

# Reinforcement Learning: Qwik Start

**GSP691**



Google Cloud Self-Paced Labs

# Overview

## Introduction

Like many other areas of machine learning research, [reinforcement learning \(RL\)](#) is evolving at breakneck speed. Just as they have done in other research areas, researchers are leveraging deep learning to achieve state-of-the-art results.

In particular, reinforcement learning has significantly outperformed prior ML techniques in game playing, reaching human-level and even world-best performance on Atari, beating the human Go champion, and is showing promising results in more difficult games like Starcraft II.

In this lab, you will learn the basics of reinforcement learning by building a simple game, which has been modelled off of a sample provided by [OpenAI Gym](#).

## Objectives

In this lab, you will:

- Understand the fundamental concepts of reinforcement learning.
  - Create an AI Platform Tensorflow 2.1 Notebook.
  - Clone the sample repository from the training data analyst repo found on Github.
  - Read, understand, and run the steps found in the notebook.
- Once you're ready, scroll down and follow the steps below to get your lab environment set up.

# Setup and Requirements

## Qwiklabs setup

### Before you click the Start Lab button

Read these instructions. Labs are timed and you cannot pause them. The timer, which starts when you click **Start Lab**, shows how long Google Cloud resources will be made available to you.

This Qwiklabs hands-on lab lets you do the lab activities yourself in a real cloud environment, not in a simulation or demo environment. It does so by giving you new, temporary credentials that you use to sign in and access Google Cloud for the duration of the lab.

### What you need

To complete this lab, you need:

- Access to a standard internet browser (Chrome browser recommended).
- Time to complete the lab.

**Note:** If you already have your own personal Google Cloud account or project, do not use it for this lab.

**Note:** If you are using a Pixelbook, open an Incognito window to run this lab.


## Cloud Console


### How to start your lab and sign in to the Google Cloud Console


1. Click the **Start Lab** button. If you need to pay for the lab, a pop-up opens for you to select your payment method. On the left is a panel populated with the temporary credentials that you must use for this lab.

[Open Google Console](#)

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. [Learn more.](#)


Username  
google2727032\_student@qwiklabs.n 

Password  
k68CZxsxMZ 

GCP Project ID  
qwiklabs-gcp-4fbfecac8667e457 

[New to labs? View our introductory video!](#)


- Copy the username, and then click **Open Google Console**. The lab spins up resources, and then opens another tab that shows the **Sign in** page.


  
**Sign in**  
Use your Google Account


[Forgot email?](#)


**Tip:** Open the tabs in separate windows, side-by-side.

If you see the **Choose an account** page, click **Use Another**

  
**Choose an account**

 Your.Email@gmail.com

 google1381214\_student@qwiklabs.net  
Signed out

 **Use another account**

**Account.**

3. In the **Sign in** page, paste the username that you copied from the Connection Details panel. Then copy and paste the password.

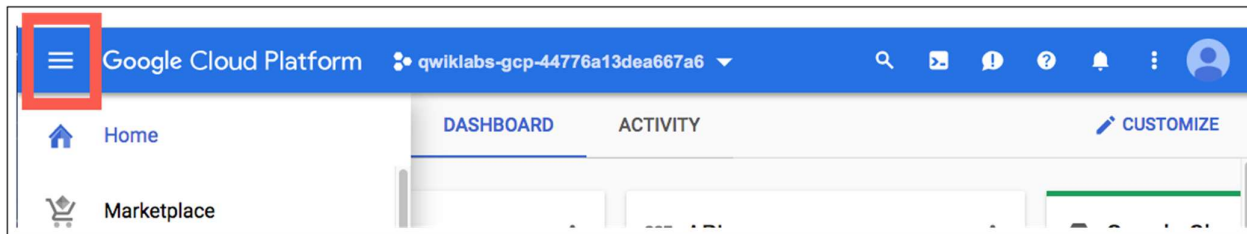
**Important:** You must use the credentials from the Connection Details panel. Do not use your Qwiklabs credentials. If you have your own Google Cloud account, do not use it for this lab (avoids incurring charges).

4. Click through the subsequent pages:

- Accept the terms and conditions.
- Do not add recovery options or two-factor authentication (because this is a temporary account).
- Do not sign up for free trials.

After a few moments, the Cloud Console opens in this tab.

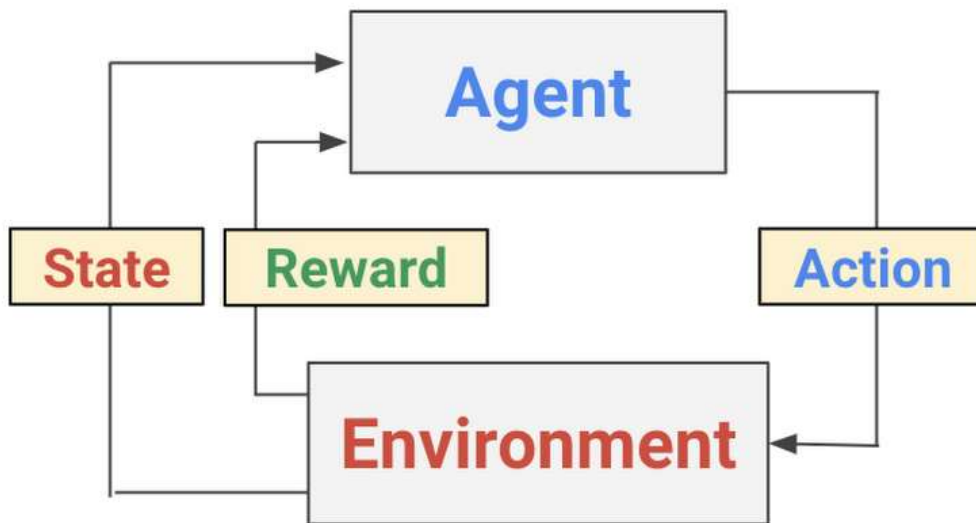
**Note:** You can view the menu with a list of Google Cloud Products and Services by clicking the **Navigation menu** at the top-left.



## Reinforcement learning 101

Reinforcement learning (RL) is a form of machine learning whereby an agent takes actions in an environment to maximize a given objective (a reward) over this sequence of steps. Unlike more traditional supervised learning techniques, every data point is not labelled and the agent only has access to "sparse" rewards.

While the [history of RL](#) can be dated back to the 1950s and there are a lot of RL algorithms out there, 2 easy to implement yet powerful deep RL algorithms have a lot of attractions recently: deep Q-network (DQN) and deep deterministic policy gradient (DDPG). We briefly introduce the algorithms and variants based on them in this section.

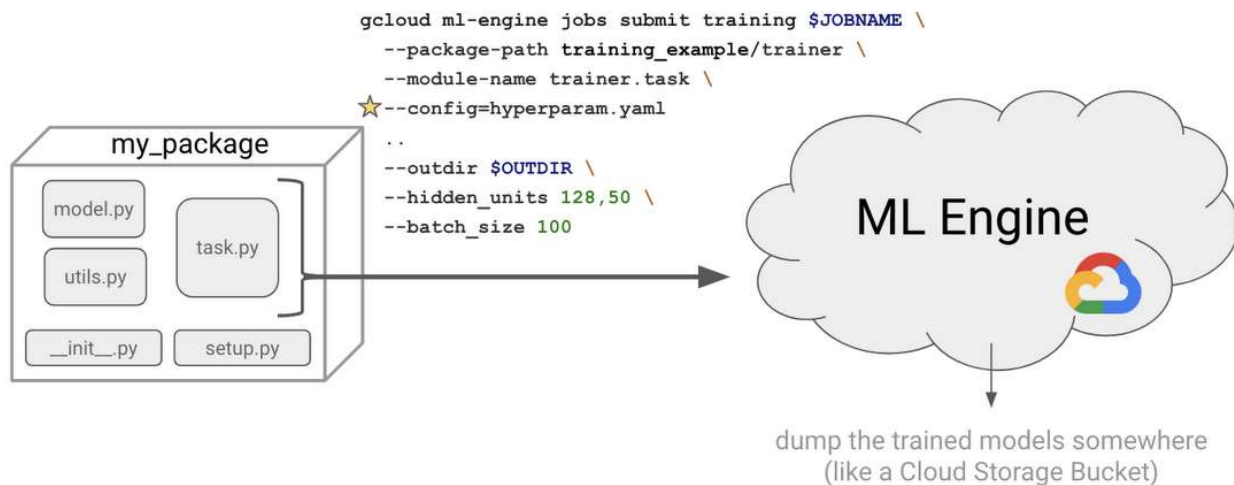


*A conceptual process diagram of the Reinforcement Learning problem*

The Deep Q-network (DQN) was introduced by Google Deepmind's group in [this Nature paper](#) in 2015. Encouraged by the success of deep learning in the field of image recognition, the authors incorporated deep neural networks into Q-Learning and tested their algorithm in the [Atari Game Engine Simulator](#), in which the dimension of the observation space is very large.

The deep neural network acts as a function approximator that predicts the output Q-values, or the desirability of taking an action, given a certain input state. Accordingly, DQN is a value-based method: in the training algorithm DQN updates Q-values according to Bellman's equation, and to avoid the difficulty of fitting a moving target, it employs a second deep neural network that serves as an estimation of target values.

On a more practical level, the following model highlights the source files, the shell command, and the endpoint to get an RL job running on Google Cloud:



# Create an AI Platform Notebook

All the required files that you need for this lab can be found in this [repository](#). You will create an AI platform tensorflow notebook to run all these commands.

From the left-hand navigation menu, select **AI Platform > Notebooks**. Then from the top-hand menu, select **+ New Instance > TensorFlow 2.x > Without GPUs**:

Customize instance

R 3.6  
Includes scikit-learn, pandas, NLTK and more

Python 2 and 3  
Includes scikit-learn, pandas and more

CUDA Toolkit 10.1  
Optimized for NVIDIA GPUs

TensorFlow Enterprise 1.15  
Includes Keras, scikit-learn, pandas, NLTK and more

TensorFlow Enterprise 2.1  
Includes Keras, scikit-learn, pandas, NLTK and more

**TensorFlow 2.3**  
Includes Keras, scikit-learn, pandas, NLTK and more

PyTorch 1.4  
Includes scikit-learn, pandas, NLTK and more

RAPIDS XGBoost [EXPERIMENTAL]  
Optimized for NVIDIA GPUs

Kaggle Python [BETA]  
Python image for Kaggle Notebooks, supporting hundreds of machine learning libraries popular on Kaggle

Smart Analytics Frameworks  
BigQuery, Apache Beam, Apache Spark, Apache Hive, and more

Select a notebook instance

Labels help organize your resources (env:prod)

Empty Tab

Without GPUs

With 1 NVIDIA Tesla T4

Then click **Create**. It will take a couple of minutes to provision your AI Platform Notebook. Refresh the page occasionally. Once the notebook has been built, click the **OPEN JUPYTERLAB** button:

Notebook instances <span>BETA</span>									
<span>+ NEW INSTANCE</span> <span>REFRESH</span> <span>START</span> <span>STOP</span> <span>RESET</span> <span>DELETE</span>									
Filter table									
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Instance name	Region	Environment	Machine type	GPUs	Permission	Labels	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	tensorflow-20200106-140612	us-west1-b		4 vCPUs, 15 GB RAM	None	Service account	No	<span>OPEN JUPYTERLAB</span>

This will open a new tab with your Jupyterlab loaded.

Click *Check my progress* to verify the objective.

# Clone the sample code

Click on the **Terminal** icon. This will give you a temporary shell to enter commands. Enter in the following command to clone the sample repo from the training data analyst repository:

```
git clone https://github.com/GoogleCloudPlatform/training-data-analyst.git
```

Wait for this command to propagate. Then from the left-hand menu, select **training-data-analyst> quests> rl > early\_rl > early\_rl.ipynb**. This will open a new tab.

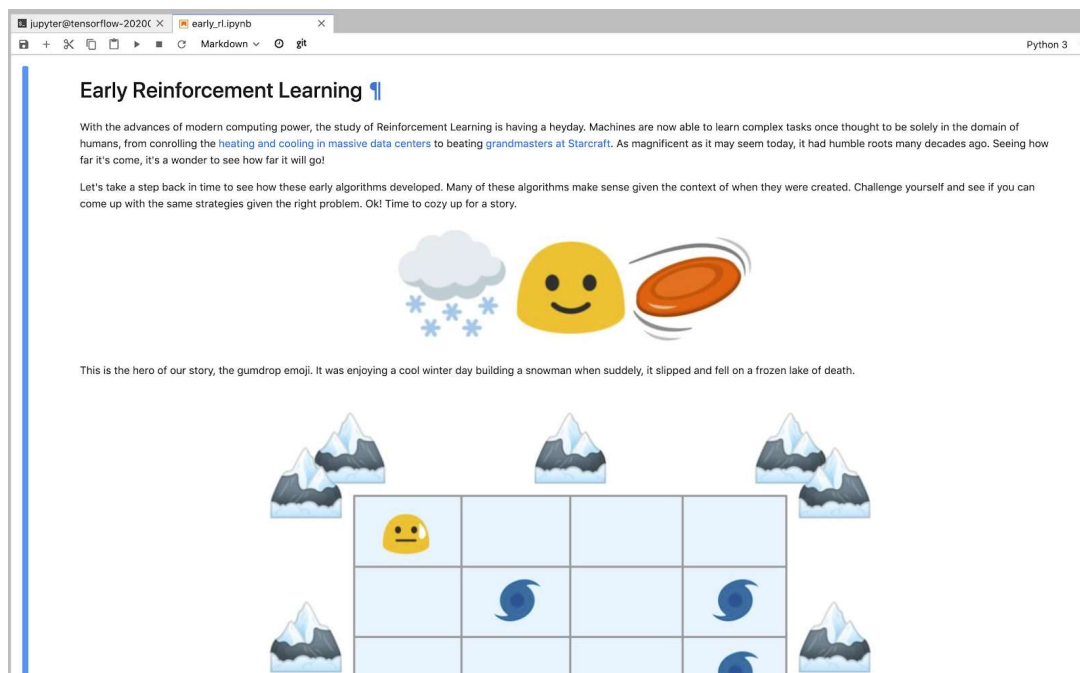
Click *Check my progress* to verify the objective.

Clone the sample code

Check my progress

# Run through the notebook

Your new tab should look similar to the following:



Read through the following notebook and run all code blocks with **Shift + Enter**.

Return here after you have completed the instructions in the notebook.



# Congratulations!

In this lab you learned the basic principles of reinforcement learning (RL). After creating a Jupyterlab instance, you cloned a sample repository and ran through a notebook where you received hands-on practice with the fundamentals of reinforcement learning. You are now ready to take more labs in this series.

## Finish Your Quest



This self-paced lab is part of the Qwiklabs Quest [Baseline: Data, ML, AI](#). A Quest is a series of related labs that form a learning path. Completing this Quest earns you the badge above, to recognize your achievement. You can make your badge (or badges) public and link to them in your online resume or social media account. [Enroll in this Quest](#) and get immediate completion credit if you've taken this lab.

This lab isn't part of a quest (yet), but you can check out other [available Qwiklabs Quests here](#).

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