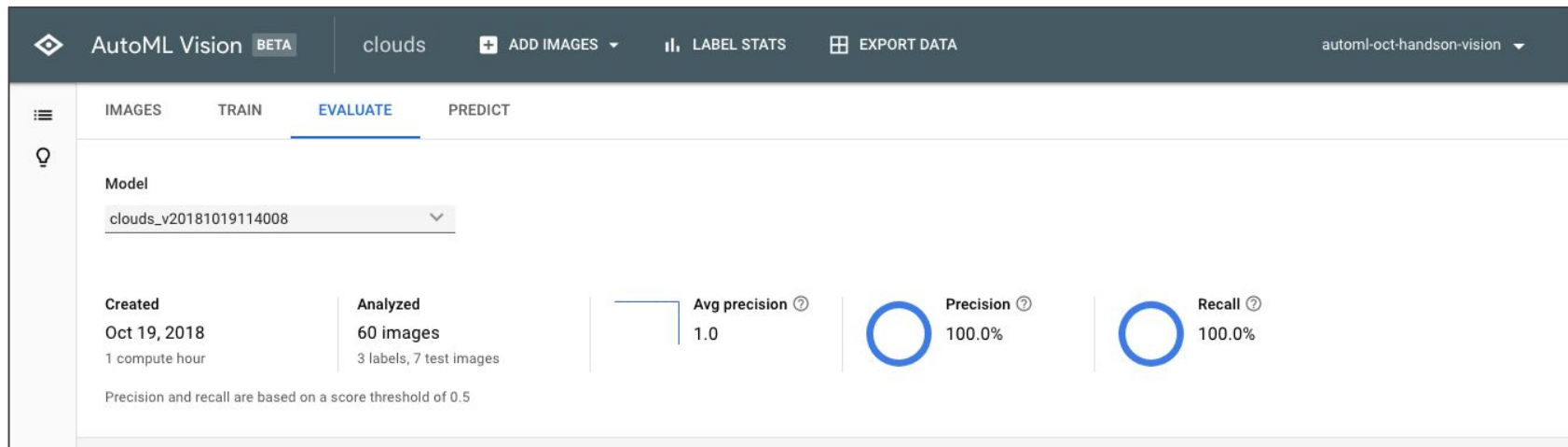
cirrus 20

cumulonimbus 20

Label: cirrus

cirrus cirrus cirrus cirrus cirrus cirrus

## A.8 Codelab: Evaluate the model



This level of precision/recall is not typical.  
(reflects demo usage & small dataset)

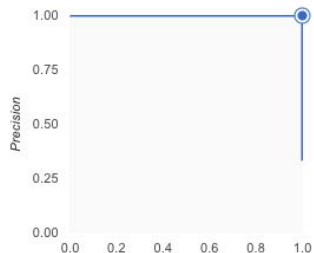


## A.8 Codelab: Evaluate the model

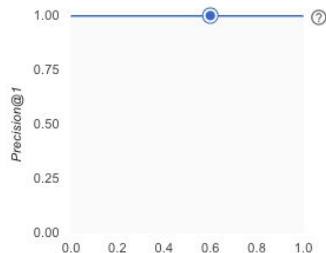
### All labels

Score threshold ?	<input type="range" value="0.60"/>	0.60
Total images	60	
Precision ?	100.0%	
Recall ?	100.0%	

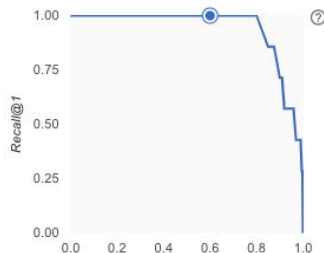
Use the slider to see which score threshold works best for your model on the precision-recall tradeoff curve. [Learn more about these metrics and graphs](#) [?](#)



Recall



Score threshold



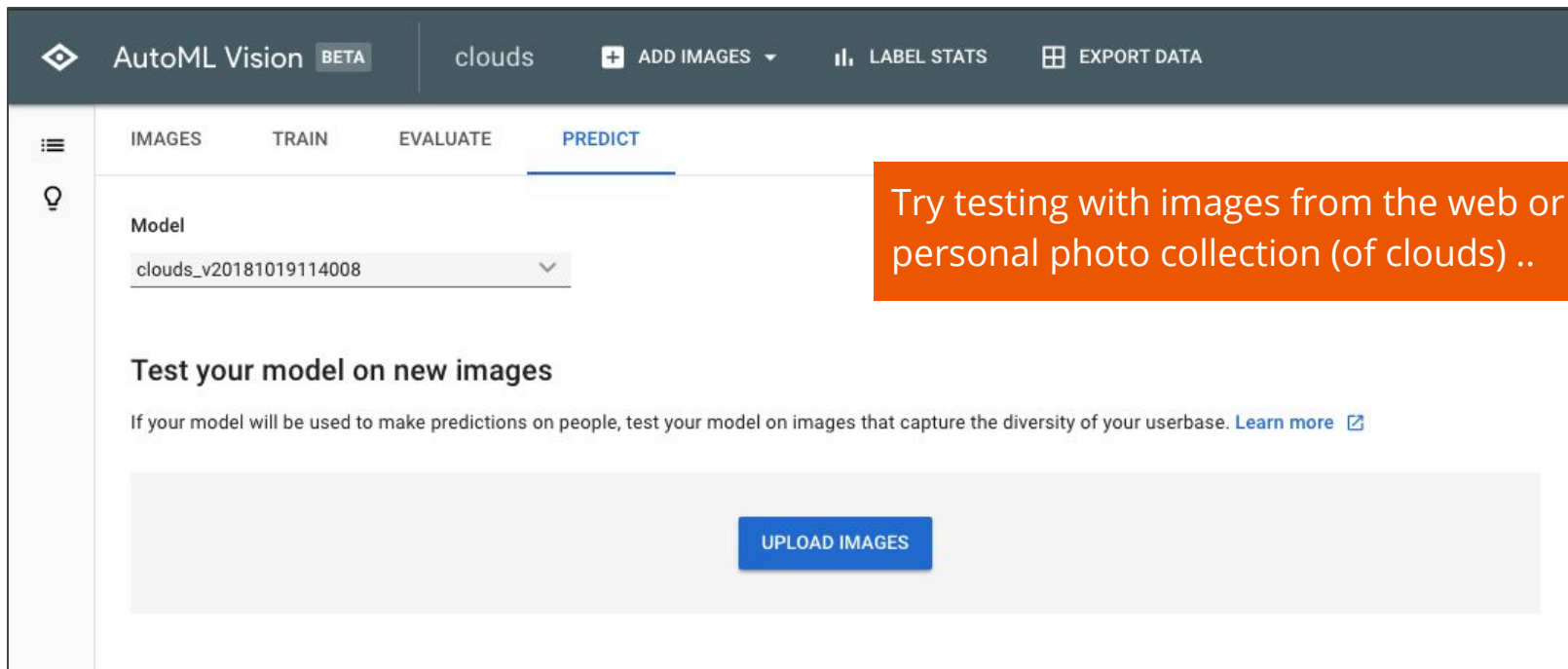
Score threshold

### 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 orange).

True label	Predicted label		
	cirrus	cumulonimbus	cumulus
cirrus	100.0%	-	-
cumulonimbus	-	100.0%	-
cumulus	-	-	100.0%

## A.9 Codelab: Generate Predictions with model



The screenshot shows the 'Predict' tab of the AutoML Vision interface. The top navigation bar includes the AutoML Vision logo, a 'BETA' badge, and links for 'clouds', 'ADD IMAGES', 'LABEL STATS', and 'EXPORT DATA'. The main content area has tabs for 'IMAGES', 'TRAIN', 'EVALUATE', and 'PREDICT'. Under the 'PREDICT' tab, there is a 'Model' dropdown menu currently set to 'clouds\_v20181019114008'. Below this, a section titled 'Test your model on new images' provides instructions and a 'Learn more' link. At the bottom, there is a large blue 'UPLOAD IMAGES' button.

AutoML Vision BETA

clouds + ADD IMAGES LABEL STATS EXPORT DATA

IMAGES TRAIN EVALUATE PREDICT

Model

clouds\_v20181019114008

**Test your model on new images**

If your model will be used to make predictions on people, test your model on images that capture the diversity of your userbase. [Learn more](#)

UPLOAD IMAGES

Try testing with images from the web or your personal photo collection (of clouds) ..

## A.9 Codelab: Test examples

### Test your model on new images

If your model will be used to make predictions on people, test your model on images that capture the diversity of your userbase. [Learn more](#)



Predictions		
Only top 4 labels are shown.		
cirrus	<div><div></div></div>	0.971
cumulonimbus	<div><div></div></div>	0.018
cumulus	<div><div></div></div>	0.011
--other--	<div><div></div></div>	0.000

[Wikipedia](#) / cirrus uncinus



training

### Test your model on new images

If your model will be used to make predictions on people, test your model on images that capture the diversity of your userbase. [Learn more](#)



Predictions		
Only top 4 labels are shown.		
cumulonimbus	<div><div></div></div>	0.857
cirrus	<div><div></div></div>	0.132
cumulus	<div><div></div></div>	0.011
--other--	<div><div></div></div>	0.000

[Wikipedia](#) / nimbostratus



training



## B. AutoML Vision Quickstart / 3600 images

- Uses sample from TensorFlow Blog Post [flower dataset](#)
- **Step 1:** Install and configure Google Cloud SDK
- **Step 2:** Setup project and create dataset
- **Step 3:** Train model using dataset
- **Step 4:** Evaluate trained model
- **Step 5:** Use trained model to make predictions
- (Delete model if not in use)

---

# Short Break

Be right back

5 mins

---

# AutoML Natural Language

Detect Entities & Sentiment in Conversation

NL API

AutoML Natural Language

Data Preparation / Model Testing / Model Evaluation

35 mins



# Cloud ML & Language: Natural Language



## Cloud Natural Language API

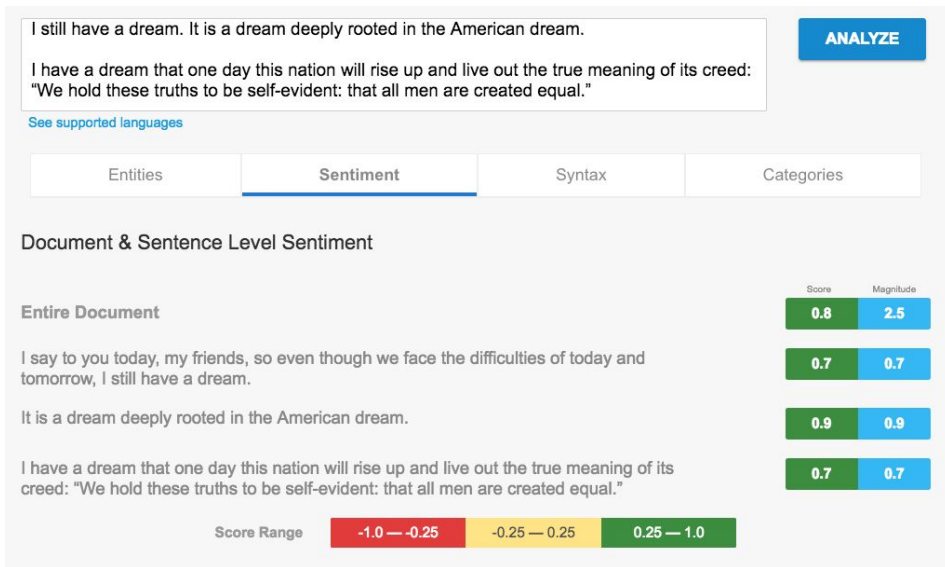
Text Parsing & Analysis using pre-trained models for easy integration



## AutoML Natural Language

**Custom** text classification models

# What is the Natural Language API?



- Syntax analysis
- Entity recognition
- Sentiment analysis
- Content classification
- Multilanguage analysis
- + REST API & libraries





# Cloud Natural Language API Pricing

PRICE PER 1,000 UNITS, BY MONTHLY USAGE				
FEATURE	0 - 5K UNITS/MONTH	5K+ - 1M UNITS/MONTH	1M+ - 5M UNITS/MONTH	5M+ - 20M UNITS/MONTH
Entity Analysis	FREE	\$1.00	\$0.50	\$0.25
Sentiment Analysis	FREE	\$1.00	\$0.50	\$0.25
Syntax Analysis	FREE	\$0.50	\$0.25	\$0.125
Entity Sentiment Analysis	FREE	\$2.00	\$1.00	\$0.50

PRICE PER 1,000 UNITS, BY MONTHLY USAGE				
FEATURE	0 - 30K UNITS/MONTH	30K+ - 250K UNITS/MONTH	250K+ - 5M UNITS/MONTH	5M+ UNITS/MONTH
Content Classification	FREE	\$2.00	\$0.50	\$0.10

# Cloud Natural Language API Interactive Demo

<https://cloud.google.com/natural-language/>

---

# How AutoML Natural Language Works





# AutoML Natural Language Pricing

## TRAINING

\$3 per hour

## PREDICTION

1–30,000 text records\*

Free

30,001–5,000,000 text records\*\*

\$5 per 1,000 text records

\*A text record corresponds to a document provided as input to a Natural Language API request, see the [pricing guide](#) for more detail.

# AutoML Natural Language Training Example


---




# AutoML Natural Language / Quickstart

- Uses sample from Kaggle [HappyDB dataset](#)
- **Step 1:** Install and configure Google Cloud SDK
- **Step 2:** Setup project and create dataset
- **Step 3:** Train model using dataset
- **Step 4:** Evaluate trained model
- **Step 5:** Use trained model to make predictions
- (Delete model if not in use)

## Step 2a / Setup AutoML NL Project

 AutoML Natural Language BETAautoml-oct-handson-1


Finish setting up your Google Cloud project

 Let's setup your project and grant AutoML Text Classification access


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' documents. You can also do this process manually.

SET UP NOWMANUAL SETUP 

CHECK AGAIN

SELECT DIFFERENT PROJECT

## Step 2b / Add New Dataset

AutoML Natural Language BETA

automl-oct-handson-1

Create dataset

Dataset name

happiness

Import text items

**To build a custom model, you first need to import a set of text items to train it.** Generally the more text items the better. Each item should be categorized with a label (labels are essential for telling the model how to classify text). AutoML Natural Language currently supports English text only.

Processed text items will be stored on Cloud Storage.

☒ **Upload a CSV file from your computer**

The CSV file should be a list of GCS paths (or the text itself) and their labels, if available.

happiness.csv

SELECT FILES

Data preparation tip

Each label should have at least 100 text items for best results. To help put together the best dataset for your use case, [read our data guidelines](#)



## Step 2c / Pick classification type, create!

- MULTICLASS assigns ONE label per document
- MULTI-LABEL allows MANY labels per document

### Classification type

☐ Enable multi-label classification

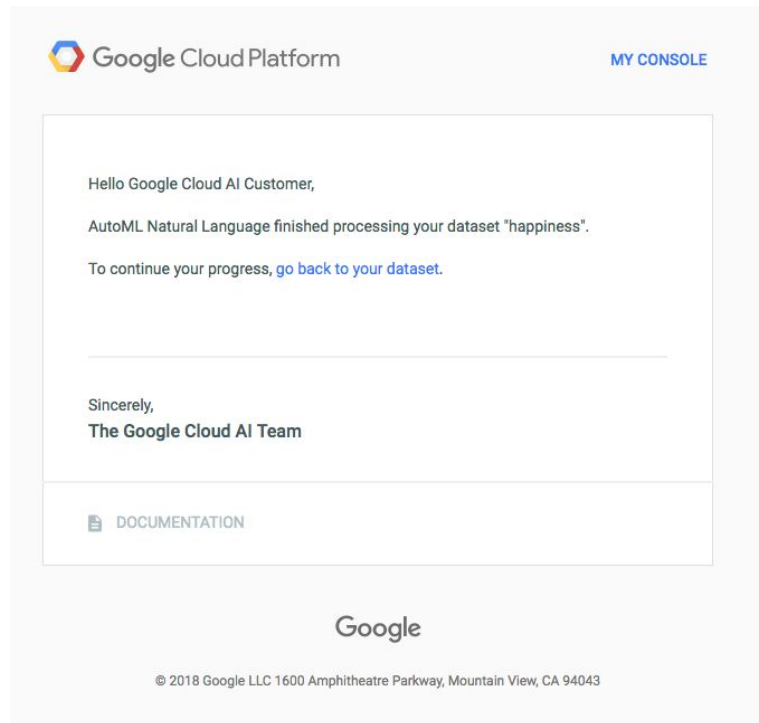
If you have documents that may require multiple labels, enable this setting now. Typically requires more training documents per label to get good model results.

**CREATE DATASET** CANCEL

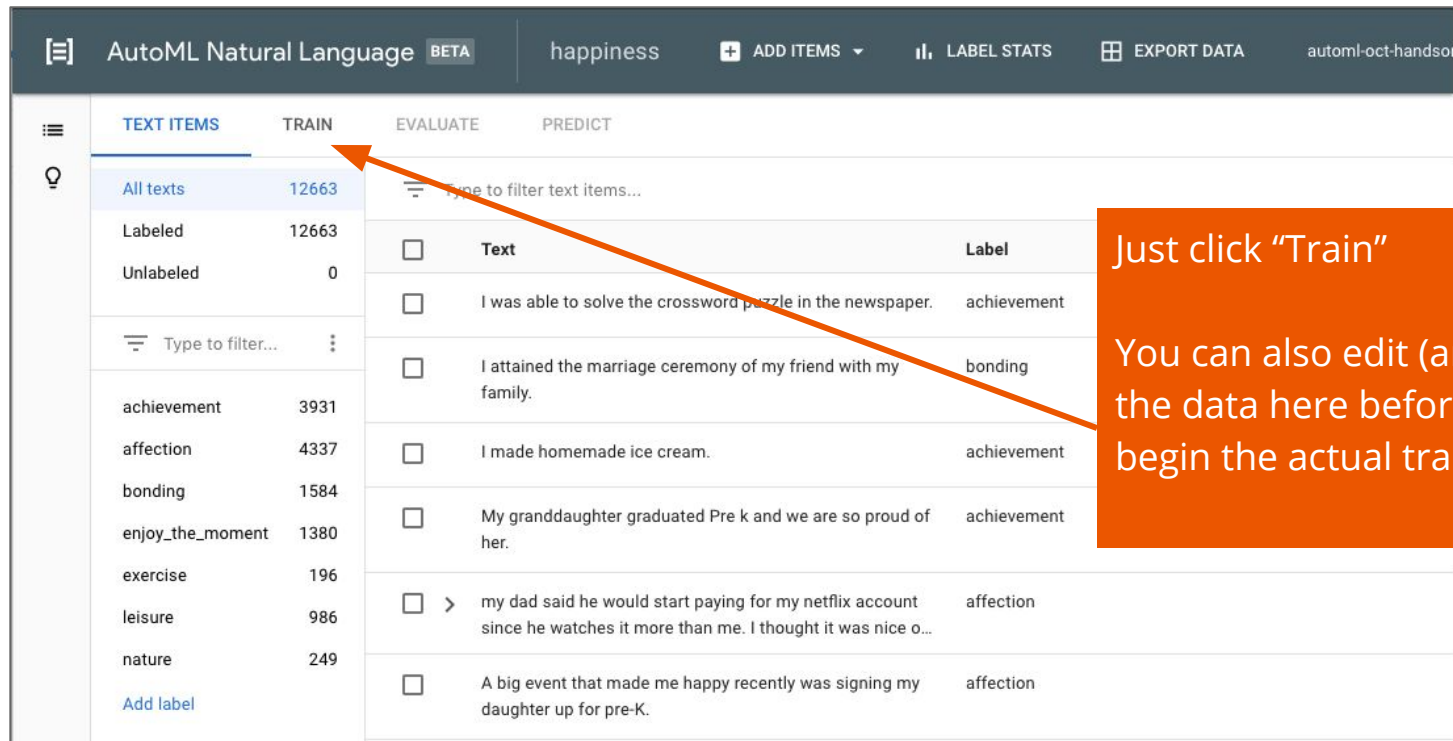
Takes a long time to load the data and create records from your document.  
(10 mins for 1000 records)

## Step 2d / Dataset created

- Example:  
I finally mastered how to  
make crispy  
tofu., **achievement**
- Example:  
Daughter committed to a  
college., **affection**



## Step 3: Train Model Using Dataset



The screenshot shows the AutoML Natural Language interface. The top navigation bar includes a menu icon, the text "AutoML Natural Language BETA", the dataset name "happiness", and buttons for "ADD ITEMS", "LABEL STATS", and "EXPORT DATA". The user's identifier "automl-oct-handson" is on the right.

The main interface has four tabs: "TEXT ITEMS", "TRAIN", "EVALUATE", and "PREDICT". The "TRAIN" tab is selected, and an orange arrow points to it from the right. The "TEXT ITEMS" tab shows a list of items on the left and a table of items on the right.

Item	Count
All texts	12663
Labeled	12663
Unlabeled	0

<input type="checkbox"/>	Text	Label
<input type="checkbox"/>	I was able to solve the crossword puzzle in the newspaper.	achievement
<input type="checkbox"/>	I attained the marriage ceremony of my friend with my family.	bonding
<input type="checkbox"/>	I made homemade ice cream.	achievement
<input type="checkbox"/>	My granddaughter graduated Pre k and we are so proud of her.	achievement
<input type="checkbox"/>	> my dad said he would start paying for my netflix account since he watches it more than me. I thought it was nice o...	affection
<input type="checkbox"/>	A big event that made me happy recently was signing my daughter up for pre-K.	affection

Just click "Train"

You can also edit (and clean) the data here before you begin the actual training..

# Step 3: Train Model Using Dataset

AutoML Natural Language BETA

happiness

ADD ITEMS

LABEL STATS

EXPORT DATA

automl-oct-handson

TEXT ITEMS

TRAIN

EVALUATE

PREDICT

You have enough text items to start training

At least **100 text items** are currently assigned to each label. [Learn more](#)

achievement	3931
affection	4337
bonding	1584
enjoy_the_moment	1380
exercise	
leisure	
nature	

Your documents will be automatically split into **training** and **validation** sets to evaluate the model's performance. Unlabeled documents will not be used.

START TRAINING

Train new model

Model name

happiness\_v20181019061757

Data summary

12663 labeled text items, 7 labels

You will be emailed when training completes. [Pricing guide](#)

CANCEL

START TRAINING

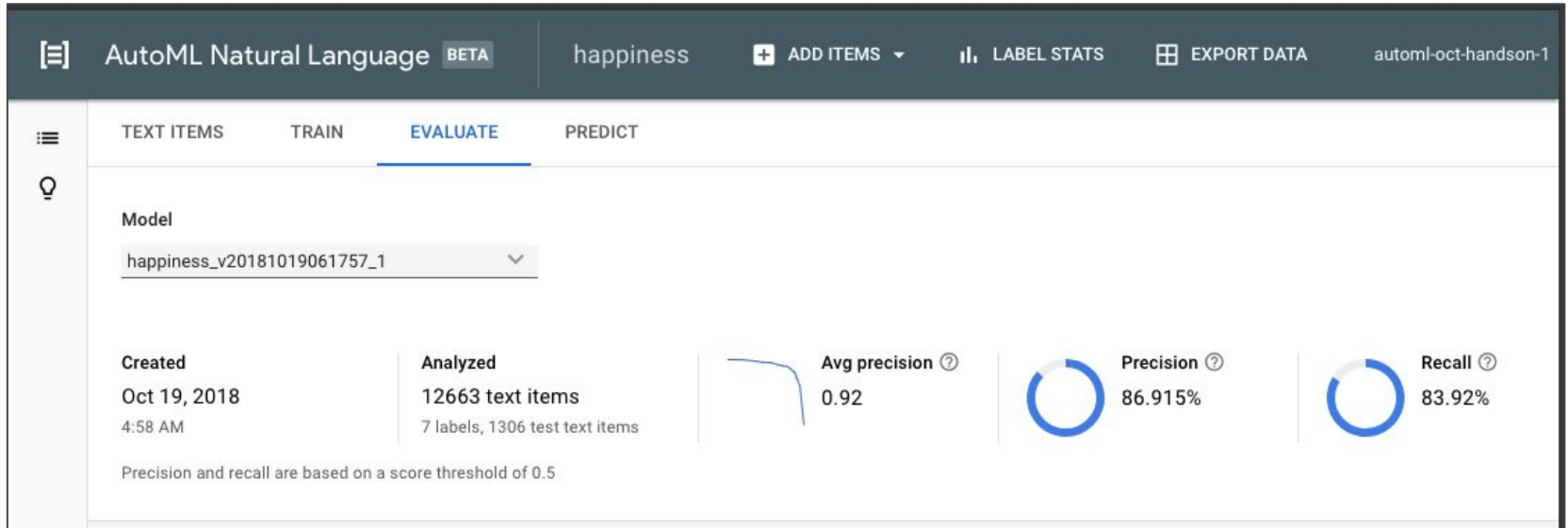
## Training text model

Training can take several hours or more, depending on the complexity of your dataset. In the meantime, you can close this window. You will be emailed once training completes.

CANCEL

Can take many hours to complete training... sends email when done.

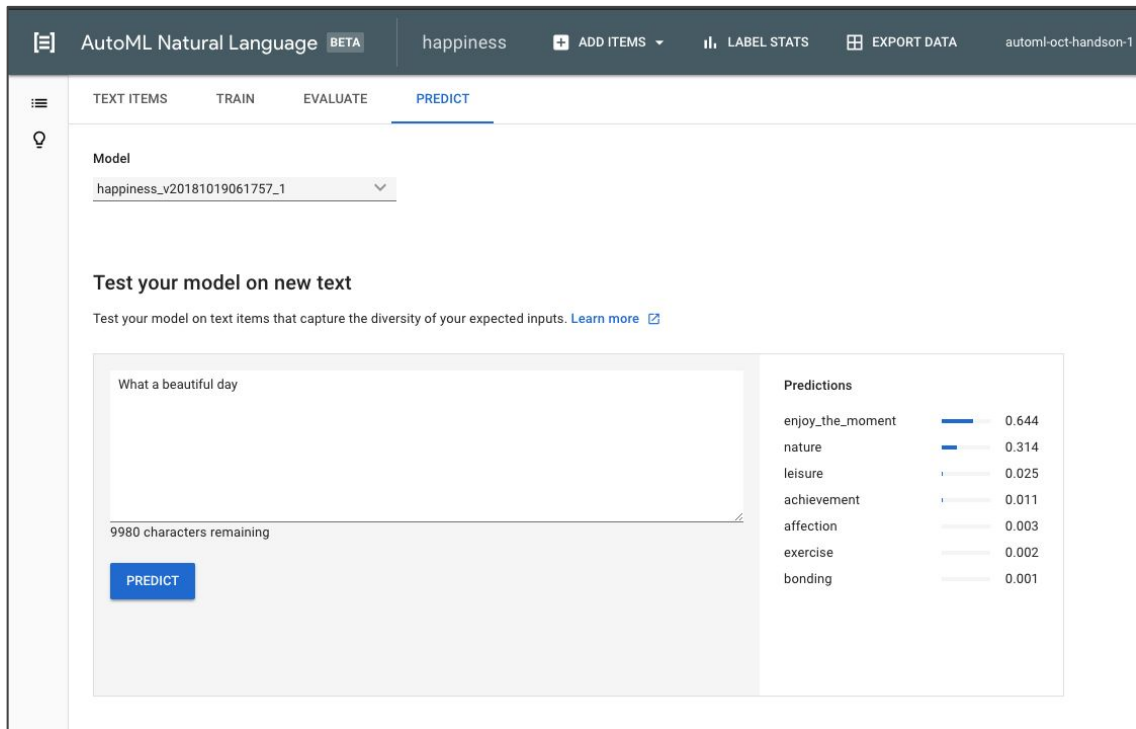
## Step 4: Evaluate Trained Model



**Precision.** Of those labeled, how many were labeled correctly?

**Recall.** Of those that should have the label, how many were assigned it?

## Step 5: Use Trained Model / In Dashboard



The screenshot shows the AutoML Natural Language dashboard in the 'PREDICT' tab. The model selected is 'happiness\_v20181019061757\_1'. The input text is 'What a beautiful day'. The predictions are displayed as a list of labels with their corresponding scores and progress bars.

**Model**  
happiness\_v20181019061757\_1

**Test your model on new text**  
Test your model on text items that capture the diversity of your expected inputs. [Learn more](#)

What a beautiful day

9980 characters remaining

**Predictions**

enjoy_the_moment	0.644
nature	0.314
leisure	0.025
achievement	0.011
affection	0.003
exercise	0.002
bonding	0.001



## Step 5: Use Trained Model / Via API

### Use your custom model

You can now run predictions on text items using your custom content classification model. (Note: You will need a [service account](#) )

REST API

PYTHON

Execute the request

```
export GOOGLE_APPLICATION_CREDENTIALS=key-file-path

curl -X POST \
  -H "Authorization: Bearer $(gcloud auth application-default print-access-token)" \
  -H "Content-Type: application/json" \
  https://automl.googleapis.com/v1beta1/projects/automl-oct-handson-1/locations/us-central1/models/TCN897237531609594639
  -d '{
    "payload": {
      "textSnippet": {
        "content": "YOUR TEXT HERE",
        "mime_type": "text/plain"
      },
    },
  }'
```



## Step 5: Use Trained Model / Via Client Library

predict.py

```
import sys

from google.cloud import automl_v1beta1
from google.cloud.automl_v1beta1.proto import service_pb2

def get_prediction(content, project_id, model_id):
    prediction_client = automl_v1beta1.PredictionServiceClient()

    name = 'projects/{}/locations/us-central1/models/{}'.format(project_id, model_id)
    payload = {'text_snippet': {'content': content, 'mime_type': 'text/plain' }}
    params = {}
    request = prediction_client.predict(name, payload, params)
    return request # waits till request is returned

if __name__ == '__main__':
    content = sys.argv[1]
    project_id = sys.argv[2]
    model_id = sys.argv[3]

    print get_prediction(content, project_id, model_id)
```

Execute the request

```
python predict.py "YOUR TEXT HERE" automl-oct-handson-1 TCN8972375316095946390
```



---

# Short Break

Be right back

5 mins

---

# AutoML Translation

Translate Query Language

Translation API

AutoML Translate

Data Preparation / Model Testing / Model Evaluation

25 mins



# Cloud ML & Language: Translation



## Cloud Translation API

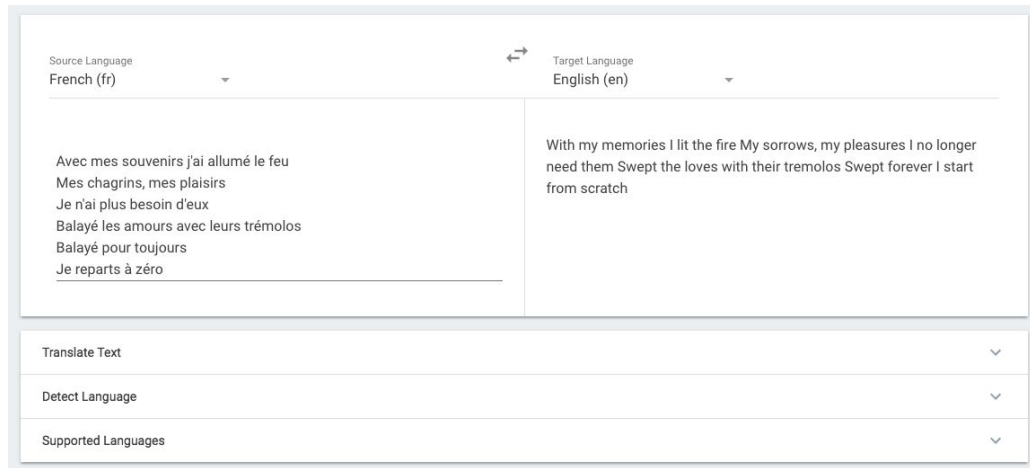
Language detection & translation



## AutoML Translation

**Custom** domain-specific translation

# What is the Translation API?



The screenshot displays the Google Cloud Translation API interface. At the top, there are two dropdown menus for 'Source Language' and 'Target Language'. The 'Source Language' is set to 'French (fr)' and the 'Target Language' is set to 'English (en)'. Below these, there are two text input fields. The left field contains the French text: 'Avec mes souvenirs j'ai allumé le feu', 'Mes chagrins, mes plaisirs', 'Je n'ai plus besoin d'eux', 'Balayé les amours avec leurs trémolos', 'Balayé pour toujours', and 'Je reparts à zéro'. The right field contains the English translation: 'With my memories I lit the fire My sorrows, my pleasures I no longer need them Swept the loves with their tremolos Swept forever I start from scratch'. At the bottom, there are three buttons: 'Translate Text', 'Detect Language', and 'Supported Languages'.

Source Language	Target Language
French (fr)	English (en)

Source Text	Target Text
Avec mes souvenirs j'ai allumé le feu Mes chagrins, mes plaisirs Je n'ai plus besoin d'eux Balayé les amours avec leurs trémolos Balayé pour toujours Je reparts à zéro	With my memories I lit the fire My sorrows, my pleasures I no longer need them Swept the loves with their tremolos Swept forever I start from scratch

Translate Text	▼
Detect Language	▼
Supported Languages	▼

- Text Translation
- Language Detection
- HTML or Text inputs
- 100+ languages (1000s of language-pairs)
- Continuous updates
- + REST API & libraries



# Cloud Translate API Pricing

Translation API pricing is based on usage. Translation usage is calculated in millions of characters. You are billed per character, so you pay only for what you use.

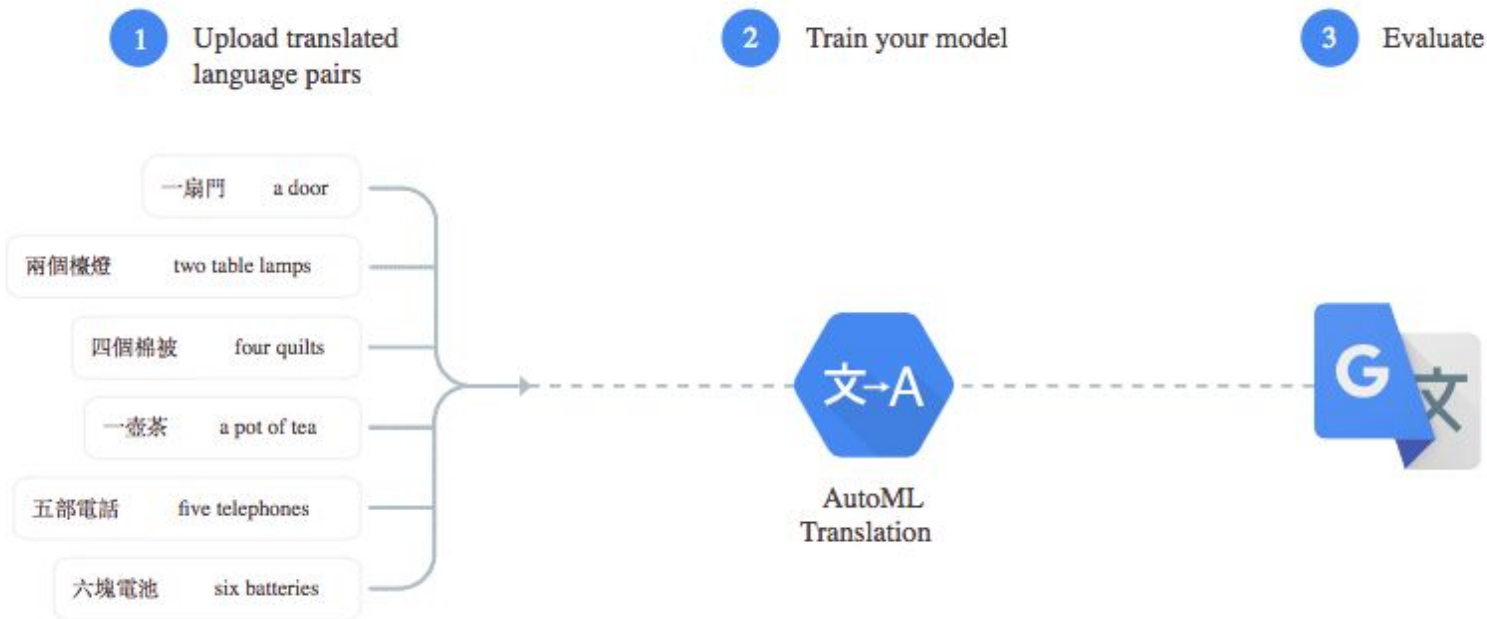
FEATURE	COST (USD) UP TO 1,000 M CHARACTERS/MONTH
Text Translation	\$20 per million characters
Language detection	\$20 per million characters

# Cloud Translate API Interactive Demo

<https://cloud.google.com/translate/>

---

# How AutoML Translate Works





# AutoML Translation Pricing

AutoML Translation pricing is based on Training and Prediction usage and storage.

## TRAINING

\$76 per hour

## PREDICTION

1–500,000 characters

Free

500,001–5,000,000 characters\*

\$80 per million characters



# AutoML Translation Training Example


---




## AutoML Translation / Quickstart

- Uses sample from [Google Quickstart](#) (en-es, en-de, en-ru, en-fr)
- **Step 1:** Install and configure Google Cloud SDK
- **Step 2:** Setup project and create dataset
- **Step 3:** Train model using dataset
- **Step 4:** Evaluate trained model
- **Step 5:** Use trained model to make predictions
- (Delete model if not in use)

## Step 2a / Setup AutoML Translate Project

 AutoML Natural Language BETAautoml-oct-handson-1 ▾


Finish setting up your Google Cloud project

 Let's setup your project and grant AutoML Text Classification access

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' documents. You can also do this process manually.

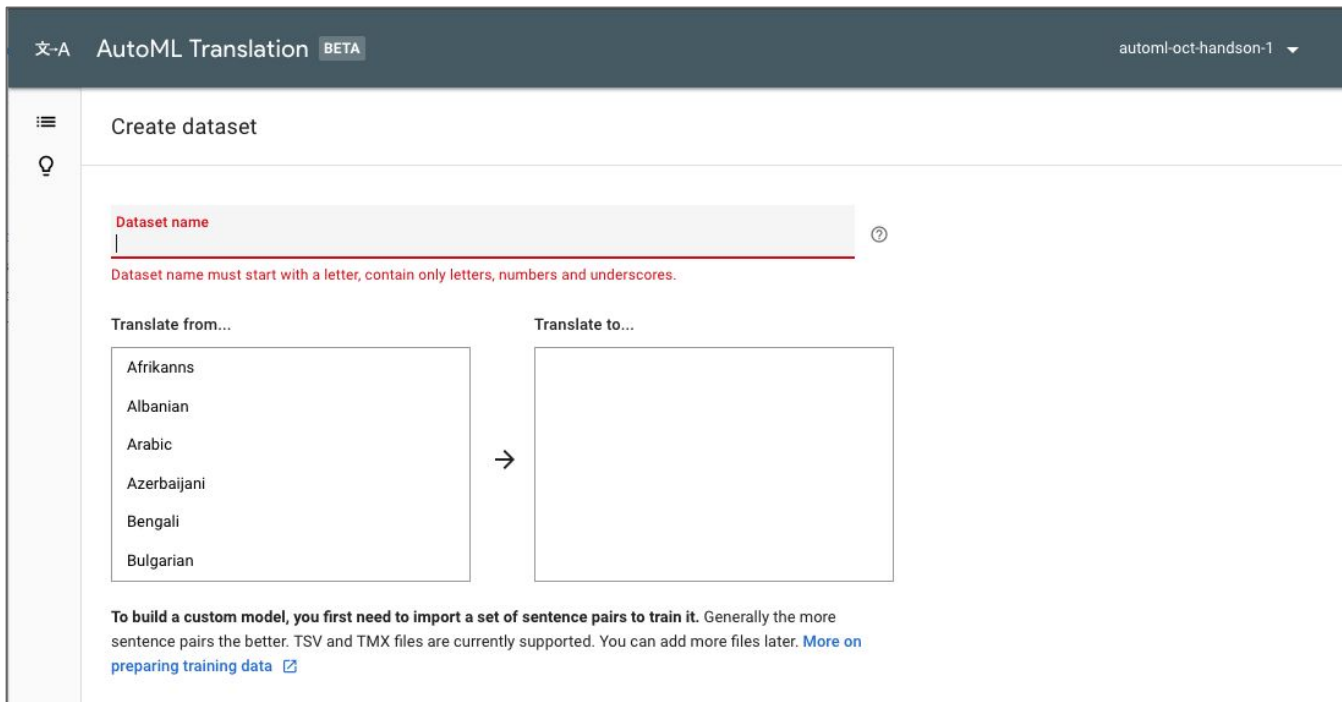
SET UP NOW

MANUAL SETUP ▾

CHECK AGAIN

SELECT DIFFERENT PROJECT

## Step 2b / Add New Dataset (sentence pairs)



The screenshot shows the 'Create dataset' page in the Google AutoML Translation interface. The header bar is dark blue with '文-A AutoML Translation BETA' on the left and 'automl-oct-handson-1' with a dropdown arrow on the right. A sidebar on the left contains a hamburger menu icon and a lightbulb icon. The main content area has a title 'Create dataset' and a text input field for 'Dataset name'. Below the input field is a red error message: 'Dataset name must start with a letter, contain only letters, numbers and underscores.' To the right of the input field is a question mark icon. Below the input field are two columns: 'Translate from...' and 'Translate to...'. The 'Translate from...' column contains a list of languages: Afrikaans, Albanian, Arabic, Azerbaijani, Bengali, and Bulgarian. The 'Translate to...' column is empty. A right-pointing arrow is positioned between the two columns. At the bottom of the page, there is a paragraph of text: 'To build a custom model, you first need to import a set of sentence pairs to train it. Generally the more sentence pairs the better. TSV and TMX files are currently supported. You can add more files later. [More on preparing training data](#) [🔗](#)'.

文-A AutoML Translation BETA automl-oct-handson-1

Create dataset

Dataset name

Dataset name must start with a letter, contain only letters, numbers and underscores.

Translate from...

Afrikaans  
Albanian  
Arabic  
Azerbaijani  
Bengali  
Bulgarian

Translate to...

→

To build a custom model, you first need to import a set of sentence pairs to train it. Generally the more sentence pairs the better. TSV and TMX files are currently supported. You can add more files later. [More on preparing training data](#) [🔗](#)

## Step 2c / Upload files, create!

AUTOMATIC

MANUAL

Your files will be automatically split into training, validation and testing sets. If you have more than 100,000 sentence pairs, consider using the Manual option.

☒ Upload files from your computer ?

☐ Select files on Google Cloud Storage

## Step 2d / Dataset created

文-A AutoML Translation **BETA**

english\_spanish

+ ADD FILES ▾

automl-oct-handson-1 ▾

SENTENCES

TRAIN

PREDICT

en-es.tsv

8720

en-es.tsv

Showing first 20 of 8720 pairs

English

Spanish

Send us your video content

Envíanos tu contenido de video.

Full time · See stats, news, and more

Fin del partido · Consulta estadísticas, noticias

Unfollowing will remove this collection from your list of collections.

Si dejas de seguir esta colección, se quitará de tu lista de colecciones.

Keep your Google Account secure: Get real-time security alerts directly on your device.

Protege tu cuenta de Google: recibe directamente alertas de seguridad en tiempo real.

To get alerts, notifications should be turned on in both Google app and device settings.

Para recibir las notificaciones, debes tener activadas las notificaciones en la app de Google y en la configuración del dispositivo.

Failed to change your settings. Try again later.

No se ha podido cambiar tu configuración. Intenta de nuevo más tarde.

Tap a match to see player stats

Toca un partido para ver estadísticas de los jugadores.

Only you can see this collection

Solo tú puedes ver esta colección.

Anyone with the link can see this collection

Cualquier usuario que tenga el enlace puede ver esta colección.

Stop seeing certain cards

Dejar de ver determinadas tarjetas

Bring back cards you removed

Recuperar las tarjetas que has quitado

Looks like this collection is empty

Parece que esta colección está vacía

Tap to copy link

Toca para copiar el enlace

Just click "Train"

You can also click "Train" the data here to begin the auto

Just click "Train"

You can also edit (and clean) the data here before you begin the actual training..

## Step 3: Train Model Using Dataset

SENTENCES **TRAIN** PREDICT

**Your model is ready to be trained**

**Source language** English

**Target language** Spanish

**Training pairs** 6976

**Validation pairs** 872

**Testing pairs** 872

**START TRAINING**

Note how dataset is automatically split into training, validation, testing sets (80-10-10)

# Step 4: Evaluate Trained Model

文-A

AutoML Translation BETA

english\_spanish

+ ADD FILES

EXPORT DATA

automl-oct-handson-1

SENTENCES

TRAIN

PREDICT

Models

TRAIN NEW MODEL

english\_spanish\_v20181019072653

<b>Created</b> Oct 19, 2018 5:16 AM Based on Google NMT	<b>Analyzed</b> 7848 sentence pairs 872 test pairs	<b>BLEU score</b> ⓘ 52.309 <a href="#">Learn more</a> ⓘ	<b>BLEU score (base model)</b> 38.488	<b>Performance gain/loss</b> +13.822
------------------------------------------------------------------	----------------------------------------------------------	---------------------------------------------------------------	------------------------------------------	-----------------------------------------

TEST AND USE



# Step 4: Evaluate Trained Model

文-A AutoML Translation BETA

english\_spanish + ADD FILES + EXPORT DATA

☰

💡

SENTENCES

TRAIN

PREDICT

Model

english\_spanish\_v20181019072653

Test your model on new sentences

English

What a beautiful day we're having

TRANSLATE

Spanish - Custom model

Que hermoso día estamos teniendo


Spanish - Google NMT model

Que hermoso dia estamos teniendo



## Step 5: Use Trained Model to Make Prediction

### Use your custom model

You can now translate using your custom translation model. (Note: You will need a [service account](#) )

REST API

PYTHON

request.json

```
{
  "payload": {
    "textSnippet": {
      "content": "YOUR_SOURCE_CONTENT"
    }
  }
}
```

Execute the request

```
curl -X POST \
  -H "Authorization: Bearer $(gcloud auth print-access-token)" \
  -H "Content-Type: application/json" \
  https://automl.googleapis.com/v1beta1/projects/automl-oct-handson-1/locations/us-central1/models/TRL806664884280189187/
-d @request.json
```

---

# Short Break

Be right back

5 mins

---

# Putting It All Together

Google ML Ecosystem // Cloud ML, AutoML, TensorFlow, Firebase MLKit

What We Covered // AutoML Vision, AutoML Natural Language, AutoML Translate

Where Is It Useful // Application Examples? Share them with me

What's Next // Resources & Learning Paths

25 mins



# AutoML Resources for Self-Study

- AutoML Vision | [Docs](#) & [Quickstart](#) | [Tutorial](#)
- AutoML Natural Language | [Docs](#) & [Quickstart](#) | [Tutorial](#)
- AutoML Translate | [Docs](#) & [Quickstart](#) | [Tutorial](#)
- [Fast.ai](#) | AutoML & Neural Architecture Search ([pt1](#), [pt2](#), [pt3](#))
- Content | [AI Adventures](#) (@yufengg) & [Medium](#) (@sRobTweets)
- Codelabs | [AutoML Vision](#)



Find me on  
TWITTER  
**@nitya**  
**#automl18**

**FOR MORE  
INFORMATION  
THANK YOU**

- **Questions**

[contact@nityan.me](mailto:contact@nityan.me)

- **Slides**

<http://bit.ly/automl18-slides>

- **Website**

<https://automl18.bitnbot.com>

*I hope to update the website with new  
datasets & resources in upcoming weeks.*