

How to install Theano on Amazon EC2 GPU instances for deep learning

[update] If you would like to skip the instructions and just install from an AMI, search the community for ami-b141a2f5 (Theano - CUDA 7) in the N. California region.

[Theano](#) is an amazing Python package for deep learning that can utilize NVIDIA's CUDA toolkit to run on the gpu. The gpu is orders of magnitude faster than the cpu for math operations (such as matrix multiplication), which is essential for many machine learning algorithms. While setting up AWS to run my thesis experiments, I realized many instructions were out of date. Hopefully these steps will help you get your deep learning models up and running on AWS. These instructions use Ubuntu 14.04 64-bit with Cuda 7.0 on a g2.2xlarge instance.

Creating an EC2 g2.2xlarge instance

Log into your AWS management console and click over to EC2. There are two options for creating your instance:

- **On-Demand Instances:** This option guarantees that you have your section of a machine for computing. Use this option if you cannot handle potential interrupts and are willing to pay more. As of this writing, a g2.2xlarge instance costs \$0.65/hr. To create a dedicated instance, go to "Instances" and click "Launch Instance".
- **Spot Instances:** This option gives you left-over compute power at a much cheaper rate. Use this option if you can handle potential interrupts. Spot instances use a bidding system to determine who gets the left-over compute power; you can look at the history of rates under "Spot Requests". As of this writing, a g2.2xlarge spot instance costs \$0.0642/hr (10% of the price!) and seems fairly stable over the last few months. I ended up using a few spot requests, bidding \$0.07.

When choosing an AMI to use for the instance, pick the latest 64-bit Ubuntu (I used ami-df6a8b9b, which is Ubuntu 14.04). You should also set up the security group for your IP to have ssh access, and download a new private/public key file.

Installing Theano and its dependencies

Follow the instructions on [Amazon](#) to ssh into your instance. For Ubuntu on AWS, I found you have to use :

```
ssh -i [path/to/key.pem] ubuntu@[DNS]
```

Once you ssh into the instance, I recommend using screens (now updated to Tmux) to keep the session open so your program can run without the terminal window being open. Here are all the commands and the order I used to set up Theano:

1) update the default packages

```
sudo apt-get update
sudo apt-get -y dist-upgrade
```

2) create a new screen named theano (or look at using Tmux instead)

```
screen -S "theano"
```

3) install all the dependencies

```
sudo apt-get install -y gcc g++ gfortran build-essential git wget linux-image-generic libopenblas-dev python-dev python-pip python-nose pythc
```

4) install the bleeding-edge version of Theano

```
sudo pip install --upgrade --no-deps git+git://github.com/Theano/Theano.git
```

5) grab the latest (7.0) cuda toolkit.

```
sudo wget http://developer.download.nvidia.com/compute/cuda/repos/ubuntu1404/x86_64/cuda-repo-ubuntu1404_7.0-28_amd64.deb
```

6) depackage Cuda

```
sudo dpkg -i cuda-repo-ubuntu1404_7.0-28_amd64.deb
```

7) add the package and install the cuda driver (this takes a while)

```
sudo apt-get update
sudo apt-get install -y cuda
```

8) update the path to include cuda nvcc and ld_library_path

```
echo -e "\nexport PATH=/usr/local/cuda/bin:$PATH\n\nexport LD_LIBRARY_PATH=/usr/local/cuda/lib64" >> .bashrc
```

9) reboot the system for cuda to load

```
sudo reboot
```

Wait a little bit for the reboot and then ssh back into the instance.

10) install included samples and test cuda

```

cuda-install-samples-7.0.sh ~/
cd NVIDIA\CUDA-7.0\Samples\1\Utilities\deviceQuery
make
./deviceQuery

```

Make sure it shows that the GPU exists.

11) set up the theano config file to use gpu by default

```

echo -e "\n[global]\nfloatX=float32\ndevice=gpu\n[mode]=FAST_RUN\n\n[nvcc]\nfastmath=True\n\n[cuda]\nroot=/usr/local/cuda" >> ~/.theanorc

```

That's it! Now you can use git to pull whatever repo you need and test Theano. I recommend using the test script from Theano's site [here](#).

These instructions were partially gathered from [Erik Bernhardsson](#) and [Erik Hazzard](#), as well as the Ubuntu instructions from [Theano](#).

Optimizations

[Netfix](#) has a great post showing that you can customize some functions in the Cuda kernel to speed up Theano by ~70%. I haven't done this, but it is definitely something to check out.

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Sanjay Dorairaj · 3 days ago

I wanted to move up to the 16.04 version of Ubuntu and followed the below steps to successfully install CUDA

1. Used the AWS g2.2xlarge instance
2. Followed instructions here with the below exceptions (<http://markus.com/install-t...>)

Exceptions:

1. Did not use the AMI provided.
2. Used Ubuntu 16.04 and ran through the same instructions mentioned here.
3. The documentation refers to a 14.04 deb...I used the one for 16.04
 - 3.1. sudo wget <http://developer.download.n...>
5. Uninstalled the nvidia-375 driver that installs by default and replaced with nvidia-367 driver.
 - 5.1 sudo apt-get remove nvidia-375
 - 5.2 sudo apt-get install nvidia-367

Here is a list of all the steps I followed

```

sudo apt-get update
sudo apt-get -y dist-upgrade

```

[see more](#)

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Moiz Sajid · 2 months ago

Is the ami-b141a2f5 AMI still active? I got the following error. Not sure why I got this?

Launch Status

Launch Failed

This account is currently blocked and not recognized as a valid account. Please contact aws-verification@amazon.com if you have questions.

[Hide launch log](#)

Creating security groups	Successful (sg-71f3116)
Authorizing inbound rules	Successful
Initiating launches	Failure Retry

[Cancel](#)
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Maciej · 6 months ago

Sort of a self-promotion I suppose but I thought some of you reading this may find it useful if you would like to skip the self-install and would like an up-to-date <http://markus.com/install-theano-on-aws/>