Troubleshooting

Finding the cause of errors that arise when training your model or getting predictions in the cloud can be challenging. This page describes how to find and debug problems you encounter in AI Platform. If you encounter problems with the machine learning framework that you are using, read the documentation for the machine learning framework (https://cloud.google.com/ml-engine/docs/getting-support#ml-framework-support) instead.

Command-line tool

ERROR: (gcloud) Invalid choice: 'ai-platform'.

This error means that you need to update gcloud. To update gcloud, run the following command:

```
gcloud components update
```

ERROR: (gcloud) unrecognized arguments: --framework=SCIKIT_LEARN.

This error means that you need to update gcloud. To update gcloud, run the following command:

```
gcloud components update
```

ERROR: (gcloud) unrecognized arguments: --framework=XGBOOST.

This error means that you need to update gcloud. To update gcloud, run the following command:

```
gcloud components update
```

ERROR: (gcloud) Failed to load model: Could not load the model: /tmp/model/0001/model.pkl. '\x03'. (Error code: 0)

This error means the wrong library was used to export the model. To correct this, re-export the model using the correct library. For example, export models of the form `model.pkl` with the `pickle` library and models of the form `model.joblib` with the `joblib` library.

ERROR: (gcloud.ai-platform.jobs.submit.prediction) argument --data-format: Invalid choice: 'json'.

This error means that you specified `json` as the value of the `--data-format` flag when submitting a batch prediction job. In order to use the `JSON` data format (https://cloud.google.com/ml-engine/docs/tensorflow/batch-predict#configuring_a_batch_prediction_job), you must provide `text` as the value of the `--data-format` flag.

Python versions

ERROR: Bad model detected with error: "Failed to load model: Could not load the model: /tmp/model/0001/model.pkl. unsupported pickle protocol: 3. Please make sure the model was exported using python 2. Otherwise, please specify the correct 'python_version' parameter when deploying the model. Currently, 'python_version' accepts 2.7 and 3.5. (Error code: 0)"

This error means a model file exported with Python 3 was deployed to an AI Platform model version resource with a Python 2.7 setting.

To resolve this:

- Create a new model version resource and set 'python_version' to 3.5.
- Deploy the same model file to the new model version resource.

The `virtualenv` command isn't found

If you got this error when you tried to activate `virtualenv`, one possible solution is to add the directory containing `virtualenv` to your `$PATH` environment variable. Modifying this variable

enables you to use `virtualenv` commands without typing their full file path.

First, install `virtualenv` by running the following command:

```
pip install --user --upgrade virtualenv
```

The installer prompts you to modify your `$PATH` environment variable, and it provides the path to the `virtualenv` script. On macOS, this looks similar to `/Users/[YOUR-USERNAME]/Library/Python/[YOUR-PYTHON-VERSION]/bin`.

Open the file where your shell loads environment variables. Typically, this is `~/.bashrc` or `~/.bash_profile` in macOS.

Add the following line, replacing `[VALUES-IN-BRACKETS]` with the appropriate values:

```
export PATH=$PATH:/Users/[YOUR-USERNAME]/Library/Python/[YOUR-PYTHON-VERSION]/bin
```

Finally, run the following command to load your updated `.bashrc` (or `.bash_profile`) file:

```
source ~/.bashrc
```

Using job logs

A good first place to start troubleshooting is the job logs captured by Stackdriver Logging.

Logging for the different types of operation

Your logging experience varies by the type of operation as shown in the following sections.

Training logs

All of your training jobs are logged. The logs include events from the training service and from your training application. You can put logging events in your application with standard Python libraries (logging (https://docs.python.org/2/library/logging.html), for example). AI Platform captures all logging messages from your application. All messages sent to stderr are automatically captured in your job's entry in Stackdriver Logging (https://cloud.google.com/logging/).

Batch prediction logs

All of your batch prediction jobs are logged.

Online prediction logs

Your online prediction requests don't generate logs by default. You can enable Stackdriver Logging when you create your model resource:

GCLOUD PYTHON

Include the `--enable-logging` flag when you run `gcloud ai-platform models create` (https://cloud.google.com/sdk/gcloud/reference/ai-platform/models/create).

Finding the logs

Your job logs contain all events for your operation, including events from all of the processes in your cluster when you are using distributed training. If you are running a distributed training job, your job-level logs are reported for the master worker process. The first step of troubleshooting an error is typically to examine the logs for that process, filtering out logged events for other processes in your cluster. The examples in this section show that filtering.

You can filter the logs from the command line or in the Stackdriver Logging section of your Google Cloud Console. In either case, use these metadata values in your filter as needed:

Metadata item	Filter to show items where it is...
resource.type	Equal to "cloud_ml_job".
resource.labels.job_id	Equal to your job name.
resource.labels.task_name	Equal to "master-replica-0" to read only the log entries for your master worker.
severity	Greater than or equal to ERROR to read only the log entries corresponding to error conditions.

Command Line

Use gcloud beta logging read (https://cloud.google.com/sdk/gcloud/reference/beta/logging/read) to construct a query that meets your needs. Here are some examples:

Each example relies on these environment variables:

```
PROJECT="my-project-name"
JOB="my_job_name"
```

You can enter the string literal in place instead if you prefer.

Note: Some of these examples show commands with the `--project flag`. In most cases you should be using a project that you have configured as the default on your development computer. In that case you can omit the flag: it's only required when requesting logs for a project that isn't your current default.

To print your job logs to screen:

```
gcloud ai-platform jobs stream-logs $JOB
```

See all the options for gcloud ai-platform jobs stream-logs (https://cloud.google.com/sdk/gcloud/reference/ai-platform/jobs/stream-logs).

To print the log for your master worker to screen:

```
gcloud beta logging read --project=${PROJECT} "resource.type=\"ml_job\" and resource
```

To print only errors logged for your master worker to screen:

```
gcloud beta logging read --project=${PROJECT} "resource.type=\"ml_job\" and resource
```

The preceding examples represent the most common cases of filtering for the logs from your AI Platform training job. Stackdriver Logging provides many powerful options for filtering that you can use if you need to refine your search. The advanced filtering documentation (https://cloud.google.com/logging/docs/view/advanced_filters) describes those options in detail.

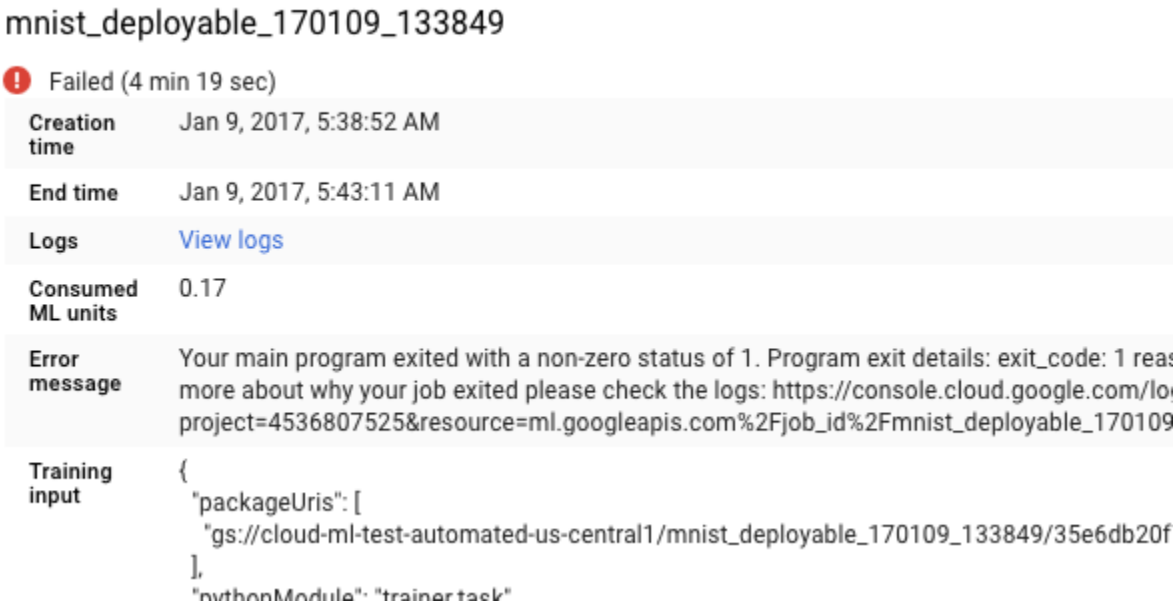
Console

1. Open the AI Platform **Jobs** page in the Cloud Console.

OPEN JOBS IN THE CLOUD CONSOLE (HTTPS://CONSOLE.CLOUD.GOOGLE.COM/MLENGINE/JOBS)

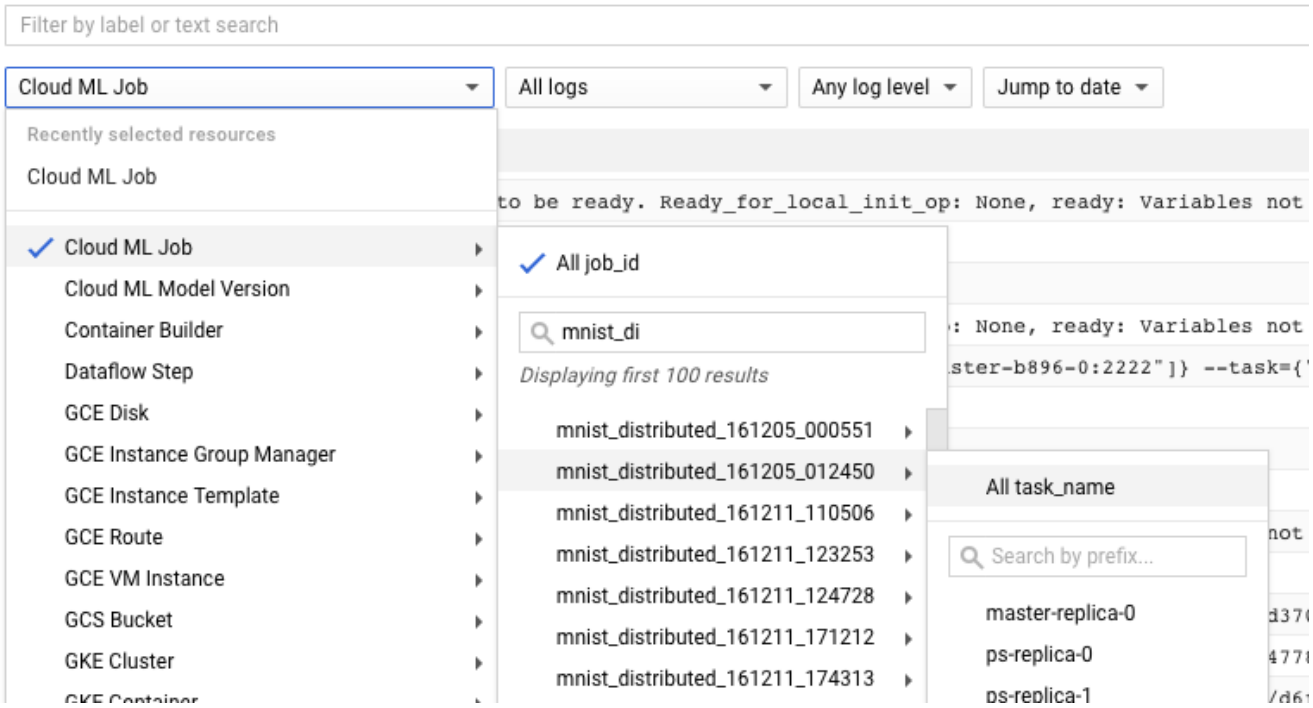
2. Select the job that failed from the list on the **Jobs** page to view its details.

1. Click **View logs** to open Stackdriver Logging.



You can also go directly to Stackdriver Logging, but you have the added step of finding your job:

1. Expand the resources selector.
2. Expand AI Platform Job in the resources list.
3. Find your job name in the job_id list (you can enter the first few letters of the job name in the search box to narrow the jobs displayed).
4. Expand the job entry and select `master-replica-0` from the task list.



Getting information from the logs

After you have found the right log for your job and filtered it to `master-replica-0`, you can examine the logged events to find the source of the problem. This involves standard Python debugging procedure, but these things bear remembering:

- Events have multiple levels of severity. You can filter to see just events of a particular level, like errors, or errors and warnings.
- A problem that causes your trainer to exit with an unrecoverable error condition (return code > 0) is logged as an exception preceded by the stack trace:

- You can get more information by expanding the objects in the logged JSON message (denoted by a right-facing arrow and contents listed as **{...}**). For example, you can expand **jsonPayload** to see the stack trace in a more readable form than is given in the main error description:

- Some errors show instances of retryable errors. These typically don't include a stack trace and can be more difficult to diagnose.

Getting the most out of logging

The AI Platform training service automatically logs these events:

- Status information internal to the service.
- Messages your trainer application sends to `stderr`.
- Output text your trainer application sends to `stdout`.

You can make troubleshooting errors in your trainer application easier by following good programming practices:

- Send meaningful messages to stderr (with logging (https://docs.python.org/2/library/logging.html) for example).
- Raise the most logical and descriptive exception when something goes wrong.
- Add descriptive strings to your exception objects.

The Python documentation (https://docs.python.org/2/tutorial/errors.html) provides more information about exceptions.

Troubleshooting training

This section describes concepts and error conditions that apply to training jobs.

Understanding training application return codes

Your training job in the cloud is controlled by the main program running on the master worker process of your training cluster:

- If you are training in a single process (non-distributed), you only have a single worker, which is the master.
- Your main program is the `__main__` function of your TensorFlow training application.
- AI Platform's training service runs your trainer application until it successfully completes or it encounters an unrecoverable error. This means it may restart processes if retryable errors arise.

The training service manages your processes. It handles a program exit according to the return code of your master worker process:

Return code	Meaning	AI Platform response
0	Successful completion	Shuts down and releases job resources.
1 - 128	Unrecoverable error	Ends the job and logs the error.

You don't need to do anything in particular regarding the return code of your `__main__` function. Python automatically returns zero on successful completion, and returns a positive code when it encounters an unhandled exception. If you are accustomed to setting specific return codes to your exception objects (a valid but uncommon practice), it won't interfere with your AI Platform job, as long as you follow the pattern in the table above. Even so, client code does not typically indicate retryable errors directly—they come from the operating environment.

Handling specific error conditions

This section provides guidance about some error conditions that are known to affect some users.

Resource exhausted

Demand is high for GPUs and for compute resources in the `us-central1` region. You may get an error message in your job logs that says: `Resources are insufficient in region: <region>. Please try a different region.`.

To resolve this, try using a different region or try again later.

Trainer runs forever without making any progress

Some situations can cause your trainer application to run continuously while making no progress on the training task. This may be caused by a blocking call that waits for a resource that never becomes available. You can mitigate this problem by configuring a timeout interval in your trainer.

Configure a timeout interval for your trainer

You can set a timeout, in milliseconds, either when creating your session, or when running a step of your graph:

- Set the desired timeout interval using the *config* parameter when you create your **Session** object:

```
sess = tf.Session(config=tf.ConfigProto(operation_timeout_in_ms=500))
```

- Set the desired timeout interval for a single call to **Session.run** by using the *options* parameter:

```
v = session.run(fetches, options=tf.RunOptions(timeout_in_ms=500))
```

See the TensorFlow **Session** documentation (https://www.tensorflow.org/api_docs/python/tf/Session) for more information.

Program exit with a code of -9

If you get exit code -9 consistently, your trainer application may be using more memory than is allocated for its process. Fix this error by reducing memory usage, using machine types with more memory, or both.

- Check your graph and trainer application for operations that are using more memory than anticipated. Memory usage is affected by the complexity of your data, and the complexity of the operations in your computation graph.
- Increasing the memory allocated to your job may require some finesse:
  - If you are using a defined scale tier, you can't increase your memory allocation per machine without adding more machines to the mix. You'll need to switch to the CUSTOM tier and define the machine types in the cluster yourself.
  - The precise configuration of each defined machine type is subject to change, but you can make some rough comparisons. You'll find a comparative table of machine types (https://cloud.google.com/ml-engine/docs/training-overview#comparing_machine_types) on the training concepts page.
  - When testing machine types for the appropriate memory allocation, you might want to use a single machine, or a cluster of reduced size, to minimize the charges incurred.

Program exit with a code of -15

Typically, an exit code of -15 indicates maintenance by the system. It's a retryable error, so your process should be restarted automatically.

Job queued for a long time

If the State (https://cloud.google.com/ml-engine/reference/rest/v1/projects.jobs#state) of a training job is `QUEUED` for an extended period, you may have exceeded your quota (https://cloud.google.com/ml-engine/quotas#job_requests) of job requests.

AI Platform starts training jobs based on job creation time, using a first-in, first-out rule. If your job is queued, it usually means that all the project quota is consumed by other jobs that were submitted before your job or the first job in the queue requested more ML units/GPUs than the available quota.

The reason that a job has been queued is logged in the training logs. Search the log for messages similar to:

```
This job is number 2 in the queue and requires
4.000000 ML units and 0 GPUs. The project is using 4.000000 ML units out of 4
allowed and 0 GPUs out of 10 allowed.
```

The message explains the current position of your job in the queue, and the current usage and quota of the project.

Note that the reason will be logged only for the first ten queued jobs ordered by the job creation time.

If you regularly need more than the allotted number of requests, you can request a quota increase. Contact support if you have a premium support (https://cloud.google.com/support/index#get-premium-support) package. Otherwise you can email your request to AI Platform feedback (mailto:cloudml-feedback@google.com).

Quota exceeded

If you get an error with a message like "Quota failure for project_number:...", you may have exceeded one of your resource quotas (https://cloud.google.com/ml-engine/quotas). You can monitor your resource consumption and request an increase on the AI Platform quotas page (https://console.cloud.google.com/apis/api/ml.googleapis.com/quotas) in your console's API Manager.

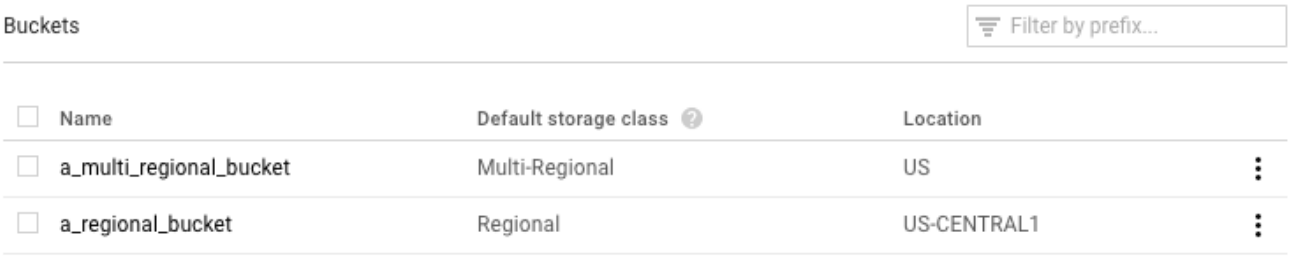
Invalid save path

If your job exits with an error message that includes "Restore called with invalid save path gs://..." you may be using an incorrectly configured Google Cloud Storage bucket.

1. Open the Google Cloud Storage **Browser** page in the Cloud Console.

OPEN BROWSER IN THE CLOUD CONSOLE (HTTPS://CONSOLE.CLOUD.GOOGLE.COM/STORAGE/BR

2. Check the **Default storage class** for the bucket you're using:



- It should be **Regional**. If it is, then something else went wrong. Try running your job again.
- If it is **Multi-Regional**, you need to either change it to **Regional**, or move your training materials to a different bucket. For the former, find instructions for changing a bucket's storage class (https://cloud.google.com/storage/docs/changing-default-storage-class) in the Cloud Storage documentation.

Trainer exits with AbortedError

This error can occur if you are running a trainer that uses TensorFlow Supervisor (https://www.tensorflow.org/api_docs/python/tf/train/Supervisor) to manage distributed jobs. TensorFlow sometimes throws AbortedError exceptions in situations where you shouldn't halt the entire job. You can catch that exception in your trainer and respond accordingly. Note that TensorFlow Supervisor is not supported in trainers you run with AI Platform.

Troubleshooting prediction

This section gathers some common issues encountered when getting predictions.

Handling specific conditions for online prediction

This section provides guidance about some online prediction error conditions that are known to affect some users.

Predictions taking too long to complete (30-180 seconds)

The most common cause of slow online prediction is scaling processing nodes up from zero. If your model has regular prediction requests made against it, the system keeps one or more nodes ready to serve predictions. If your model hasn't served any predictions in a long time, the service "scales down" to zero ready nodes. The next prediction request after such a scale-down will take much more time to return than usual because the service has to provision nodes to handle it.

HTTP status codes

When an error occurs with an online prediction request, you usually get an HTTP status code back from the service. These are some commonly encountered codes and their meaning in the context of online prediction:

429 - Out of Memory

The processing node ran out of memory while running your model. There is no way to increase the memory allocated to prediction nodes at this time. You can try these things to get your model to run:

- Reduce your model size by:
  - Using less precise variables.
  - Quantizing your continuous data.
  - Reducing the size of other input features (using smaller vocab sizes, for example).
  - Send the request again with a smaller batch of instances.

429 - Too many pending requests

Your model is getting more requests than it can handle. If you are using auto-scaling, it is getting requests faster than the system can scale up.

With auto-scaling, you can try to resend requests with exponential backoff. Doing so can give the system time to adjust.

429 - Quota

Your Google Cloud Platform project is limited to 10,000 requests every 100 seconds (about 100 per second). If you get this error in temporary spikes, you can often retry with exponential backoff to process all of your requests in time. If you consistently get this code, you can request a quota increase. See the quota page (https://cloud.google.com/ml-engine/quotas) for more details.

503 - Our systems have detected unusual traffic from your computer network

The rate of requests your model has received from a single IP is so high that the system suspects a denial of service attack. Stop sending requests for a minute and then resume sending them at a lower rate.

500 - Could not load model

The system had trouble loading your model. Try these steps:

- Ensure that your trainer is exporting the right model.
- Try a test prediction with the `gcloud ai-platform local predict` (https://cloud.google.com/sdk/gcloud/reference/ai-platform/local/predict) command.
- Export your model again and retry.

Formatting errors for prediction requests

These messages all have to do with your prediction input (https://cloud.google.com/ml-engine/docs/prediction-overview#prediction_input_data).

"Empty or malformed/invalid JSON in request body"

The service couldn't parse the JSON in your request or your request is empty. Check your message for errors or omissions that invalidate JSON.

"Missing 'instances' field in request body"

Your request body doesn't follow the correct format. It should be a JSON object with a single key named `"instances"` that contains a list with all of your input instances.

JSON encoding error when creating a request

Your request includes base64 encoded data, but not in the proper JSON format. Each base64 encoded string must be represented by an object with a single key named `"b64"`. For example:

```
{"b64": "an_encoded_string"}
```

Another base64 error occurs when you have binary data that isn't base64 encoded. Encode your data and format it as follows:

```
{"b64": base64.b64encode(binary_data)}
```

See more information on formatting and encoding binary data (https://cloud.google.com/ml-engine/docs/online-predict#binary_data_in_prediction_input).

Prediction in the cloud takes longer than on the desktop

Online prediction is designed to be a scalable service that quickly serves a high rate of prediction requests. The service is optimized for aggregate performance across all of the serving requests. The emphasis on scalability leads to different performance characteristics than generating a small number of predictions on your local machine.

What's next

- Get support (https://cloud.google.com/ml-engine/docs/support).
- Learn more about the Google APIs error model (https://cloud.google.com/apis/design/errors), in particular the canonical error codes defined in `google.rpc.Code` (https://github.com/googleapis/googleapis/blob/master/google/rpc/code.proto) and the standard error details defined in google/rpc/error_details.proto (https://github.com/googleapis/googleapis/blob/master/google/rpc/error_details.proto).
- Learn how to monitor your training jobs (https://cloud.google.com/ml-engine/docs/monitor-training).
- See the Cloud TPU troubleshooting and FAQ (https://cloud.google.com/tpu/docs/troubleshooting) for help diagnosing and solving problems when running AI Platform with Cloud TPU.

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