Deep Reinforcement Beginners Learning Tutorial
Installation Guide

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Contents

1 Introduction

Deep Reinforcement Learning (also called RL) is a huge step towards the creation of an universal artificial intelligence. In 2013 a company, owned by Google, called "Deep Mind", was able to create an astonishing implementation of RL, which was capable to play retro games of the console "Atari 2600". In many cases the AI [1] was not only able to play the games successfully, but also exceeded human performances significantly [1].
As a fairly new topic, beginners often struggle to find a good starting point into the world of AI and specifically RL. Many tutorials are written for more advanced users, who already know basics of machine learning. The "Deep Reinforcement Learning Tutorial" will provide an easy-to-follow, hands-on beginners guide to RL. After the completion, we will be able to write our own algorithm to play some basic games for us.
This installation guide will lead the reader through the setup process for the tutorial. It is also possible to use this as a base for different Machine Learning base, as we will install many standard utilities.

Prerequisites It is recommended that the reader already acquired some basic knowledge about programming with Python and is familiar with basic deep learning concepts like Un-/Supervised Learning or at least with basic concept

[1] Artificial Intelligence

of AI. It is also useful to be able to perform some basic Linux commands, as we will use them later to install some additional packages.

Outlook The user will get to know basic concepts of RL with the help of the following programs/utilities/libraries:

Python3 One of the most popular programming languages for deep learning. The following tutorials will be based on Python. See `https://www.python.org/` for more information.

Pip A package installer for Python, which will download and install packages for us from a repository.

Jupyter Lab Enables execution of Python code inside a document, used to teach theory and implementation.

Google Cloud Cloud based processing power for training of different implementations of RL. Delivers a linux environment with preinstalled utilities for deep learning including different libraries for Python, Python itself and Jupyter Lab.

Keras Framework, which delivers different premade algorithms.

OpenAiGym A framework to train and evaluate different AI-based algorithms

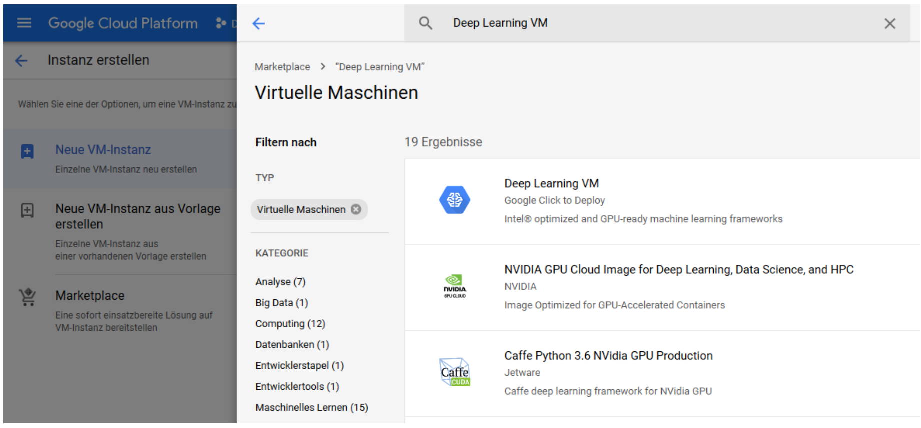
2 Installation

2.1 Google Cloud

As "Reinforcement Learning" is pretty resource-intensive, Google Cloud will deliver the required performance in the cloud. Python itself, all libraries required and Jupyter Lab need to be available. Luckily, Google already provides a template for a Linux Virtual Machine, which we can use as base for this tutorial. You will have to create a Google account to use the cloud.
It is also possible to use this tutorial locally. You will have to prepare a Jupyter Lab environment with the help of PIP or Anaconda and install all required libraries manually. Both are package installers for Python. Check this tutorial `https://jupyterlab.readthedocs.io/en/stable/getting_started/installation.html` for more information.

2.1.1 Deep Learning VM

To get started in the most simple way, we will use the Google "Deep Learning VM" template to create our environment. It can be found at `https://cloud.google.com/deep-learning-vm` or alternatively you can search for "Deep Learning VM" in the Google Cloud marketplace, as shown in picture 1.



Google Cloud Platform

Instanz erstellen

Wählen Sie eine der Optionen, um eine VM-Instanz zu

Neue VM-Instanz
Einzelne VM-Instanz neu erstellen

Neue VM-Instanz aus Vorlage erstellen
Einzelne VM-Instanz aus einer vorhandenen Vorlage erstellen

Marketplace
Eine sofort einsatzbereite Lösung auf VM-Instanz bereitstellen

Deep Learning VM

Marketplace > "Deep Learning VM"

Virtuelle Maschinen

Filtern nach

TYP

Virtuelle Maschinen

KATEGORIE

Analyse (7)
Big Data (1)
Computing (12)
Datenbanken (1)
Entwicklerstapel (1)
Entwicklertools (1)
Maschinelles Lernen (15)

19 Ergebnisse

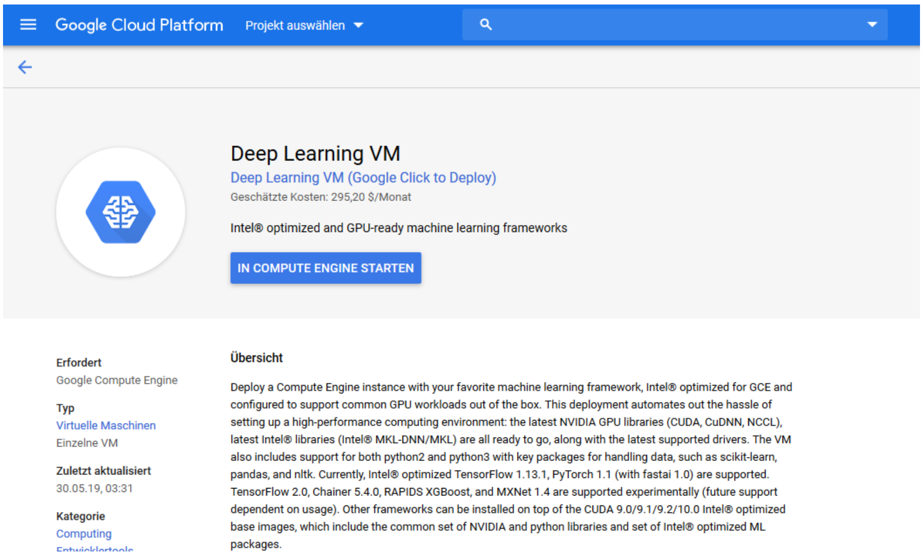
Deep Learning VM
Google Click to Deploy
Intel® optimized and GPU-ready machine learning frameworks

NVIDIA GPU Cloud Image for Deep Learning, Data Science, and HPC
NVIDIA
Image Optimized for GPU-Accelerated Containers

Caffe Python 3.6 NVidia GPU Production
Jetware
Caffe deep learning framework for NVidia GPU

Figure 1: Searching for "Deep Learning VM"

After you choose the virtual machine, you will be provided with some additional information. Choose "start in compute engine" as shown in picture 2.



Google Cloud Platform Projekt auswählen

Deep Learning VM
Deep Learning VM (Google Click to Deploy)
Geschätzte Kosten: 295,20 $/Monat

Intel® optimized and GPU-ready machine learning frameworks

IN COMPUTE ENGINE STARTEN

Erfordert
Google Compute Engine

Typ
Virtuelle Maschinen
Einzelne VM

Zuletzt aktualisiert
30.05.19, 03:31

Kategorie
Computing
Entwicklertools

Übersicht

Deploy a Compute Engine instance with your favorite machine learning framework, Intel® optimized for GCE and configured to support common GPU workloads out of the box. This deployment automates out the hassle of setting up a high-performance computing environment: the latest NVIDIA GPU libraries (CUDA, CuDNN, NCCL), latest Intel® libraries (Intel® MKL-DNN/MKL) are all ready to go, along with the latest supported drivers. The VM also includes support for both python2 and python3 with key packages for handling data, such as scikit-learn, pandas, and nltk. Currently, Intel® optimized TensorFlow 1.13.1, PyTorch 1.1 (with fastai 1.0) are supported. TensorFlow 2.0, Chainer 5.4.0, RAPIDS XGBoost, and MXNet 1.4 are supported experimentally (future support dependent on usage). Other frameworks can be installed on top of the CUDA 9.0/9.1/9.2/10.0 Intel® optimized base images, which include the common set of NVIDIA and python libraries and set of Intel® optimized ML packages.

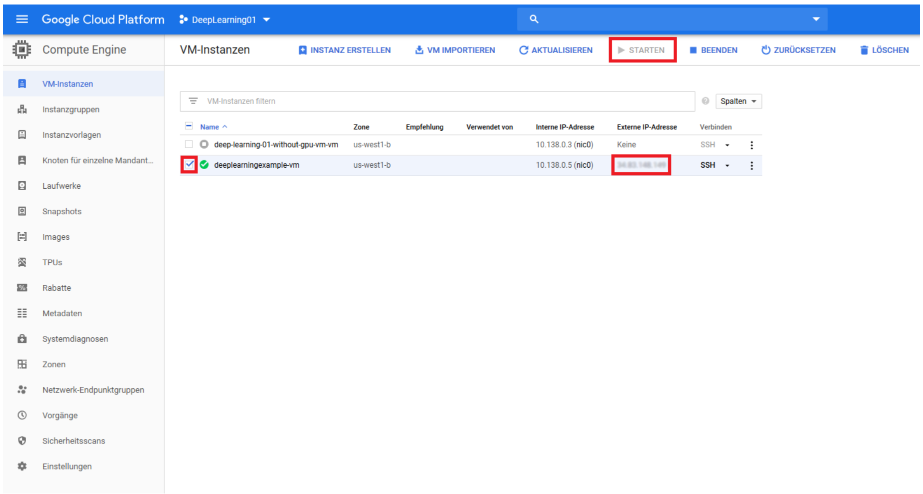
Figure 2: After Selecting "Deep Learning VM"

You will be presented with the final configuration screen as shown in picture 3 . We need to configure the following options:

- Choose a name for your virtual machine
- Choose any number of CPU/GPU you want to use (1 CPU is enough)
- Choose TensorFlow 1.13 as framework
- Activate: "Install NVIDIA GPU Driver automatically on first startup?"
- Activate: "Enable access to JupyterLab via URL instead of SSH."

- Choose a proper size for the boot disk (minimum of 30 GB is enough)

Starting the VM The VM will start automatically after creating it. It can also be started manually by selecting it in the vm instances menu and pressing the start button, as shown in picture 4.

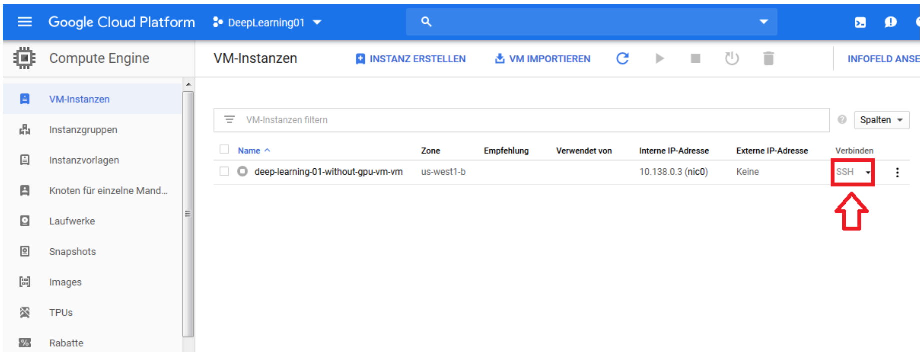


	Name	Zone	Empfehlung	Verwendet von	Interne IP-Adresse	Externe IP-Adresse	Verbinden
□	deep-learning-01-without-gpu-vm-vm	us-west1-b			10.138.0.3 (nic0)	Keine	SSH
☑	deeplearningexample-vm	us-west1-b			10.138.0.5 (nic0)	[redacted]	SSH

Figure 4: Starting the VM

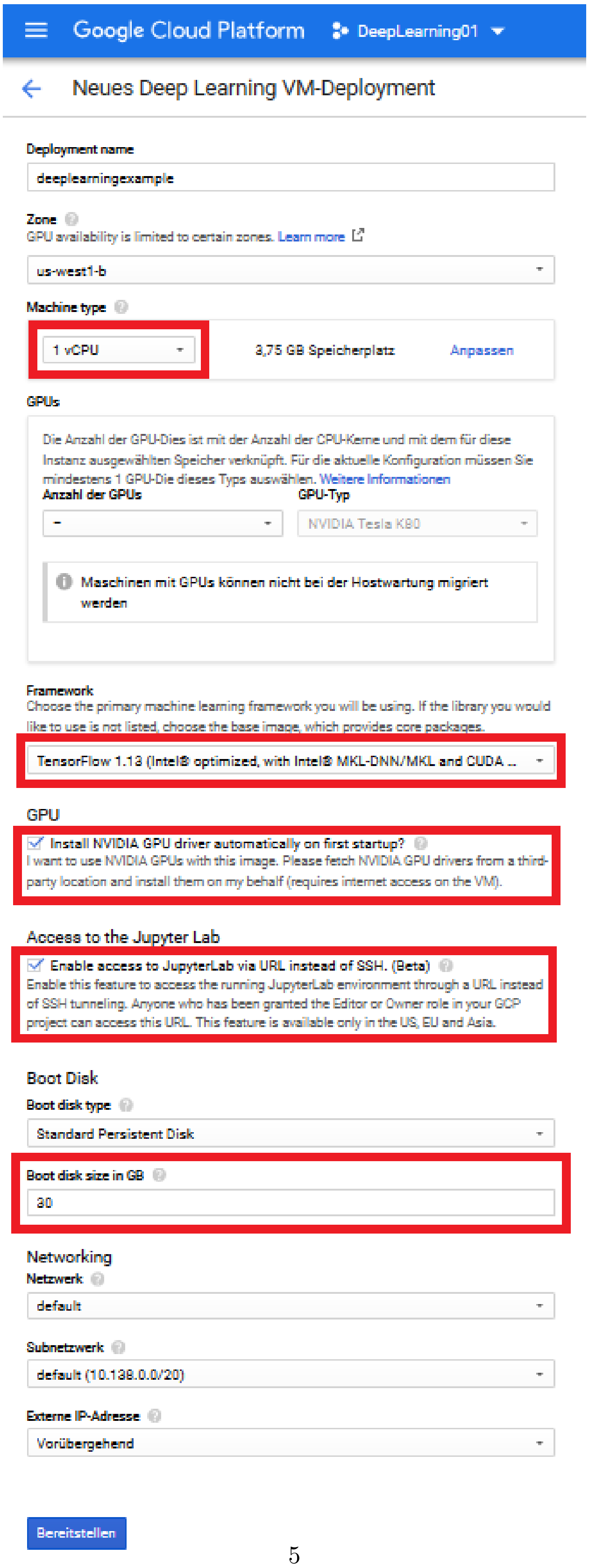
2.1.2 Installing Additional Software

After we successfully created our first virtual machine instance, we need to install some additional software on the virtual machine. This is possible through an administrator console, which can be opened by clicking the "SSH" button in the "virtual machine instances" sub-menu, as shown in picture 5. The open console can be seen in picture 6.



	Name	Zone	Empfehlung	Verwendet von	Interne IP-Adresse	Externe IP-Adresse	Verbinden
□	deep-learning-01-without-gpu-vm-vm	us-west1-b			10.138.0.3 (nic0)	Keine	SSH

Figure 5: The "SSH" button



Neues Deep Learning VM-Deployment

Deployment name

deeplearningexample

Zone

GPU availability is limited to certain zones. Learn more

us-west1-b

Machine type

1 vCPU | 3,75 GB Speicherplatz | Anpassen

GPUs

Die Anzahl der GPU-Dies ist mit der Anzahl der CPU-Kerne und mit dem für diese Instanz ausgewählten Speicher verknüpft. Für die aktuelle Konfiguration müssen Sie mindestens 1 GPU-Die dieses Typs auswählen. Weitere Informationen

Anzahl der GPUs: –

GPU-Typ: NVIDIA Tesla K80

Maschinen mit GPUs können nicht bei der Hostwartung migriert werden

Framework

Choose the primary machine learning framework you will be using. If the library you would like to use is not listed, choose the base image, which provides core packages.

TensorFlow 1.13 (Intel® optimized, with Intel® MKL-DNN/MKL and CUDA ...

GPU

☑ Install NVIDIA GPU driver automatically on first startup?

I want to use NVIDIA GPUs with this image. Please fetch NVIDIA GPU drivers from a third-party location and install them on my behalf (requires internet access on the VM).

Access to the Jupyter Lab

☑ Enable access to JupyterLab via URL instead of SSH. (Beta)

Enable this feature to access the running JupyterLab environment through a URL instead of SSH tunneling. Anyone who has been granted the Editor or Owner role in your GCP project can access this URL. This feature is available only in the US, EU and Asia.

Boot Disk

Boot disk type

Standard Persistent Disk

Boot disk size in GB

30

Networking

Netzwerk

default

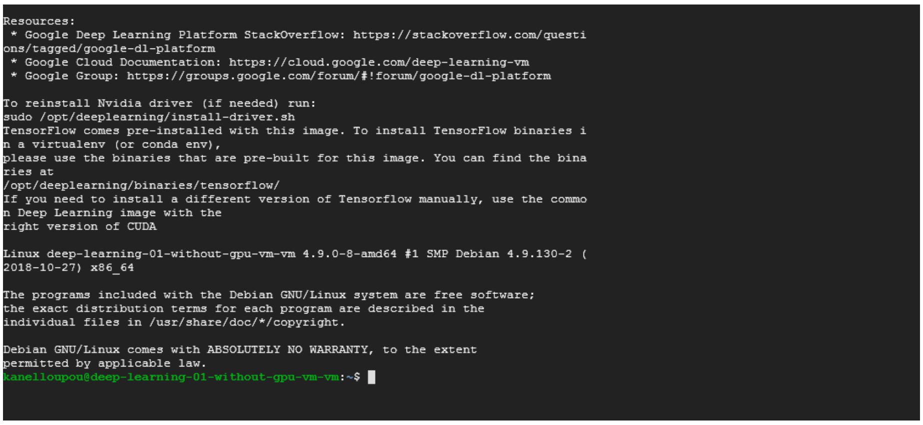
Subnetzwerk

default (10.138.0.0/20)

Externe IP-Adresse

Vorübergehend

Figure 3: Final Configuration Screen



```
Resources:
 * Google Deep Learning Platform StackOverflow: https://stackoverflow.com/questi
ons/tagged/google-dl-platform
 * Google Cloud Documentation: https://cloud.google.com/deep-learning-vm
 * Google Group: https://groups.google.com/forum/#!forum/google-dl-platform

To reinstall Nvidia driver (if needed) run:
sudo /opt/deeplearning/install-driver.sh
TensorFlow comes pre-installed with this image. To install TensorFlow binaries i
n a virtualenv (or conda env),
please use the binaries that are pre-built for this image. You can find the bina
ries at
/opt/deeplearning/binaries/tensorflow/
If you need to install a different version of Tensorflow manually, use the commo
n Deep Learning image with the
right version of CUDA

Linux deep-learning-01-without-gpu-vm-vm 4.9.0-8-amd64 #1 SMP Debian 4.9.130-2 (
2018-10-27) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
kanelloupou@deep-learning-01-without-gpu-vm-vm:~$
```

Figure 6: The administrator console

We need to execute the following commands:

- sudo apt−get install python−opengl
- sudo apt−get install xvfb

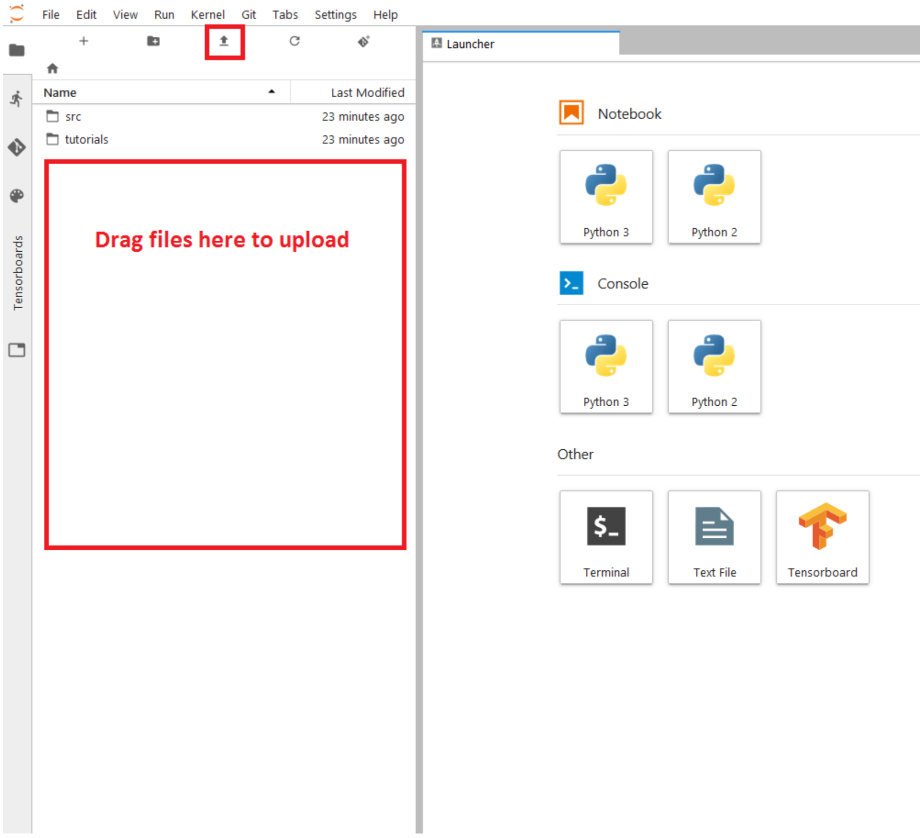
This will install both python-opengl and xvfb with root rights on our server. We may need to allow the installation by entering ”y”, if the console requests it. As the Google Cloud server does not provide a display or Open-Gl graphics drivers, we need these programs to run OpenAiGym with visible training/evaluation. After the installation we can finally use Jupyter Lab.

2.2 Jupyter Lab

We can connect to Jupyter Lab through the external address that is displayed in the vm instances menu and the port 8080 as shown in picture 4. The address can be entered into a web browser as follows: <external−address>:8080.

2.2.1 Upload Notebooks

After connecting to Jupyter Lab you will be presented with the main menu of Jupyter Lab as shown in picture 7. We can now upload the supplied ”Deep Reinforcement Learning” notebooks either by using the upload button in the left upper corner or drag and drop to files into the filebrowser. The notebooks can now be opened and used.



Name	Last Modified
src	23 minutes ago
tutorials	23 minutes ago

Drag files here to upload

Figure 7: Main Menu

3 Conclusion

We have now successfully set up the Google Cloud VM and fetched all dependencies that need to be installed manually. All other libraries will be automatically downloaded while using the notebooks. We can now continue with the first notebook.

References

[1] V. Mnih, K. Kavukcuoglu, D. Silver, A. Graves, I. Antonoglou, D. Wierstra, and M. A. Riedmiller, "Playing atari with deep reinforcement learning," *CoRR*, vol. abs/1312.5602, 2013.