

Machine Learning

## Experiments

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# CLOUDERA

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## Running an Experiment (QuickStart)

This topic walks you through a simple example to help you get started with experiments in Cloudera Machine Learning.

The following steps describe how to launch an experiment from the Workbench console. In this example we are going to run a simple script that adds all the numbers passed as arguments to the experiment.

1. Go to the project Overview page.
2. Click Open Workbench.
3. Create/modify any project code as needed. You can also launch a session to simultaneously test code changes on the interactive console as you launch new experiments.

As an example, you can run this Python script that accepts a series of numbers as command-line arguments and prints their sum.

add.py

```
import sys
import cdsw

args = len(sys.argv) - 1
sum = 0
x = 1

while (args >= x):
    print ("Argument %i: %s" % (x, sys.argv[x]))
    sum = sum + int(sys.argv[x])
    x = x + 1

print ("Sum of the numbers is: %i." % sum)
```

To test the script, launch a Python session and run the following command from the workbench command prompt:

```
!python add.py 1 2 3 4
```

4. Click Run Experiment. If you're already in an active session, click `Run Run Experiment` . Fill out the following fields:

- Script - Select the file that will be executed for this experiment.
- Arguments - If your script requires any command line arguments, enter them here.



**Note:** Arguments are not supported with Scala experiments.

- Engine Kernel and Resource Profile - Select the kernel and computing resources needed for this experiment.



**Note:** The list of options here is specific to the default engine you have specified in your Project Settings: ML Runtimes or Legacy Engines. Engines allow kernel selection, while ML Runtimes allow Editor, Kernel, Variant, and Version selection. Resource Profile list is applicable for both ML Runtimes and Legacy Engines.

For this example we will run the `add.py` script and pass some numbers as arguments.

### Run New Experiment ✕

**Script**

**Arguments** ?

---

**Runtime**

**Editor** i  **Kernel** i

**Edition** i  **Version**

**Runtime Image**  
- docker-registry.infra.cloudera.com/cdsw/runtime-python-quickstart:2020.08.1-b0

**Resource Profile**

**Comment**

[Cancel](#) [Start Run](#)

5. Click Start Run.

- To track progress for the run, go back to the project Overview. On the left navigation bar click Experiments. You should see the experiment you've just run at the top of the list. Click on the Run ID to view an overview for each individual run. Then click Build.

On this Build tab you can see realtime progress as Cloudera Machine Learning builds the Docker image for this experiment. This allows you to debug any errors that might occur during the build stage.

```

Run-4 New Experiment
Overview Session Build
Sending build context to Docker daemon 14.34 MB

Step 1/5 : FROM docker.repository.cloudera.com/cdsw/engine:5
----> da62f78351e0
Step 2/5 : COPY sources /home/cdsw
----> dc0d62362524
Removing intermediate container 52edb8ecef1f
Step 3/5 : WORKDIR /home/cdsw
----> 604125f1bd47
Removing intermediate container 934e47683660
Step 4/5 : RUN chown -R 8536:8536 /home/cdsw
----> Running in 80097e84eb11

```

- Once the Docker image is ready, the run will begin execution. You can track progress for this stage by going to the Session tab.

For example, the Session pane output from running `add.py` is:

```

Run-4 New Experiment
Overview Session Build
> import sys
> import cdsw
> args = len(sys.argv) - 1
> sum = 0
> x = 1
> while (args >= x):
    print ("Parameter %i: %s" % (x, sys.argv[x]))
    sum = sum + int(sys.argv[x])
    x = x + 1
Parameter 1: 18
Parameter 2: 90
Parameter 3: 34
> print ("Sum of the numbers is: %i." % sum)
Sum of the numbers is: 142.

```

8. (Optional) The `cdsw` library that is bundled with Cloudera Machine Learning includes some built-in functions that you can use to compare experiments and save any files from your experiments.

For example, to track the sum for each run, add the following line to the end of the `add.py` script.

```
cdsw.track_metric("Sum", sum)
```

This will be tracked in the Experiments table:

Run	Script	Arguments	Kernel	Comment	Submitter	Created At	Sum	Status	Duration	Actions
5	add.py	66 42 97 104 2004	Python 3.7		csso_wclemens	10/25/21 4:24 PM	2313	Success	0 mins	
4	add.py	1 2 3 4 5	Python 3.7		csso_wclemens	10/25/21 4:24 PM	15	Success	0 mins	
3	add.py	4 60 72	Python 3.7		csso_wclemens	10/25/21 4:23 PM	136	Success	0 mins	
2	add.py	12 56 77	Python 3.7		csso_wclemens	10/25/21 4:21 PM	145	Success	0 mins	
1	add.py		Python 3.7		csso_wclemens	10/25/21 4:17 PM		Success	0 mins	

### Related Information

[Tracking Metrics](#)

[Saving Files](#)

## Limitations

This topic lists some of the known issues and limitations associated with experiments.

- Experiments do not store snapshots of project files. You cannot automatically restore code that was run as part of an experiment.
- Experiments will fail if your project filesystem is too large for the Git snapshot process. As a general rule, any project files (code, generated model artifacts, dependencies, etc.) larger than 50 MB must be part of your project's `.gitignore` file so that they are not included in snapshots for experiment builds.
- Experiments cannot be deleted. As a result, be conscious of how you use the `track_metrics` and `track_file` functions.
  - Do not track files larger than 50MB.
  - Do not track more than 100 metrics per experiment. Excessive metric calls from an experiment may cause Cloudera Machine Learning to stop responding.
- The Experiments table will allow you to display only three metrics at a time. You can select which metrics are displayed from the metrics dropdown. If you are tracking a large number of metrics (100 or more), you might notice some performance lag in the UI.
- Arguments are not supported with Scala experiments.
- The `track_metrics` and `track_file` functions are not supported with Scala experiments.
- The UI does not display a confirmation when you start an experiment or any alerts when experiments fail.

### Related Information

[Engines for Experiments and Models](#)

## Tracking Metrics

This topic teaches you how to use the `track_metric` function to log metrics associated with experiments.

The `cdsw` library includes a `track_metric` function that can be used to log up to 50 metrics associated with a run, thus allowing accuracy and scores to be tracked over time.

The function accepts input in the form of key value pairs.

```
cdsw.track_metric(key, value)
```

Python

```
cdsw.track_metric("R_squared", 0.79)
```

R

```
cdsw::track.metric("R_squared", 0.62)
```

These metrics will be available on the project's Experiments tab where you can view, sort, and filter experiments on the values. The table on the Experiments page will allow you to display only three metrics at a time. You can select which metrics are displayed from the metrics dropdown.



**Note:** This function is not supported with Scala experiments.

## Saving Files

This topic teaches you how to use the `track_file` function to save files associated with experiments.

Cloudera Machine Learning allows you to select which artifacts you'd like to access and evaluate after an experiment is complete. These artifacts could be anything from a text file to an image or a model that you have built through the run.

The `cdsw` library includes a `track_file` function that can be used to specify which artifacts should be retained after the experiment is complete.

Python

```
cdsw.track_file('model.pkl')
```

R

```
cdsw::track.file('model.pkl')
```

Specified artifacts can be accessed from the run's Overview page. These files can also be saved to the top-level project filesystem and downloaded from there.



**Note:** This function is not supported with Scala experiments.

## Debugging Issues with Experiments

This topic lists some common issues to watch out for during an experiment's build and execution process:

### Experiment spends too long in Scheduling/Built stage

If your experiments are spending too long in any particular stage, check the resource consumption statistics for the cluster. When the cluster starts to run out of resources, often experiments (and other entities like jobs, models) will spend too long in the queue before they can be executed.

Resource consumption by experiments (and jobs, sessions) can be tracked by site administrators on the Admin Activity page.

### Experiment fails in the Build stage

During the build stage Cloudera Machine Learning creates a new Docker image for the experiment. You can track progress for this stage on each experiment's Build page. The build logs on this page should help point you in the right direction.

Common issues that might cause failures at this stage include:

- Lack of execute permissions on the build script itself.
- Inability to reach the Python package index or R mirror when installing packages.
- Typo in the name of the build script (cdsw-build.sh). Note that the build process will only run a script called cdsw-build.sh; not any other bash scripts from your project.
- Using pip3 to install packages in cdsw-build.sh, but selecting a Python 2 kernel when you actually launch the experiment. Or vice versa.

### Experiment fails in the Execute stage

Each experiment includes a Session page where you can track the output of the experiment as it executes. This is similar to the output you would see if you test the experiment in the workbench console. Any runtime errors will display on the Session page just as they would in an interactive session.

### Related Information

[Engines for Experiments and Models](#)