Start Lab 02:15:00

Identify Damaged Car Parts with Vertex AutoML Vision

Lab 1 hour 30 minutes No cost Intermediate

GSP972

Google Cloud Self-Paced Labs

Parts with Vertex AutoML Vision

Lab 1 hour 30 minutes No cost Intermediate

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Google Cloud Self-Paced Labs

Activate Cloud Shell

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

1. Click **Activate Cloud Shell** at the top of the Google Cloud console.

When you are connected, you are already authenticated, and the project is set to your **Project_ID**, `PROJECT_ID`. The output contains a line that declares the **Project_ID** for this session:

```
Your Cloud Platform project in this session is set to "PROJECT_ID"
```

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

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

```
gcloud auth list
```

3. Click **Authorize**.

Output:

```
ACTIVE: *
ACCOUNT: "ACCOUNT"

To set the active account, run:
    $ gcloud config set account `ACCOUNT`
```

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

```
gcloud config list project
```

Output:

```
[core]
project = "PROJECT_ID"
```

Note: For full documentation of `gcloud`, in Google Cloud, refer to the gcloud CLI overview guide.

Task 1. Upload training images to Cloud Storage

In this task you will upload the training images you want to use to Cloud Storage. This will make it easier to import the data into Vertex AI later.

To train a model to classify images of damaged car parts, you need to provide the machine with labeled training data. The model will use the data to develop an understanding of each image, differentiating between car parts and those with damages on them.

Note: For the purposes of this lab, you won't need to label images because a labeled dataset (i.e. image plus label) in a CSV file has been provided. The next section outlines the steps to use the CSV file.

In this example, your model will learn to classify five different damaged car parts: **bumper**, **engine compartment**, **hood**, **lateral**, and **windshield**.

Create a Cloud Storage bucket

1. To start, open a new Cloud Shell window and execute the following commands to set some environment variables:

```
export PROJECT_ID=$DEVSHELL_PROJECT_ID
export BUCKET=$PROJECT_ID
```

2. Next, to create a Cloud Storage bucket, execute the following command:

```
gsutil mb -p $PROJECT_ID \
    -c standard    \
    -l "REGION" \
    gs://${BUCKET}
```

Upload car images to your Storage Bucket

The training images are publicly available in a Cloud Storage bucket. Again, copy and paste the script template below into Cloud Shell to copy the images into your own bucket.

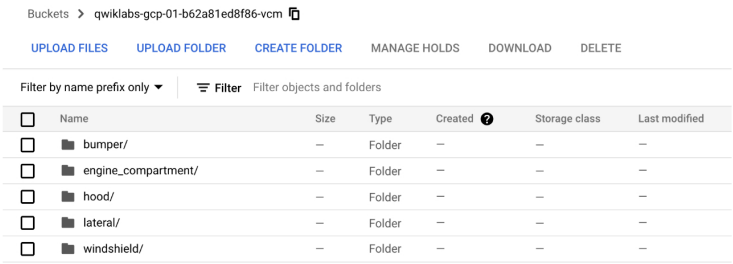
1. To copy images into your Cloud Storage bucket, execute the following command:

```
gsutil -m cp -r gs://car_damage_lab_images/* gs://${BUCKET}
```

2. In the navigation pane, click **Cloud Storage** > **Buckets**.

3. Click the **Refresh** button at the top of the Cloud Storage browser.

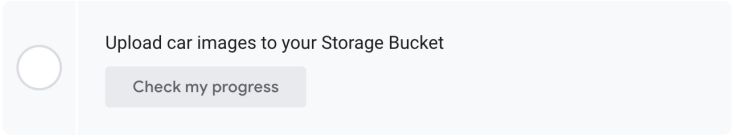
4. Click on your bucket name. You should see five folders of photos for each of the five different damaged car parts to be classified:



5. Optionally, you can click one of the folders and check out the images inside.

Great! Your car images are now organized and ready for training.

Click *Check my progress* to verify the objective.



Task 2. Create a dataset

In this task, you create a new dataset and connect your dataset to your training images to allow Vertex AI to access them.

Normally, you would create a CSV file where each row contains a URL to a training image and the associated label for that image. In this case, the CSV file has been created for you; you just need to update it with your bucket name and upload the CSV file to your Cloud Storage bucket.

Update the CSV file

Copy and paste the script templates below into Cloud Shell and press enter to update, and upload the CSV file.

1. To create a copy of the file, execute the following command:

```
gsutil cp gs://car_damage_lab_metadata/data.csv .
```

2. To update the CSV with the path to your storage, execute the following command:

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

3. Verify your bucket name was inserted into the CSV properly:

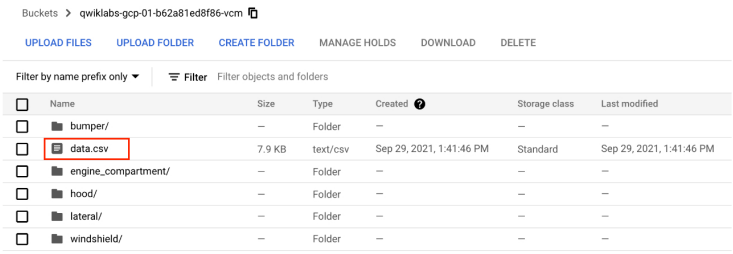
```
cat ./data.csv
```

4. To upload the CSV file to your Cloud Storage bucket, execute the following command:

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

5. Once the command completes, click the **Refresh** button at the top of the Cloud Storage browser and open your bucket.

6. Confirm that the `data.csv` file is listed in your bucket.



Create a managed dataset

1. In the Google Cloud Console, on the **Navigation menu** (≡) click **Vertex AI** > **Dashboard**.

2. Click **Enable All Recommended APIs** if it is not already enabled.

3. From the Vertex AI navigation menu on the left, click **Datasets**.

4. At the top of the console, click **+ Create**.

5. For Dataset name, type `damaged_car_parts`.

6. Select **Image classification (Single label)**. (Note: in your own projects, you may want to check the "Multi-label Classification" box if you're doing multi-class classification).

7. Select the Region as `REGION` .

8. Click **Create**.

Connect your dataset to your training images

In this section, you will choose the location of your training images that you uploaded in the previous step.

1. In the **Select an import method** section, click **Select import files from Cloud Storage**.

2. In the **Select import files from Cloud Storage** section, click **Browse**.

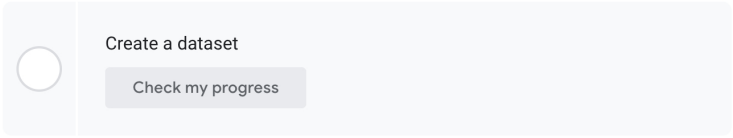
3. Follow the prompts to navigate to your storage bucket and click your `data.csv` file. Click **Select**.

4. Once you've properly selected your file, a green checkbox appears to the left of the file path. Click **Continue** to proceed.

Note: It will take around 9 to 12 minutes for your images to import and be aligned with their categories. You'll need to wait for this step to complete before checking your progress.

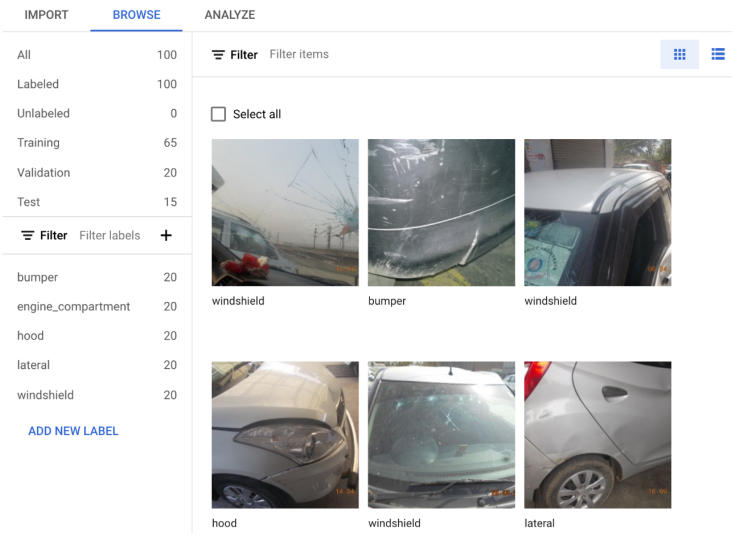
5. Once the import has completed, prepare for the next section by clicking the **Browse** tab. *(Hint: You may need to refresh the page to confirm.)*

Click *Check my progress* to verify the objective.



Task 3. Inspect images

In this task, you examine the images to ensure there are no errors in your dataset.



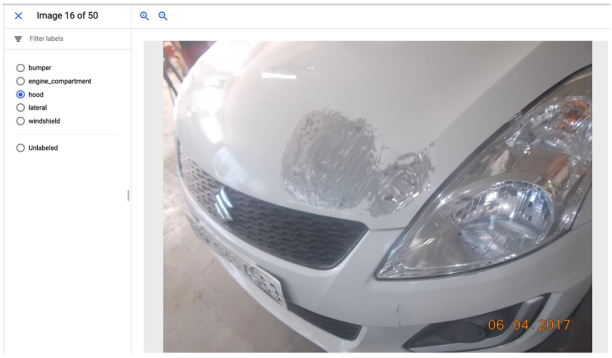
Check image labels

1. If your browser page has refreshed, click **Datasets** , select your image name, and then click **Browse**.

2. Under **Filter labels**, click any one of the labels to view the specific training images. *(Example: engine_compartment.)*

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

3. If an image is labeled incorrectly, you can click on it to select the correct label or delete the image from your training set:



4. Next, click on the **Analyze** tab to view the number of images per label. The **Label Stats** window appears on your browser.

Note: If you need help labeling your dataset, Vertex AI Labeling Services lets you work with human labelers to generate highly accurate labels.

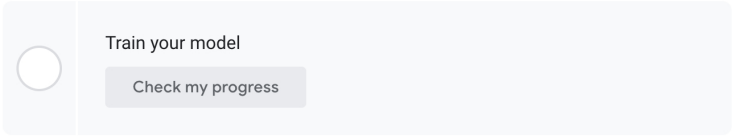
Task 4. Train your model

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

1. From the right-hand side, click **Train New Model**.
2. From the **Training method** window, leave the default configurations and select **AutoML** as the training method. Click **Continue**.
3. From the **Model details** window, enter a name for your model, use: `damaged_car_parts_model`. Click **Continue**.
4. From the **Training options** window, select **Higher accuracy (new)** and click **Continue**.
5. From **Compute and pricing** window, set your budget to **8** maximum node hours.
6. Click **Start Training**.

Note: Model training can take longer than the allotted time to complete the lab. The model **does not need to finish training** to continue to the next section.

Click *Check my progress* to verify the objective.



Task 5. Request a prediction from a hosted model

For the purposes of this lab, a model trained on the exact same dataset is hosted in a different project so that you can request predictions from it while your local model finishes training, as it is likely that the local model training will exceed the limit of this lab.

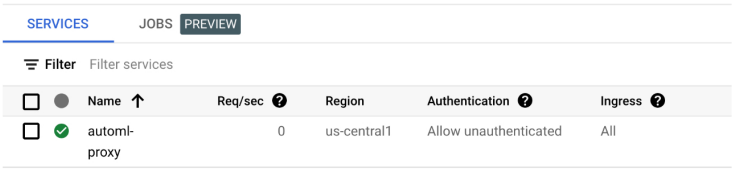
A proxy to the pre-trained model is set up for you so you don't need to run through any extra steps to get it working within your lab environment.

To request predictions from the model, you will send predictions to an endpoint inside of your project that will forward the request to the hosted model and return back the output. Sending a prediction to the AutoML Proxy is very similar to the way that you would interact with your model you just created, so you can use this as practice.

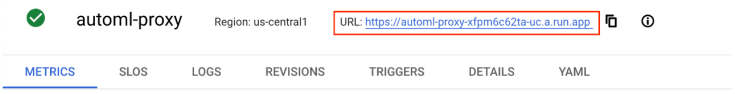
Get the name of AutoML proxy endpoint

1. In the Google Cloud Console, on the **Navigation menu** (≡) click **Cloud Run**.

2. Click **automl-proxy**.



3. Copy the **URL** to the endpoint. It should look something like: `https://automl-proxy-xfpm6c62ta-uc.a.run.app`.



You will use this endpoint for the prediction request in the next section.

Create a prediction request

1. Open a new Cloud Shell window.

2. On the Cloud Shell toolbar, click **Open Editor**. If prompted click **Open in New Window**.

3. Click **File** > **New File**.

4. Copy the following content into the new file you just created:

```
{
    "instances": [{
      "content":
"/9j/4AAQSkZJRgABAQAAAQABAAD/4gIoSUNDX1BST0ZJTEUAAQEAAAIYAAAAAAQwAA
    }],
    "parameters": {
      "confidenceThreshold": 0.5,
      "maxPredictions": 5
    }
  }
```

5. Click **File > Save** then select your path from dropdown **(/home/student_xx_xxxxx)**.

6. Name your file as `payload.json` and then click **Save**.

For reference, the content you supplied is a Base64 string from the following image.

7. Next, set the following environment variables. Copy in your AutoML Proxy URL you retrieved in earlier.

```
AUTOML_PROXY=<automl-proxy url>
INPUT_DATA_FILE=payload.json
```

8. Perform a API request to the AutoML Proxy endpoint to request the prediction from the hosted model:

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

If you ran a successful prediction, your output should resemble the following:


```
{"predictions":[{"confidences":[0.951557755],"displayNames":["bumper"],"id
```


For this model, the prediction results are pretty self-explanatory. The `displayNames` field should correctly predict a `bumper` with a high confidence threshold. Now, you can change the Base64 encoded image value in the JSON file you created.

Click *Check my progress* to verify the objective.

Create the prediction request

Check my progress

9. Right-click on each image below, then select **Save image As...**.

10. Follow the prompts to save each image with a unique name. *(Hint: Assign a simple name like 'Image1' and 'Image2' to assist with uploading).*

11. Open the Base64 Image Encoder follow the instructions to upload and encode an image to a Base64 string.

12. Replace the Base64 encoded string value in the `content` field in your JSON payload file, and run the prediction again. Repeat for the other image(s).

How did your model do? Did it predict all three images correctly? You should see the the following outputs, respectively:


```
{"predictions":[{"ids":["5419751198540431360"],"confidences":[0.985487759]
```

```
{"predictions":[{"displayNames":["hood"],"ids":["3113908189326737408"],"co
```


Congratulations!

In this lab, you learned how to train your own custom machine learning model and generate predictions on hosted model via an API request. You uploaded training images to Cloud Storage and used a CSV file for Vertex AI to find these images. You inspected the labeled images for any discrepancies before finally evaluating a trained model. Now you've got what it takes to train a model on your own image dataset!

Next steps / learn more

- Read more about Vertex AI in the Vertex AI Documentation

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