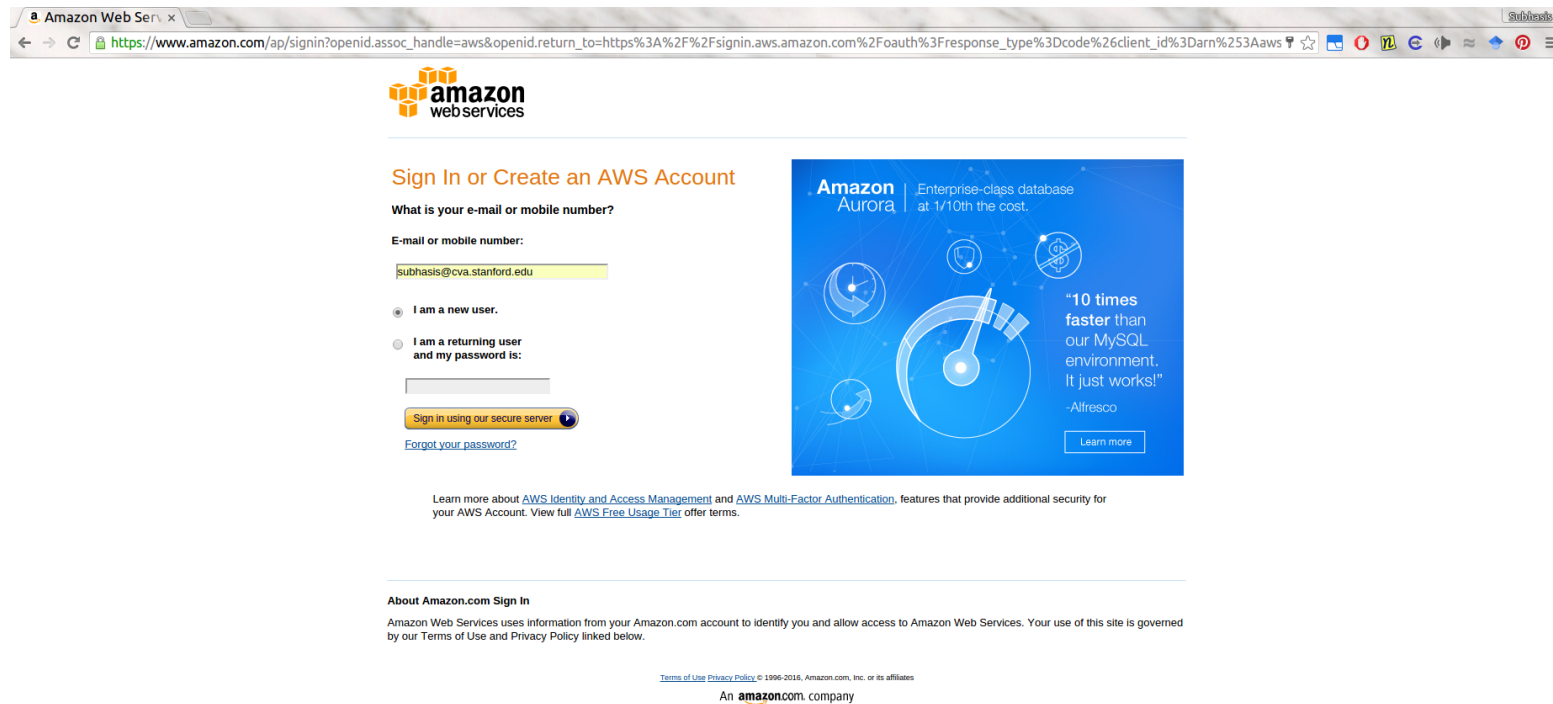


AWS Tutorial

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.

Amazon Web Services

Sign In or Create an AWS Account

What is your e-mail or mobile number?

E-mail or mobile number:

subhasis@cva.stanford.edu

☐ I am a new user.

☒ I am a returning user and my password is:

Sign in using our secure server

[Forgot your password?](#)

Amazon Aurora | Enterprise-class database at 1/10th the cost.

"10 times faster than our MySQL environment. It just works!"
-Alfresco

Learn more

Learn more about [AWS Identity and Access Management](#) and [AWS Multi-Factor Authentication](#), features that provide additional security for your AWS Account. View full [AWS Free Usage Tier](#) offer terms.

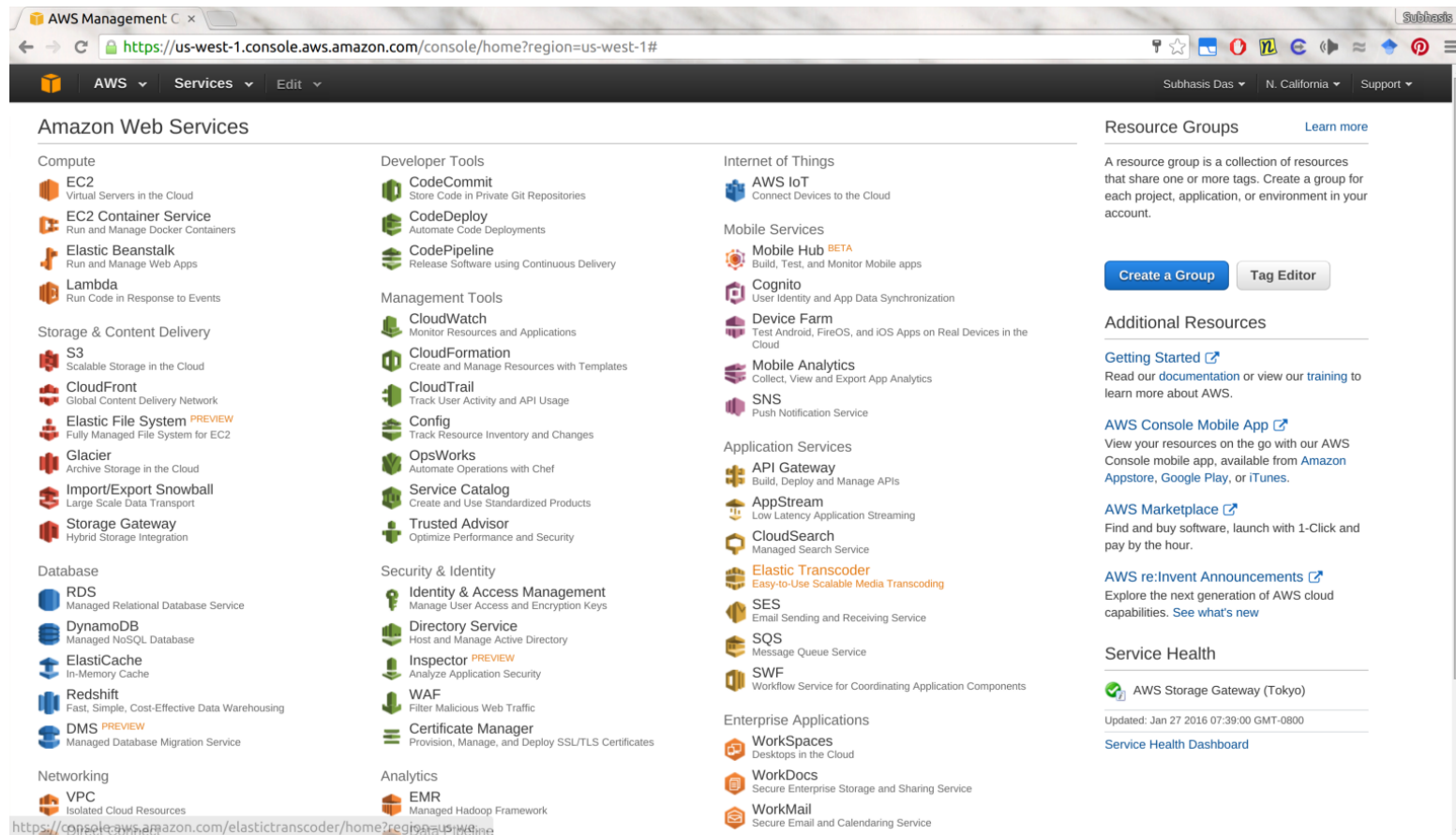
About Amazon.com Sign In

Amazon Web Services uses information from your Amazon.com account to identify you and allow access to Amazon Web Services. Your use of this site is governed by our [Terms of Use](#) and [Privacy Policy](#) linked below.

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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-1 region. The left sidebar contains a navigation menu with categories like EC2 Dashboard, INSTANCES, IMAGES, ELASTIC BLOCK STORE, NETWORK & SECURITY, LOAD BALANCING, and AUTO SCALING. The main content area is divided into several sections: Resources (listing 0 Running Instances, 0 Elastic IPs, 0 Snapshots, 0 Load Balancers, 0 Key Pairs, 1 Security Groups, 0 Dedicated Hosts, 0 Volumes, 0 Placement Groups), Account Attributes (Supported Platforms, Default VPC, Resource ID length management), Additional Information (Getting Started Guide, Documentation, All EC2 Resources, Forums, Pricing, Contact Us), AWS Marketplace (Tableau Server, SAP HANA One), Create Instance (with a 'Launch Instance' button), Service Health (showing US West (N. California) as operating normally), and Scheduled Events (showing no events). A blue banner at the top of the main content area promotes Amazon Simple Queue Service. The bottom of the page features a footer with 'Feedback', 'English', and copyright information.

EC2 Management Console

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

AWS Services Edit

Subhas 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

Resources

You are using the following Amazon EC2 resources in the US West (N. California) region:

- 0 Running Instances
- 0 Elastic IPs
- 0 Dedicated Hosts
- 0 Snapshots
- 0 Volumes
- 0 Load Balancers
- 0 Key Pairs
- 1 Security Groups
- 0 Placement Groups

Need fast, reliable, scalable, fully-managed message queuing? [Try Amazon Simple Queue Service.](#)

Create Instance

To start using Amazon EC2 you will want to launch a virtual server, known as an Amazon EC2 instance.

[Launch Instance](#)

Note: Your instances will launch in the US West (N. California) region

Service Health

Service Status:

- US West (N. California): This service is operating normally

Availability Zone Status:

- us-west-1a: Availability zone is operating normally
- us-west-1c: Availability zone is operating normally

[Service Health Dashboard](#)

Scheduled Events

US West (N. California):

No events

Account Attributes

Supported Platforms

VPC

Default VPC

vpc-90bc22f5

Resource ID length management

Additional Information

- [Getting Started Guide](#)
- [Documentation](#)
- [All EC2 Resources](#)
- [Forums](#)
- [Pricing](#)
- [Contact Us](#)

AWS Marketplace

Find **free software trial** products in the AWS Marketplace from the [EC2 Launch Wizard](#). Or try these popular AMIs:

- [Tableau Server \(10 users\)](#)
Provided by Tableau
Rating ★★★★★
Pay by the hour for Tableau software and AWS usage
[View all Business Intelligence](#)
- [SAP HANA One 244GiB](#)
Provided by SAP America, Inc

Feedback English

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

EC2 Management Console

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

AWS Services Edit

Subhasis Das N. California Support

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

Step 1: Choose an Amazon Machine Image (AMI)






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

☐ Free tier only ⓘ

 Amazon Linux Free tier eligible	Amazon Linux AMI 2015.09.1 (HVM), SSD Volume Type - ami-d5ea86b5 The Amazon Linux AMI is an EBS-backed, AWS-supported image. The default image includes AWS command line tools, Python, Ruby, Perl, and Java. The repositories include Docker, PHP, MySQL, PostgreSQL, and other packages. Root device type: ebs Virtualization type: hvm	Select 64-bit
 Red Hat Free tier eligible	Red Hat Enterprise Linux 7.2 (HVM), SSD Volume Type - ami-d1315fb1 Red Hat Enterprise Linux version 7.2 (HVM), EBS General Purpose (SSD) Volume Type Root device type: ebs Virtualization type: hvm	Select 64-bit
 SUSE Linux Free tier eligible	SUSE Linux Enterprise Server 12 SP 1 (HVM), SSD Volume Type - ami-6d701b0d SUSE Linux Enterprise Server 12 Service Pack 1 (HVM), EBS General Purpose (SSD) Volume Type. Public Cloud, Advanced Systems Management, Web and Scripting, and Legacy modules enabled. Root device type: ebs Virtualization type: hvm	Select 64-bit
 Ubuntu Free tier eligible	Ubuntu Server 14.04 LTS (HVM), SSD Volume Type - ami-06116566 Ubuntu Server 14.04 LTS (HVM), EBS General Purpose (SSD) Volume Type. Support available from Canonical (http://www.ubuntu.com/cloud/services). Root device type: ebs Virtualization type: hvm	Select 64-bit
	Microsoft Windows Server 2012 R2 Base - ami-e7e78d87	Select

Feedback English

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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

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

AWS Services Edit

Subhasis Das N. California Support

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

Step 1: Choose an Amazon Machine Image (AMI)

[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

Architecture

☐ Amazon Linux

☐ Cent OS

☐ Debian

☐ Fedora

☐ Gentoo

☐ OpenSUSE

☐ Other Linux

☐ Red Hat

☐ SUSE Linux

☐ Ubuntu

☐ Windows

☐ 32-bit

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

Choose the instance type `g2.2xlarge`, and click on "Review and Launch".

EC2 Management Console | Subhasis

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

AWS Services Edit Subhasis Das N. California Support

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	g2.2xlarge	8	15	1 x 60 (SSD)	Yes	High
<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

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In the next page, click on Launch.

EC2 Management Console

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

AWS Services Edit

Subhasis Das N. California Support

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 [Edit AMI](#)

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 [Edit instance type](#)

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
g2.2xlarge	26	8	15	1 x 60	Yes	High

Security Groups [Edit security groups](#)

Security group name: launch-wizard-1

Description: launch-wizard-1 created 2016-01-27T07:51:23-08:00

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

Feedback English

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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

Subhasis

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

AWS

Services

Edit

Subhasis Das

N. California

Support

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 on the Internet.

You can also open additional ports in your security group.

⚠️


Your instance configuration is not eligible for the free usage tier.

To launch an instance that's eligible for the free usage tier, see [Free tier eligibility and usage restrictions](#).

Don't show me this again

Edit AMI

▼ AMI Details



cs231n_caffe_torch7_keras_lasagne_v2 -

Image for CS231N. Contains Caffe, Torch7, Keras,

Root Device Type: ebs Virtualization type: hvm

▼ Instance Type

Instance Type	ECUs	vCPUs	Memory (GB)
g2.2xlarge	26	8	15

▼ Security Groups

Security group name	Description
launch-wizard-1	launch-wizard-1 created 2016-01-27T07:51:23-08:00

Cancel

Launch Instances

⚠️

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.

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

Cancel

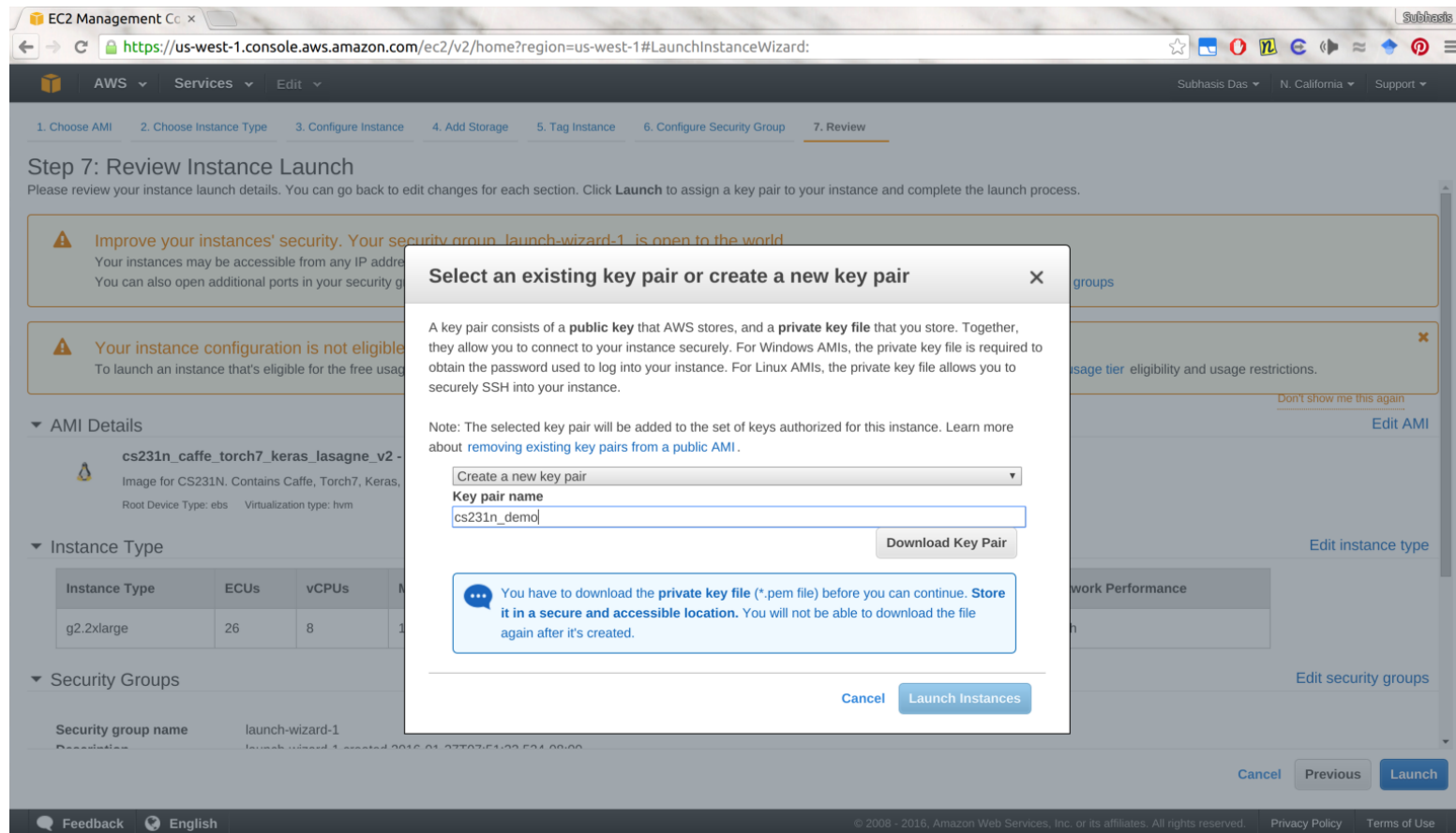
Previous

Launch

Feedback

English

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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 Subhish Das

← → ↻ <https://us-west-1.console.aws.amazon.com/ec2/v2/home?region=us-west-1#LaunchInstanceWizard> ☆

AWS Services Edit Subhish Das N. California Support

Launch Status

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

ℹ **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](#)

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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.

The screenshot shows the AWS Management Console for EC2. The left sidebar contains navigation links for EC2 Dashboard, Events, Tags, Reports, Limits, INSTANCES, IMAGES, ELASTIC BLOCK STORE, NETWORK & SECURITY, LOAD BALANCING, and AUTO SCALING. The main content area displays a table of instances with columns: Name, Instance ID, Instance Type, Availability Zone, Instance State, Status Checks, Alarm Status, Public DNS, and Public IP. One instance is listed: 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. Below the table, the details for instance i-af41511d are shown, including its public IP 54.183.60.80 and other configuration details.

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			
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 encounter
```

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).
-

 [cs231n](#)

 [cs231n](#)

karpthy@cs.stanford.edu