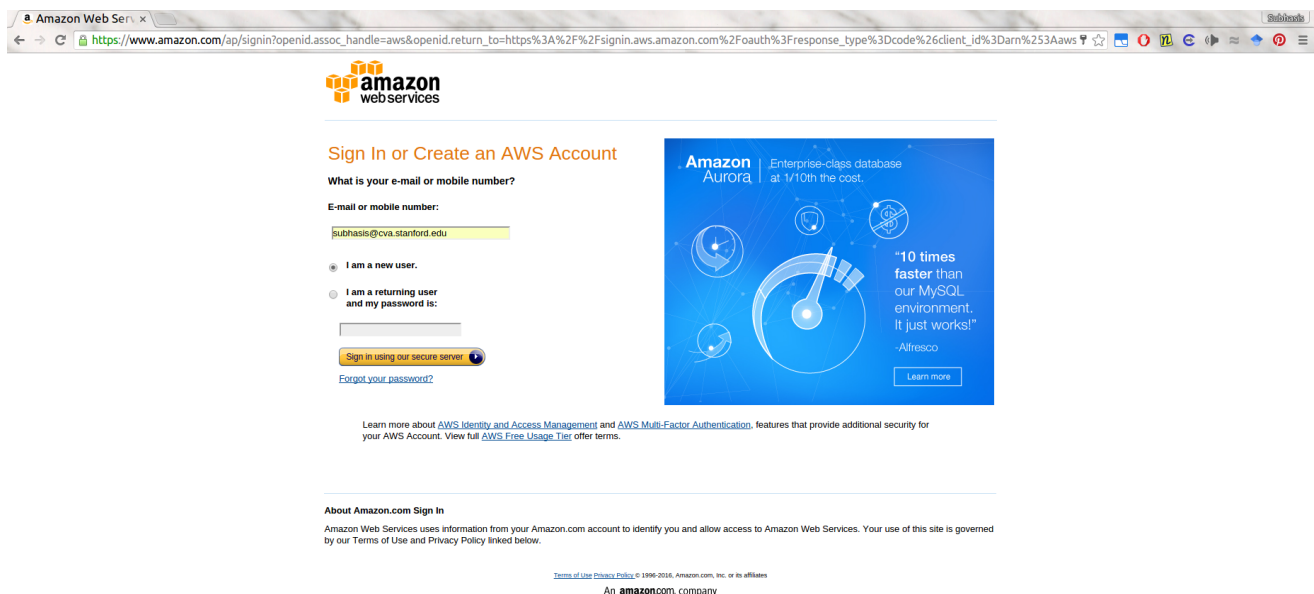


# Module 0: AWS Tutorial

For GPU instances, we also have an Amazon Machine Image (AMI) that you can use to launch GPU instances on Amazon EC2. This tutorial goes through how to set up your own EC2 instance with the provided AMI. **We do not currently distribute AWS credits to CS231N students but you are welcome to use this snapshot on your own budget.**

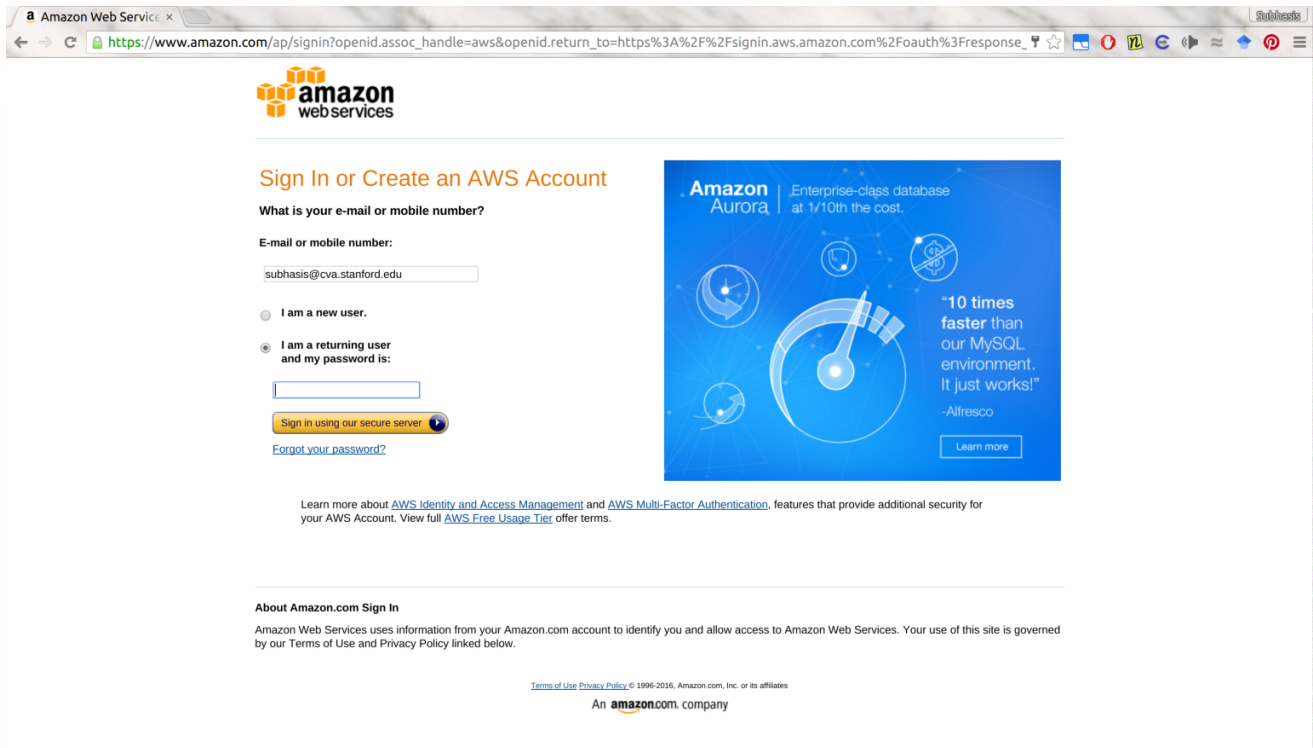
**TL;DR** for the AWS-savvy: Our image is `cs231n_caffe_torch7_keras_lasagne_v2`, AMI ID: `ami-125b2c72` in the us-west-1 region. Use a `g2.2xlarge` instance. Caffe, Torch7, Theano, Keras and Lasagne are pre-installed. Python bindings of caffe are available. It has CUDA 7.5 and CuDNN v3.

First, if you don't have an AWS account already, create one by going to the [AWS homepage](#), and clicking on the yellow "Sign In to the Console" button. It will direct you to a signup page which looks like the following.

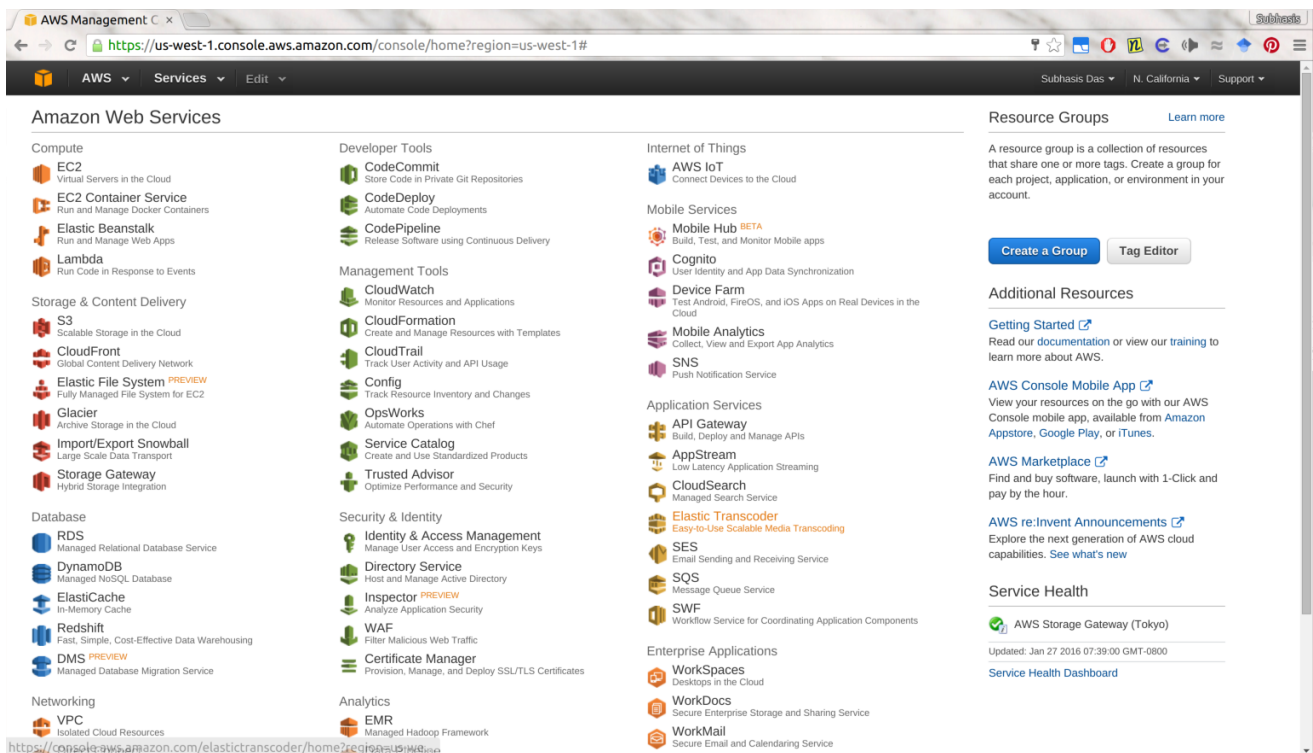


Select the "I am a new user" checkbox, click the "Sign in using our secure server" button, and follow the subsequent pages to provide the required details. They will ask for a credit card information, and also a phone verification, so have your phone and credit card ready.

Once you have signed up, go back to the [AWS homepage](#), click on "Sign In to the Console", and this time sign in using your username and password.



Once you have signed in, you will be greeted by a page like this:



Make sure that the region information on the top right is set to N. California. If it is not, change it to N. California by selecting from the dropdown menu there.

(Note that the subsequent steps requires your account to be "Verified" by Amazon. This may take up to 2 hrs, and you may not be able to launch instances until your account verification is complete.)

Next, click on the EC2 link (first link under the Compute category). You will go to a dashboard page like this:

The screenshot shows the AWS Management Console for the EC2 service in the US West (N. California) region. The left sidebar contains navigation links for various AWS services. The main area displays the 'Resources' section, which lists the number of resources in use for different EC2 categories. A 'Create Instance' button is prominently displayed. The right sidebar provides account details and additional resources.

Click the blue "Launch Instance" button, and you will be redirected to a page like the following:

The screenshot shows the 'Launch Instance Wizard' in the AWS Management Console, specifically Step 1: Choose an Amazon Machine Image (AMI). The page displays a list of available AMIs, including Amazon Linux, Red Hat Enterprise Linux, SUSE Linux Enterprise Server, Ubuntu Server, and Microsoft Windows Server. The 'Amazon Linux AMI 2015.09.1 (HVM), SSD Volume Type' is highlighted. The left sidebar shows navigation links, and the right sidebar includes a 'Cancel and Exit' link.

Click on the "Community AMIs" link on the left sidebar, and search for "cs231n" in the search box. You should be able to see the AMI `cs231n_caffe_torch7_keras_lasagne_v2` (AMI ID: `ami-125b2c72`). Select that AMI, and continue to the next step to choose your instance type.

EC2 Management Console - Step 1: Choose an Amazon Machine Image (AMI)

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group 7. Review

Cancel and Exit

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your own AMIs.

Quick Start

My AMIs

AWS Marketplace

Community AMIs

Operating system

- ☐ Amazon Linux
- ☐ Cent OS
- ☐ Debian
- ☐ Fedora
- ☐ Gentoo
- ☐ OpenSUSE
- ☐ Other Linux
- ☐ Red Hat
- ☐ SUSE Linux
- ☐ Ubuntu
- ☐ Windows

Architecture

- ☐ 32-bit

Search: cs231n

cs231n\_caffe\_torch7\_keras\_lasagne\_v2 - ami-125b2c72

Image for CS231N. Contains Caffe, Torch7, Keras, Lasagne. CUDA v7.5, CUDNN v3.

Root device type: ebs Virtualization type: hvm

Select

64-bit

Feedback English

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Choose the instance type `g2.xlarge`, and click on "Review and Launch".

EC2 Management Console - Step 2: Choose an Instance Type

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group 7. Review

Step 2: Choose an Instance Type

|                                     |                   |                  |          |           |                     |            |             |
|-------------------------------------|-------------------|------------------|----------|-----------|---------------------|------------|-------------|
| <input type="checkbox"/>            | Compute optimized | c3.xlarge        | 4        | 7.5       | 2 x 40 (SSD)        | Yes        | Moderate    |
| <input type="checkbox"/>            | Compute optimized | c3.2xlarge       | 8        | 15        | 2 x 80 (SSD)        | Yes        | High        |
| <input type="checkbox"/>            | Compute optimized | c3.4xlarge       | 16       | 30        | 2 x 160 (SSD)       | Yes        | High        |
| <input type="checkbox"/>            | Compute optimized | c3.8xlarge       | 32       | 60        | 2 x 320 (SSD)       | -          | 10 Gigabit  |
| <input checked="" type="checkbox"/> | GPU instances     | <b>g2.xlarge</b> | <b>8</b> | <b>15</b> | <b>1 x 60 (SSD)</b> | <b>Yes</b> | <b>High</b> |
| <input type="checkbox"/>            | GPU instances     | g2.8xlarge       | 32       | 60        | 2 x 120 (SSD)       | -          | 10 Gigabit  |
| <input type="checkbox"/>            | Memory optimized  | r3.large         | 2        | 15        | 1 x 32 (SSD)        | -          | Moderate    |
| <input type="checkbox"/>            | Memory optimized  | r3.xlarge        | 4        | 30.5      | 1 x 80 (SSD)        | Yes        | Moderate    |
| <input type="checkbox"/>            | Memory optimized  | r3.2xlarge       | 8        | 61        | 1 x 160 (SSD)       | Yes        | High        |
| <input type="checkbox"/>            | Memory optimized  | r3.4xlarge       | 16       | 122       | 1 x 320 (SSD)       | Yes        | High        |
| <input type="checkbox"/>            | Memory optimized  | r3.8xlarge       | 32       | 244       | 2 x 320 (SSD)       | -          | 10 Gigabit  |
| <input type="checkbox"/>            | Storage optimized | i2.xlarge        | 4        | 30.5      | 1 x 800 (SSD)       | Yes        | Moderate    |
| <input type="checkbox"/>            | Storage optimized | i2.2xlarge       | 8        | 61        | 2 x 800 (SSD)       | Yes        | High        |
| <input type="checkbox"/>            | Storage optimized | i2.4xlarge       | 16       | 122       | 4 x 800 (SSD)       | Yes        | High        |

Cancel Previous **Review and Launch** Next: Configure Instance Details

Feedback English

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In the next page, click on Launch.

EC2 Management Console - Step 7: Review Instance Launch

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group 7. Review

Step 7: Review Instance Launch

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

**Improve your instances' security.** Your security group, **launch-wizard-1**, is open to the world.  
Your instances may be accessible from any IP address. We recommend that you update your security group rules to allow access from known IP addresses only. You can also open additional ports in your security group to facilitate access to the application or service you're running, e.g., HTTP (80) for web servers. [Edit security groups](#)

**Your instance configuration is not eligible for the free usage tier**  
To launch an instance that's eligible for the free usage tier, check your AMI selection, instance type, configuration options, or storage devices. Learn more about [free usage tier](#) eligibility and usage restrictions. [Don't show me this again](#)

AMI Details

**cs231n\_caffe\_torch7\_keras\_lasagne\_v2 - ami-125b2c72**  
Image for CS231N. Contains Caffe, Torch7, Keras, Lasagne. CUDA v7.5, CUDNN v3.  
Root Device Type: ebs Virtualization type: hvm

Instance Type

| Instance Type | ECUs | vCPUs | Memory (GiB) | Instance Storage (GB) | EBS-Optimized Available | Network Performance |
|---------------|------|-------|--------------|-----------------------|-------------------------|---------------------|
| g2.xlarge     | 26   | 8     | 15           | 1 x 60                | Yes                     | High                |

Security Groups

Security group name: launch-wizard-1

[Cancel](#) [Previous](#) [Launch](#)

You will be then prompted to create or use an existing key-pair. If you already use AWS and have a key-pair, you can use that, or alternately you can create a new one by choosing "Create a new key pair" from the drop-down menu and giving it some name of your choice. You should then download the key pair, and keep it somewhere that you won't accidentally delete. Remember that there is **NO WAY** to get to your instance if you lose your key.

EC2 Management Console - Step 7: Review Instance Launch

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group 7. Review

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AMI Details

**cs231n\_caffe\_torch7\_keras\_lasagne\_v2 - ami-125b2c72**  
Image for CS231N. Contains Caffe, Torch7, Keras, Lasagne. CUDA v7.5, CUDNN v3.  
Root Device Type: ebs Virtualization type: hvm

Instance Type

| Instance Type | ECUs | vCPUs | Memory (GiB) | Instance Storage (GB) | EBS-Optimized Available | Network Performance |
|---------------|------|-------|--------------|-----------------------|-------------------------|---------------------|
| g2.xlarge     | 26   | 8     | 15           | 1 x 60                | Yes                     | High                |

Security Groups

Security group name: launch-wizard-1

[Cancel](#) [Previous](#) [Launch](#)

**Select an existing key pair or create a new key pair**

A key pair consists of a **public key** that AWS stores, and a **private key file** that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance.

Note: The selected key pair will be added to the set of keys authorized for this instance. Learn more about [removing existing key pairs from a public AMI](#).

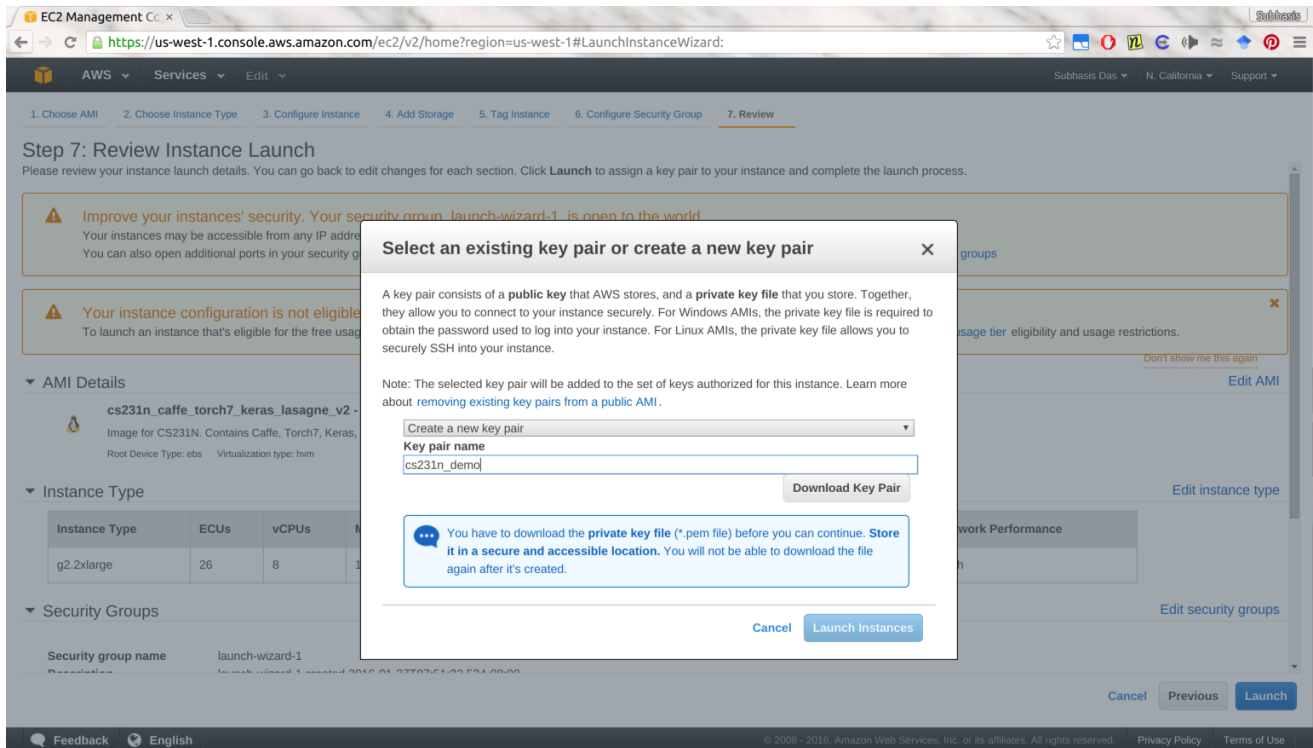
Choose an existing key pair

Select a key pair

No key pairs found

**No key pairs found**  
You don't have any key pairs. Please create a new key pair by selecting the **Create a new key pair** option above to continue.

[Cancel](#) [Launch Instances](#)



Once you download your key, you should change the permissions of the key to user-only RW, In Linux/OSX you can do it by:

```
$ chmod 600 PEM_FILENAME
```

Here `PEM_FILENAME` is the full file name of the .pem file you just downloaded.

After this is done, click on "Launch Instances", and you should see a screen showing that your instances are launching:



EC2 Management x

https://us-west-1.console.aws.amazon.com/ec2/v2/home?region=us-west-1#LaunchInstanceWizard:

AWS Services Edit

Subhasis Das N. California Support

### Launch Status

**Your instances are now launching**  
The following instance launches have been initiated: [i-af41511d](#) [View launch log](#)

**Get notified of estimated charges**  
Create billing alerts to get an email notification when estimated charges on your AWS bill exceed an amount you define (for example, if you exceed the free usage tier).

How to connect to your instances

Your instances are launching, and it may take a few minutes until they are in the **running** state, when they will be ready for you to use. Usage hours on your new instances will start immediately and continue to accrue until you stop or terminate your instances. Click **View Instances** to monitor your instances' status. Once your instances are in the **running** state, you can **connect** to them from the Instances screen. [Find out](#) how to connect to your instances.

▼ Here are some helpful resources to get you started

- [How to connect to your Linux instance](#)
- [Amazon EC2: User Guide](#)
- [Learn about AWS Free Usage Tier](#)
- [Amazon EC2: Discussion Forum](#)

While your instances are launching you can also

- [Create status check alarms](#) to be notified when these instances fail status checks. (Additional charges may apply)
- [Create and attach additional EBS volumes](#) (Additional charges may apply)
- [Manage security groups](#)

[View Instances](#)

Click on "View Instances" to see your instance state. It should change to "Running" and "2/2 status checks passed" as shown below within some time. You are now ready to ssh into the instance.

EC2 Management x

https://us-west-1.console.aws.amazon.com/ec2/v2/home?region=us-west-1#Instances:

AWS Services Edit

Subhasis Das N. California Support

EC2 Dashboard Events Tags Reports Limits

INSTANCES

- Instances
- Spot Requests
- Reserved Instances
- Commands
- Dedicated Hosts

IMAGES

- AMIs
- Bundle Tasks

ELASTIC BLOCK STORE

- Volumes
- Snapshots

NETWORK & SECURITY

- Security Groups
- Elastic IPs
- Placement Groups
- Key Pairs
- Network Interfaces

LOAD BALANCING

- Load Balancers

AUTO SCALING

- Launch Configurations
- Auto Scaling Groups

**Launch Instance** **Connect** **Actions**

Filter by tags and attributes or search by keyword

| Name | Instance ID | Instance Type | Availability Zone | Instance State | Status Checks  | Alarm Status | Public DNS                                       | Public IP    |
|------|-------------|---------------|-------------------|----------------|----------------|--------------|--|--------------|
|      | i-af41511d  | g2.2xlarge    | us-west-1c        | running        | 2/2 checks ... | None         | ec2-54-183-60-80.us-west-1.compute.amazonaws.com | 54.183.60.80 |

Instance: **i-af41511d** Public DNS: **ec2-54-183-60-80.us-west-1.compute.amazonaws.com**

**Description** **Status Checks** **Monitoring** **Tags**

|                       |  |                   |   |
|-----------------------|--|-------------------|---|
| Instance ID           | i-af41511d                                 | Public DNS        | ec2-54-183-60-80.us-west-1.compute.amazonaws.com    |
| Instance state        | running                                    | Public IP         | 54.183.60.80  |
| Instance type         | g2.2xlarge                                 | Elastic IP        | -   |
| Private DNS           | ip-172-31-0-241.us-west-1.compute.internal | Availability zone | us-west-1c  |
| Private IPs           | 172.31.0.241                               | Security groups   | launch-wizard-3, view rules                         |
| Secondary private IPs | -  | Scheduled events  | No scheduled events                                 |
| VPC ID                | vpc-90bc22f5                               | AMI ID            | cs231n_caffe_torch7_keras_lasagne_v2 (ami-125b2c72) |
| Subnet ID             | subnet-7f199526                            | Platform          | -   |

First, note down the Public IP of the instance from the instance listing. Then, do:

```
ssh -i PEM_FILENAME ubuntu@PUBLIC_IP
```

Now you should be logged in to the instance. You can check that Caffe is working by doing:

```
$ cd caffe
$ ./build/tools/caffe time --gpu 0 --model examples/mnist/lenet.prototxt
```

We have Caffe, Theano, Torch7, Keras and Lasagne pre-installed. Caffe python bindings are also available by default. We have CUDA 7.5 and CuDNN v3 installed.

If you encounter any error such as

```
Check failed: error == cudaSuccess (77 vs. 0) an illegal memory access was
encountered
```

you might want to terminate your instance and start over again. I have observed this rarely, and I am not sure what causes this.

About how to use these instances:

- The root directory is only 12GB, and only ~ 3GB of that is free.
- There should be a 60GB `/mnt` directory that you can use to put your data, model checkpoints, models etc.
- Remember that the `/mnt` directory won't be persistent across reboots/terminations.
- Stop your instances when are done for the day to avoid incurring charges. GPU instances are costly. Use your funds wisely. Terminate them when you are sure you are done with your instance (disk storage also costs something, and can be significant if you have a large disk footprint).
- Look into creating custom alarms to automatically stop your instances when they are not doing anything.
- If you need access to a large dataset and don't want to download it every time you spin up an instance, the best way to go would be to create an AMI for that and attach that AMI to your machine when configuring your instance (before launching but after you have selected the AMI).