

AutoML Modeling Report



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DataSets Used for the AutoML Classifier Test

https://console.cloud.google.com/vision/datasets?project=automl-classifier-test-298803							
Free trial status: \$390.47 credit and 87 days remaining - with a full account, you'll get unlimited access to all of Google Cloud Platform.							
Google Cloud Platform AutoML Classifier Test Search products and resources							
Vision	Datasets NEW DATASET						
Dashboard							
Datasets							
Models							
	Name	Type	Total images	Labeled images	Last updated	Status	
	AutoML3class ICN7188148526050705408	Single-Label Classification	299	299	Dec 17, 2020, 10:45:49 PM	Success: Training model	
	AutoMLdirtyBalanced ICN8715431749682724864	Single-Label Classification	200	200	Dec 17, 2020, 10:00:29 PM	Success: Training model	
	AutoMLCleanUnbalanced ICN4970688659524157440	Single-Label Classification	400	400	Dec 17, 2020, 9:01:29 PM	Success: Training model	
	AutoMLDataset ICN2279013825984331776	Single-Label Classification	200	200	Dec 15, 2020, 9:15:48 PM	Success: Training model	

Binary Classifier with Clean/Balanced Data

Train/Test Split


How much data was used for training? How much data was used for testing?

100 images for normal and 100 images for pneumonia images were used in total. After training was run, 180 images are allocated to training and 20 images for testing.

Confusion Matrix

What do each of the cells in the confusion matrix describe? What values did you observe (include a screenshot)? What is the true positive rate for the "pneumonia" class? What is the false positive rate for the "normal" class?

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		True Label	Predicted Label	
	pneumonia	normal		pneumonia	normal
pneumonia	100%	-	pneumonia	10	-
normal	-	100%	normal	-	10

		Predicated Labels		
		Pneumonia	Normal	
True Labels	Pneumonia	TP	FN	Total Pneumonia Set
	Normal	FP	TN	Total Normal Set
		Total Pneumonia Predicted	Total Normal Predicted	

$$TP(\text{pneumonia}) = TP / \text{Total Predicted} = 10 / 10 = 1$$

$$FP(\text{normal}) = FP / \text{Total Predicted} = 0 / 10 = 0$$

The true positive rate for the pneumonia class is 100% and the false positive rate for the normal class is 0%.

Precision and Recall

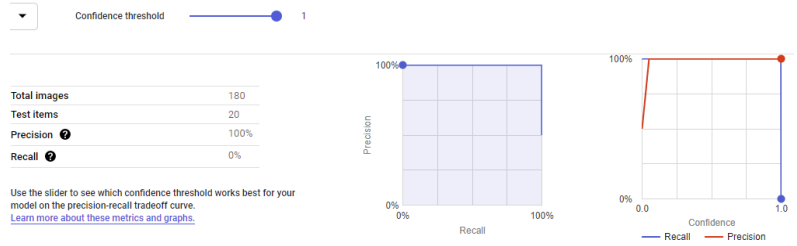
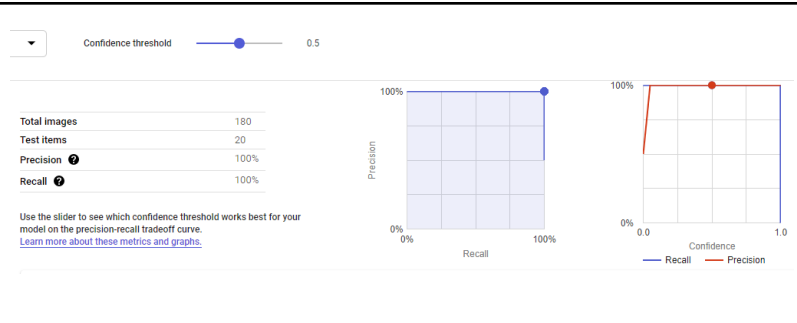
What does precision measure? What does recall measure? What precision and recall did the model achieve (report the values for a score threshold of 0.5)?

Precision measures how likely the prediction is correct, i.e. $TP / (TP + FP)$. A high precision model produces fewer false positives. At 0.5 score threshold, the model produced a precision value of 100%

Recall measures how good the model is at identifying actual occurrences in the data, i.e. $TP / (TP + FN)$. A high recall model produces fewer false negatives. At 0.5 score threshold, the model produced a recall value of 100%

Score Threshold

When you increase the threshold what happens to precision? What happens to recall? Why?



When I change the score threshold from 0.5 to 1, the Recall drops to 0% and Precision remains at 100%. This high confidence level means there is 0% chance of getting a false negative.

Binary Classifier with Clean/Unbalanced Data

<h3>Train/Test Split</h3> <p>How much data was used for training? How much data was used for testing?</p>	<p>100 images for normal and 300 images for pneumonia images were used in total. After training was run, 360 images are allocated to training and 40 images for testing.</p>																								
<h3>Confusion Matrix</h3> <p>How has the confusion matrix been affected by the unbalanced data? Include a screenshot of the new confusion matrix.</p>	<div><h4>Confusion matrix</h4><div> Item counts</div><p>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.</p><div><table><tr><th>True Label</th><th colspan="2">Predicted Label</th></tr><tr><th></th><th>normal</th><th>pneumonia</th></tr><tr><td>normal</td><td>90%</td><td>10%</td></tr><tr><td>pneumonia</td><td>-</td><td>100%</td></tr></table><table><tr><th>True Label</th><th colspan="2">Predicted Label</th></tr><tr><th></th><th>normal</th><th>pneumonia</th></tr><tr><td>normal</td><td>9</td><td>1</td></tr><tr><td>pneumonia</td><td>-</td><td>30</td></tr></table></div></div> <p>With unbalanced data favoring the pneumonia class, we see the matrix switch to classifying pneumonia in the “negative” column having either FN and TN values. There is a 10% false negative for the normal class and 90% true positive predictions. However, because there are a lot more images for the pneumonia class, the true negative detections is 100%, meaning there is 100% certainty that an image is not normal and that it is from a pneumonia patient.</p>	True Label	Predicted Label			normal	pneumonia	normal	90%	10%	pneumonia	-	100%	True Label	Predicted Label			normal	pneumonia	normal	9	1	pneumonia	-	30
True Label	Predicted Label																								
	normal	pneumonia																							
normal	90%	10%																							
pneumonia	-	100%																							
True Label	Predicted Label																								
	normal	pneumonia																							
normal	9	1																							
pneumonia	-	30																							
<h3>Precision and Recall</h3> <p>How have the model's precision and recall been affected by the unbalanced data (report the values for a score threshold of 0.5)?</p>	<div><div><div><div></div><div>Confidence threshold</div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></d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Binary Classifier with Dirty/Balanced Data

Train/Test Split

How much data was used for training? How much data was used for testing?

70 images for normal are classified in the correct folder for training but the other 30 normal images were mixed in with the pneumonia folders.
70 images for pneumonia were also classified correctly in the folder but the other 30 pneumonia images were mixed in with normal images in the normal folder.
Total images used is 100 each. After training was run, 180 images were allocated to training and 20 images for testing.

Confusion Matrix

How has the confusion matrix been affected by the dirty data? Include a screenshot of the new confusion matrix.

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	
	normal	pneumonia
normal	70%	30%
pneumonia	20%	80%

True Label	Predicted Label	
	normal	pneumonia
normal	7	3
pneumonia	2	8

For an equal split of datasets, there is a 70% chance of true positives for the normal class and 30% chance of a false negative, i.e. 30% chance of getting a prediction wrong to indicate an image belongs to the pneumonia class instead of being classified as normal.

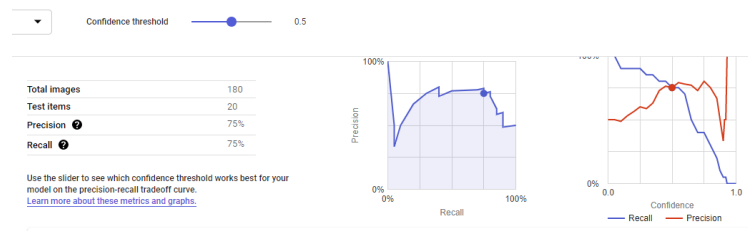
On the other hand, it seems there is a bigger percentage at 80% for the pneumonia class to get a true negative prediction that an image is classified correctly as not normal, i.e. coming from a pneumonia patient. Only 20% chance that it is a false positive.

Precision and Recall

How have the model's precision and recall been affected by the

dirty data (report the values for a score threshold of 0.5)?

Of the binary classifiers, which has the highest precision? Which has the highest recall?



At 0.5 score threshold, both precision and recall intersect to provide 75% value. However, increasing the score threshold increases the precision percentage and drops recall to 0%, meaning the false negatives are eliminated. .

Of the binary classifiers, the highest precision is Clean/Balanced Data with 100% and also has the highest recall at 100%.

Dirty Data

From what you have observed, how does dirty data affect a machine learning model?

Dirty data introduces more FP and FN by about 20-30%. Dirty data has caused these multiple misclassifications.

3-Class Model

Train/Test Split

How much data was used for training? How much data was used for testing?

300 total images were used for this model. 100 images allotted to the normal folder, 100 images with “virus” in the filename allotted to the “viral pneumonia” folder, and the last 100 images with “bacteria” in the filename allotted to the “bacterial pneumonia” folder.

Confusion Matrix

Summarize the 3-class confusion matrix. Which classes is the model most likely to confuse? Which class(es) is the model most likely to get right? Why might you do to try to remedy the model’s “confusion”? Include a screenshot of the new confusion matrix.

Confusion matrix

Item counts

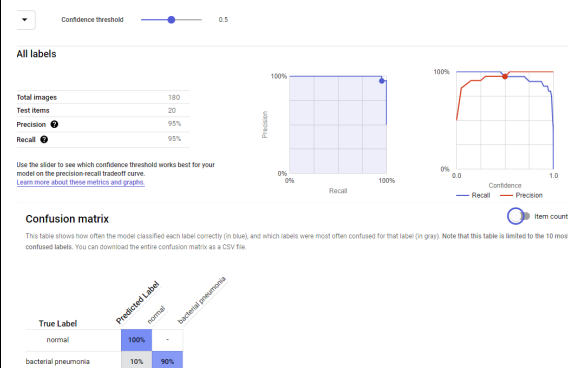
This table shows how often the model classified each label correctly (in blue), and which labels were most often confused for that label (in gray). Note that this table is limited to the 10 most confused labels. You can download the entire confusion matrix as a CSV file.

True Label	Predicted Label		
	bacterial pneumonia	normal	viral pneumonia
bacterial pneumonia	100%	-	-
normal	-	100%	-
viral pneumonia	-	-	100%

True Label	Predicted Label		
	bacterial pneumonia	normal	viral pneumonia
bacterial pneumonia	10	-	-
normal	-	10	-
viral pneumonia	-	-	10

The model will most likely get confused with the two pneumonia classes - Bacterial Pneumonia and Viral Pneumonia. The normal class is the most likely the model will get correct. To improve the confusion model, I would only keep one of the pneumonia classes with the normal class. The way this is setup with 3-classes, I don’t know what to classify as positives and negatives. Another way is to add more true “bacterial” images and have more training cycles.

Here is the new confusion matrix:



	<div><div><div><div><div></div><div>Confidence 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Appendix A – GCP AutoML Vision Classifier Test dataset

The screenshot shows the Google Cloud Platform console for the AutoML Vision Classifier Test dataset. The left sidebar contains navigation links for Vision, Dashboard, Datasets, and Models. The main content area is titled 'AutoMLDataset' and includes tabs for IMPORT, IMAGES, TRAIN, EVALUATE, and TEST & USE. The 'IMAGES' tab is active, displaying a grid of 18 chest X-ray images. A summary on the left indicates 200 total images, with 200 labeled and 0 unlabeled. The labels are 'normal' (100) and 'pneumonia' (100). Below the image grid, a table lists the labels and their counts. The bottom right corner shows 'Images per page: 50' and '1 - 50 of many'.

Filter labels	Count
normal	100
pneumonia	100

Appendix B – GCP Cloud Storage

The screenshot shows the Google Cloud Platform console for the Storage browser. The left sidebar contains navigation links for Storage, Browser, Monitoring, and Settings. The main content area is titled 'Storage browser' and includes buttons for CREATE BUCKET, DELETE, and REFRESH. A table lists the storage buckets, with columns for Name, Created, Location type, Location, Default storage class, Updated, Public access, Access control, and Lifecycle rules. The table shows one bucket named 'chromilo' created on Dec 15, 2020, at 9:03:45 PM, located in the 'us-west1' region, with a 'Standard' storage class, updated on Dec 15, 2020, at 9:03:45 PM, with 'Subject to object ACLs' public access, 'Fine-grained' access control, and 'None' lifecycle rules.

Name	Created	Location type	Location	Default storage class	Updated	Public access	Access control	Lifecycle rules
chromilo	Dec 15, 2020, 9:03:45 PM	Region	us-west1 (Ore...	Standard	Dec 15, 2020, 9:03:45 PM	Subject to object ACLs	Fine-grained	None

← → ↻ 🔒 https://console.cloud.google.com/vision/datasets/ICN4970688659524157440/import?project=automl-classifier-test-298803

📁 Free trial status: \$390.47 credit and 88 days remaining - with a full account, you'll get unlimited access to all of Google Cloud Platform.

Google Cloud Platform AutoML Classifier Test 🔍 Search products and resources

Vision ← AutoMLCleanUnbalanced LABEL STATS EXPORT DATA

Dashboard Datasets Models

IMPORT IMAGES TRAIN EVALUATE TEST & USE

Select files to import

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

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

☒ Upload images from your computer
☐ Select a CSV file on Cloud Storage

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.

CleanUnbalanced.zip 1 file ✕

SELECT FILES

Destination on Cloud Storage
gs:// chromilo BROWSE

IMPORTING IMAGES...

Appendix C – GCP AutoML Vision | Training

← → ↻ 🔒 console.cloud.google.com/vision/datasets/ICN2279013825984331776/train?project=automl-classifier-test-298803

Google Cloud Platform AutoML Classifier Test 🔍 Search products and resources

Vision ← AutoMLDataset LABEL STATS EXPORT DATA

Dashboard Datasets Models

IMPORT IMAGES TRAIN EVALUATE TEST & USE

You have enough images to start training

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

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

Labels	Images	Train	Validation	Test
normal	100	80	10	10
pneumonia	100	80	10	10

START TRAINING

Train new model

1 Define your model

2 Set a node hour budget

Enter the maximum number of node hours you want to spend training your model.

We recommend using **16 node hours** for your dataset. However, you can train for as little as 8 node hours. You may also be eligible to train with free node hours. [Pricing guide](#)

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

Set your budget * 8 node hours

Estimated completion date: Dec 15, 2020 11 PM GMT-8

☐ Deploy model to 1 node after training

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

START TRAINING CANCEL

← → ↻ console.cloud.google.com/vision/datasets/ICN2279013825984331776/train?project=automl-classifier-test-298803

Google Cloud Platform AutoML Classifier Test Search products and resources

Vision AutoMLDataset LABEL STATS EXPORT DATA


Dashboard Datasets Models

IMPORT IMAGES TRAIN EVALUATE TEST & USE

Models

[TRAIN NEW MODEL](#)

AutoMLDataset_20201215092920



Average precision 1

Precision* 100%

Recall* 100%

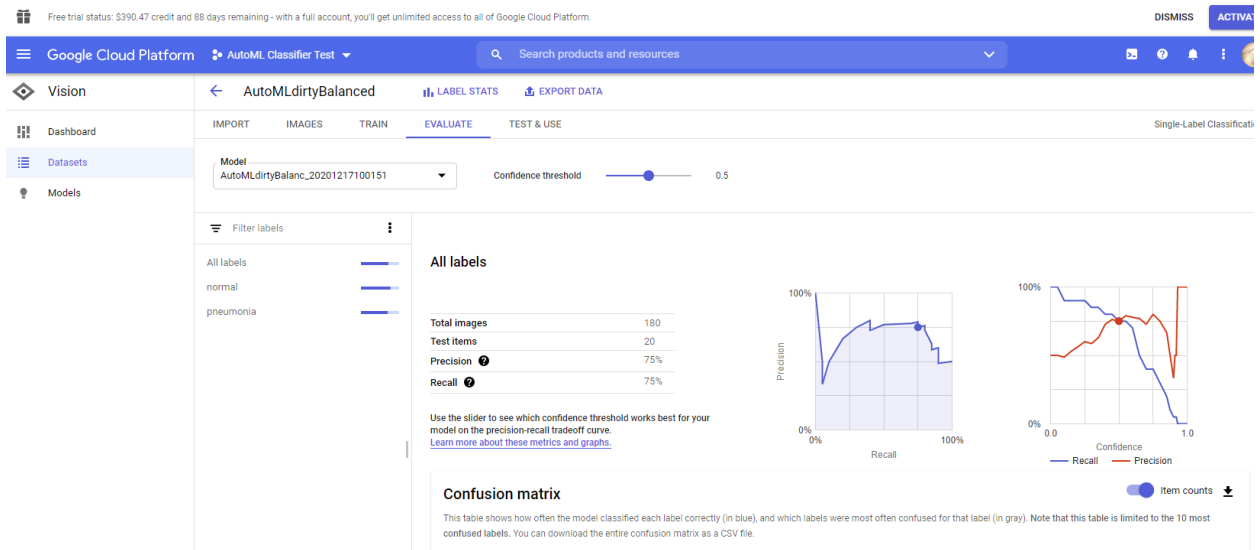
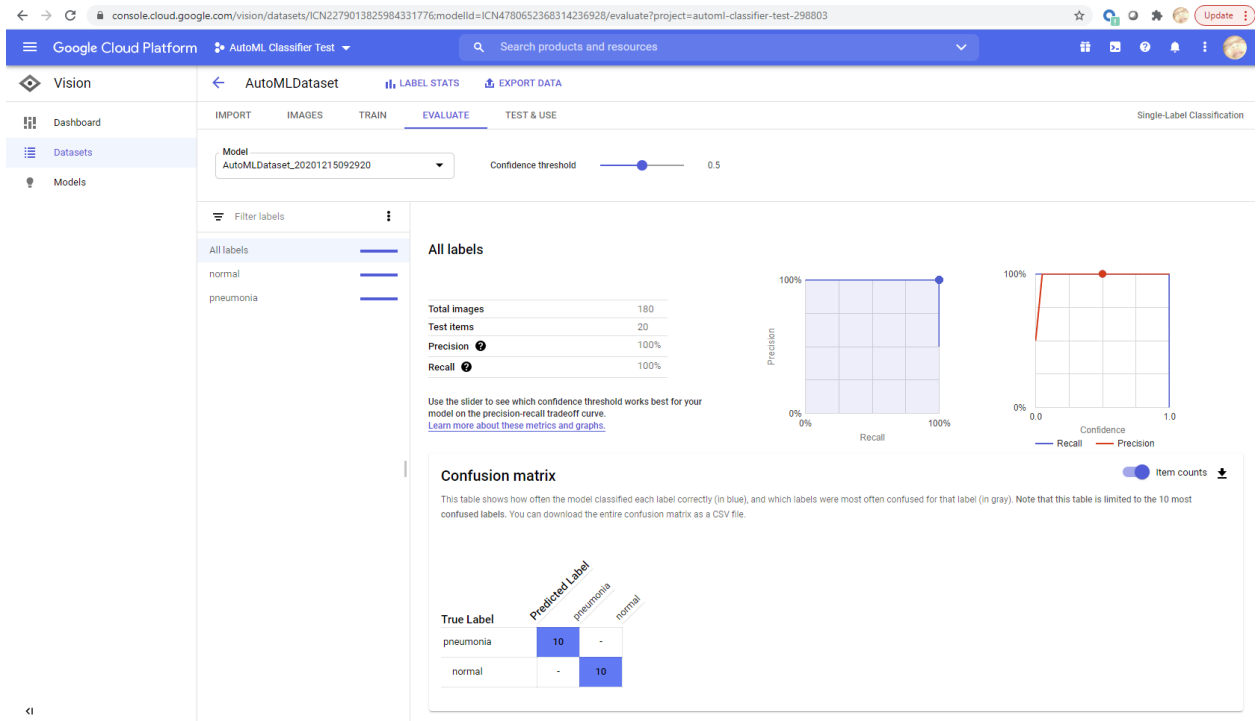
* Using a score threshold of 0.5

Model ID	ICN4780652368314236928
Created	Dec 15, 2020, 9:32:09 PM
Base model	None
Data	200 images
Model type	Cloud
Train cost	8 node hours
Deployment state	Not deployed

[SEE FULL EVALUATION](#)

[RESUME TRAINING](#)

Appendix D – GCP AutoML Vision | Evaluation



Appendix E – GCP AutoML Vision | Costs

