

CS234 Azure Step-by-Step Setup

Adapted from the setup instructions for Chris Manning's 2017 offering of CS224n

Key-Points

- This guide will walk you through running your code on GPUs in Azure.
- Before we start, it cannot be stressed enough: **do not leave the VM running when you are not using it.**
- Each person has initially been assigned \$50 of credit
- **The expected time from start to finish is 1-2 hours. The most time consuming part will be downloading and installing NVIDIA drivers, CUDA and Tensorflow.**

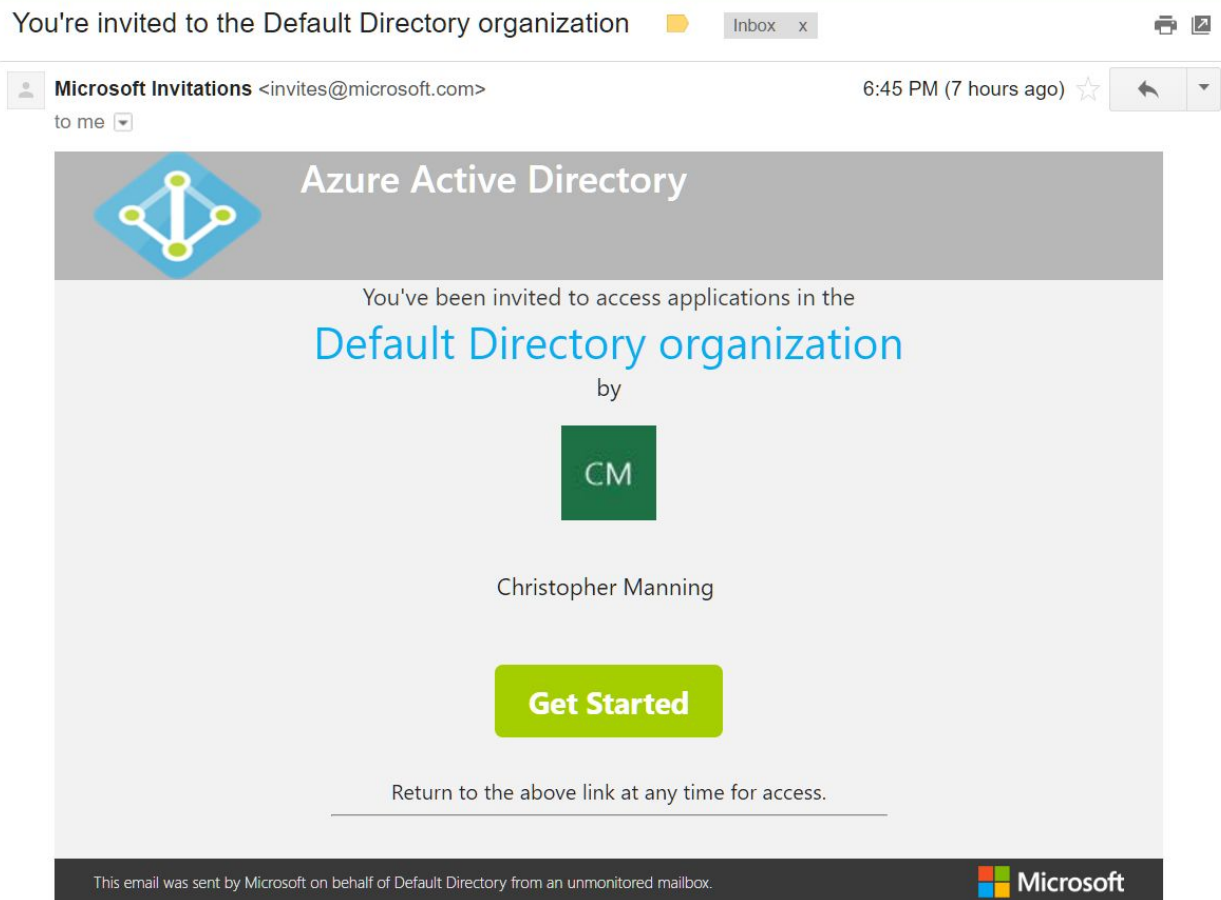
FAQ

- Do not install updates using: `sudo apt-get install --upgrade`
 - This might break the CUDA driver installation if the kernel is updated.
- Out of disk space error when unzipping or downloading your dataset.
 - Attach a larger disk to your VM.
<https://docs.microsoft.com/en-us/azure/virtual-machines/virtual-machines-linux-classic-attach-disk>
 - Run `df -h` to see which disks have free space.
 - Store your data to the attached disk. There may be a temporary disk as well; do not store persistent data to it!
- Problems connecting (e.g., using SSH) to the VM
 - Try `ping <vm's ip address>`
 - Try ssh to myth/rice first and then try ssh'ing to the VM from there
 - Try restarting the VM and/or your local machine
 - If you restart the VM, remember to refresh your browser, as the IP address may change
 - If all of the previous steps fail, file an Azure support ticket
- Checking Azure credits
 - <https://www.microsoftazuresponsorships.com/>
 - When you log on click "check my balance" and then "manage" in the sidebar
 - Azure may say "this account does not have active sponsorship". This is because a "subscription" can mean multiple things within Azure, and this is referring to organization/class (e.g. the whole of cs234 wide) sponsorship.
 - **You subscription balance is only updated during working hours, so may not reflect your ACTUAL usage. For example, if you log on at 11pm on**

Sunday, azure sponsorships will show your usage as of 5pm Friday, and not reflect ANY of your weekend usage.

Creating a Microsoft account

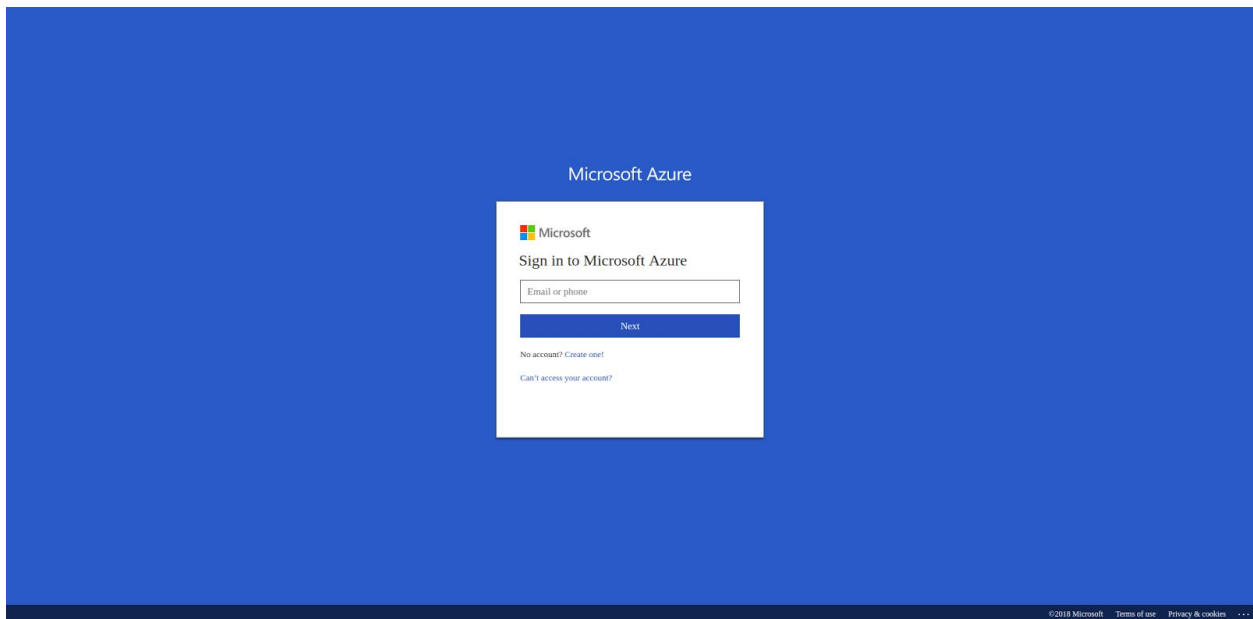
- You should have received an email to your inbox with an invitation to join the Azure subscription with credits.
- Please **follow the instructions** using the email address that received this invitation.



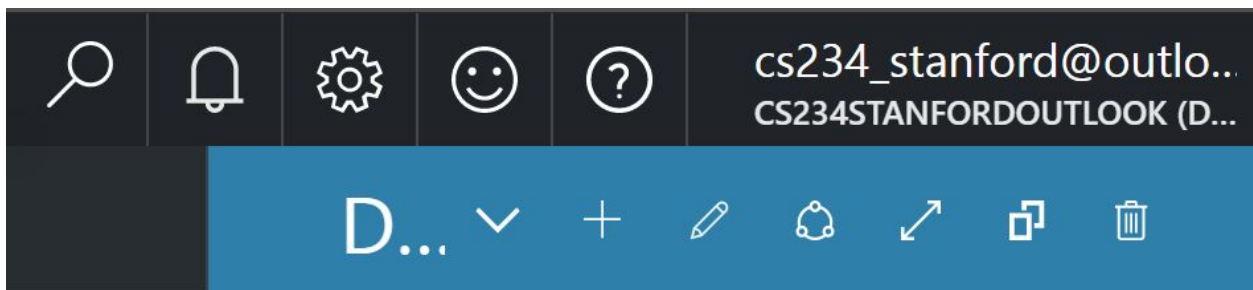
Getting started

Logging into Azure portal

- Once you have created your account, log in to Azure at: portal.azure.com

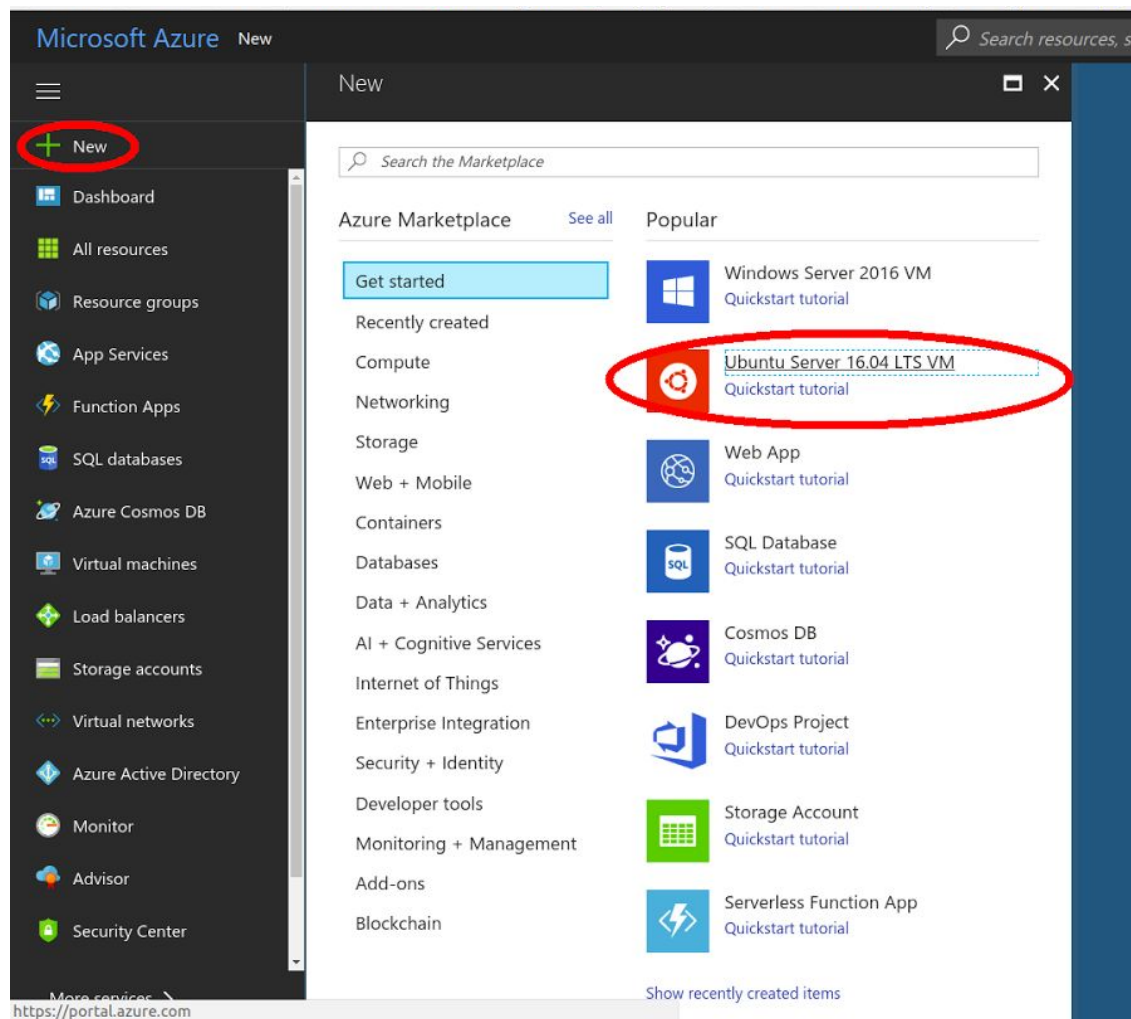


- After logging in, you should reach the dashboard page.
- If you have multiple subscriptions (e.g., you previously signed up for a free one), then you must select CS234STANFORD by clicking in the top right quarter. If no such option appears see Piazza.



Create a VM

Once you are logged in, click on the + on the left. Select **Ubuntu Server 16.04 LTS**.



Fill in the name, user, etc for your VM. You must change the storage type from SSD to HDD. Choose “South Central US” for location. If there is a problem when using South Central US, you may use another location, but not GPUs are only available in certain locations.

If you are in multiple classes using azure, you need to make sure that you select the correct subscription at this stage. **For cs234 your subscription name will be your SUNetID. (That is, you will see your SUNetID in place for “TASubscription”).**

The screenshot displays the Microsoft Azure portal's 'Create virtual machine' wizard, specifically the 'Basics' tab. The left sidebar contains navigation links such as 'New', 'Dashboard', 'All resources', 'Resource groups', 'App Services', 'Function Apps', 'SQL databases', 'Azure Cosmos DB', 'Virtual machines', 'Load balancers', 'Storage accounts', 'Virtual networks', 'Azure Active Directory', 'Monitor', 'Advisor', and 'Security Center'. The central pane shows the progress of the wizard with four steps: 1. Basics (Configure basic settings), 2. Size (Choose virtual machine size), 3. Settings (Configure optional features), and 4. Summary (Ubuntu Server 16.04 LTS). The right pane contains the configuration fields for the VM. The 'Name' field is set to 'example'. The 'VM disk type' is set to 'HDD'. The 'User name' is 'cs234'. The 'Authentication type' is 'SSH public key'. The 'Password' and 'Confirm password' fields are masked with dots. The 'Subscription' is set to 'TASubscription'. The 'Resource group' is 'exampleResourceGroup'. The 'Location' is 'South Central US'. An 'OK' button is at the bottom right.

Field	Value
Name	example
VM disk type	HDD
User name	cs234
Authentication type	SSH public key
Password
Confirm password
Subscription	TASubscription
Resource group	exampleResourceGroup
Location	South Central US

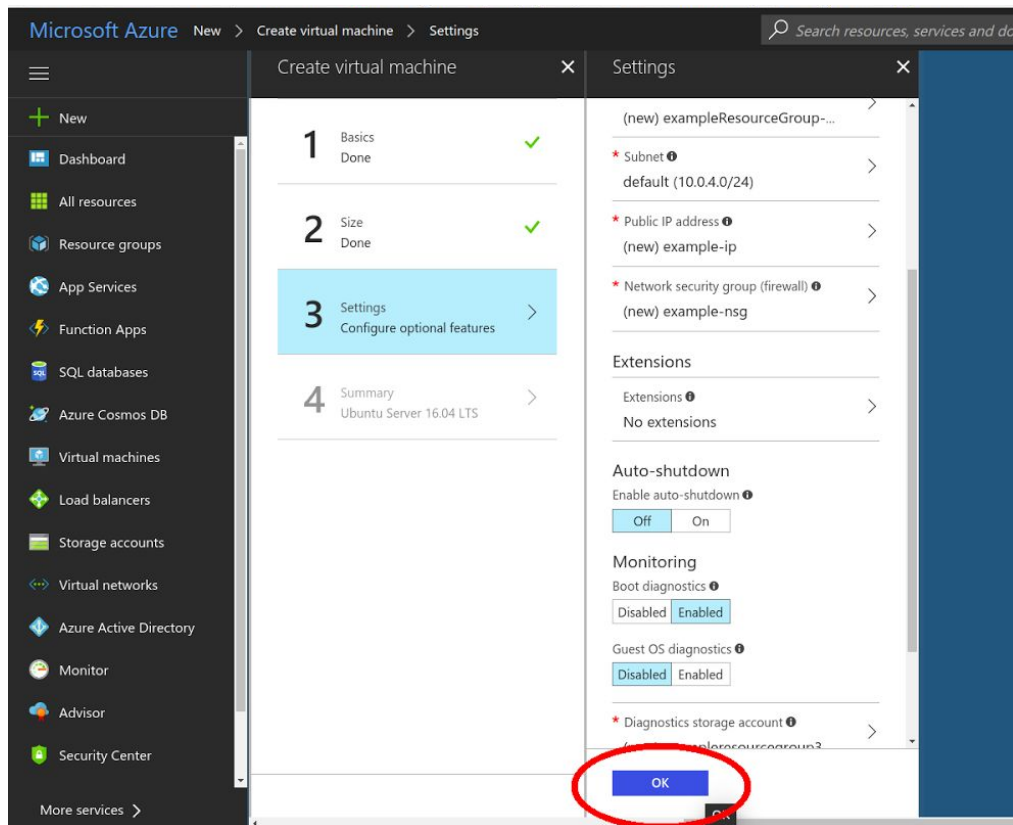
View all (click the button) of the options and **select NV6** by scrolling through the list, and then click select. **If NV6 does not show up, then you probably chose the wrong region or chose SSD in the previous page.** Also, if you do not select NV6 (or any of the NV/NC options), then you are not using a GPU instance and the setup scripts later will fail.

The screenshot shows the 'Choose a size' page in the Microsoft Azure portal. The page is divided into three main columns, each representing a different VM size family: NV6, NC6, and NC12. The NV6 size is highlighted with a red circle, and its 'Select' button is also circled in red. The page includes a sidebar with navigation options and a progress bar at the top.

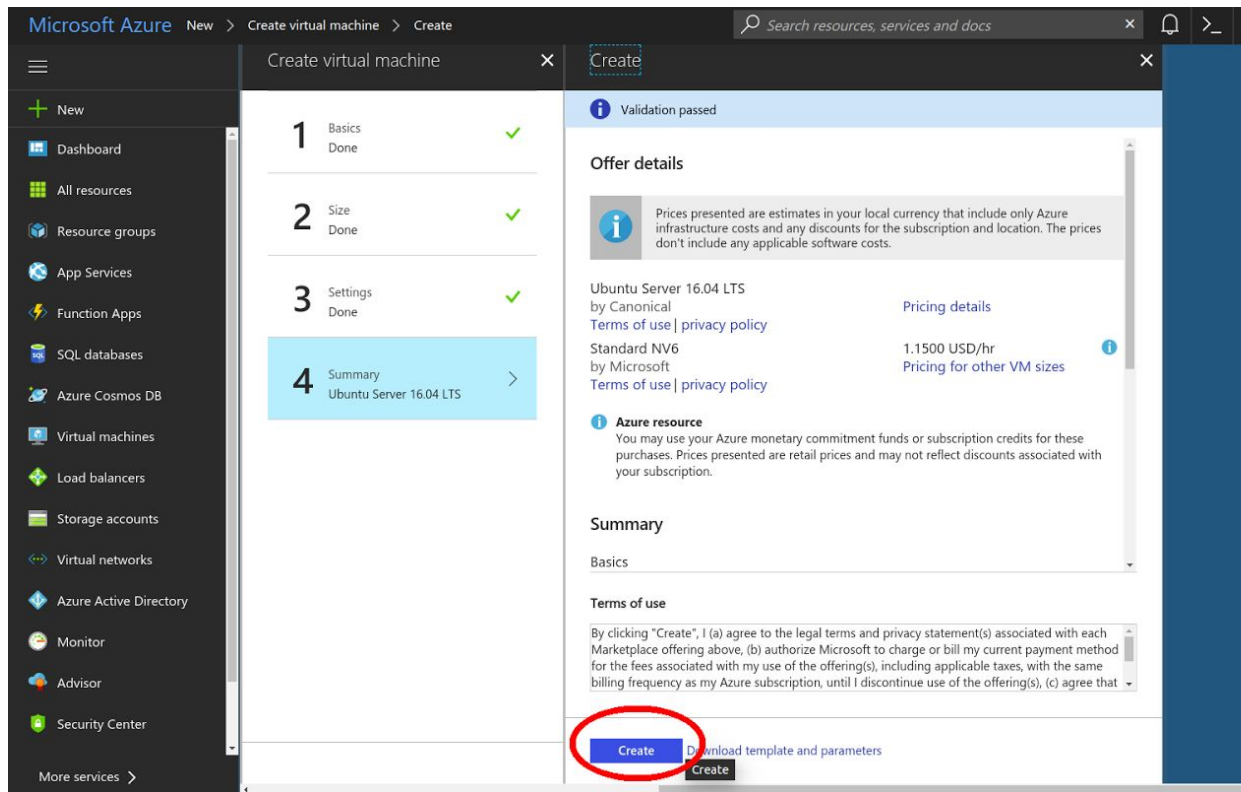
Size	224 GB	448 GB	448 GB
Data disks	24	32	32
Graphics	2 P100 (PCIe)	4 P100 (PCIe)	4 P100 (PCIe)
Premium disk support	Yes	Yes	Yes
Load balancing	Yes	Yes	Yes
Price (USD/MONTH (ESTIMATED))	3,696.19	7,392.38	8,131.92
Size	NV6 Standard	NC6 Standard	NC12 Standard
vCPUs	6	6	12
GB	56	56	112
Data disks	24	24	48
Max IOPS	8x500	8x500	16x500
Local SSD	380 GB	380 GB	680 GB
Graphics	1x M60	1x K80	2x K80
Load balancing	Yes	Yes	Yes
Price (USD/MONTH (ESTIMATED))	855.60	803.52	1,607.04

Buttons: Select (circled in red), Select

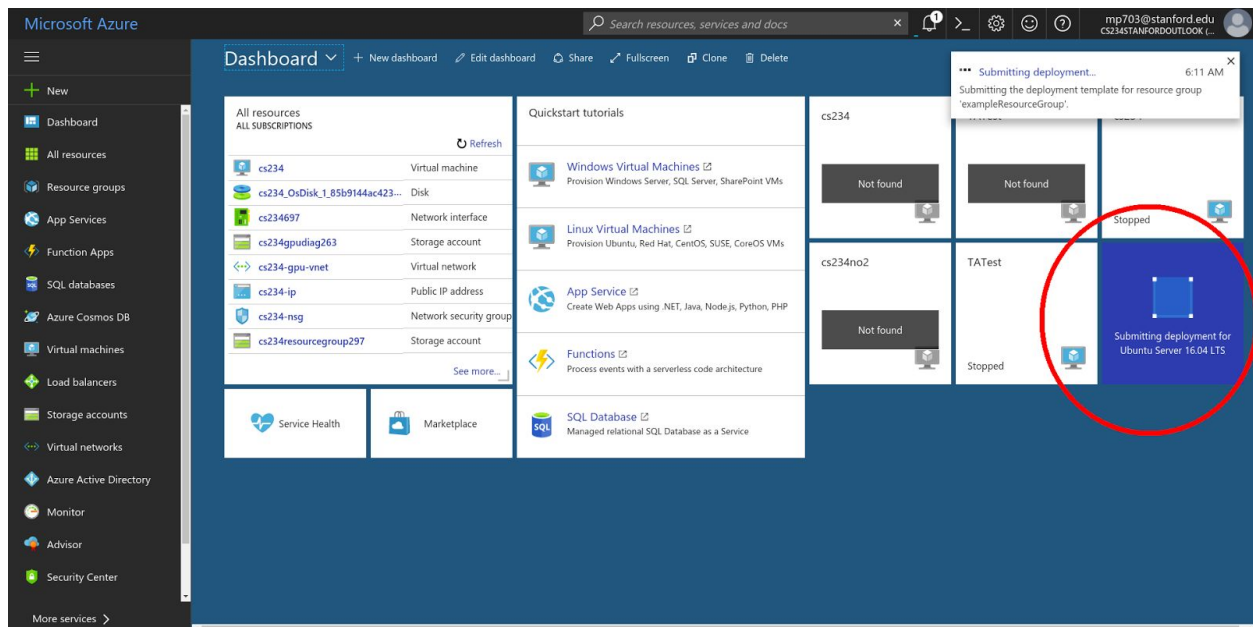
Click OK.



Wait for the configuration to validate and then click CREATE.



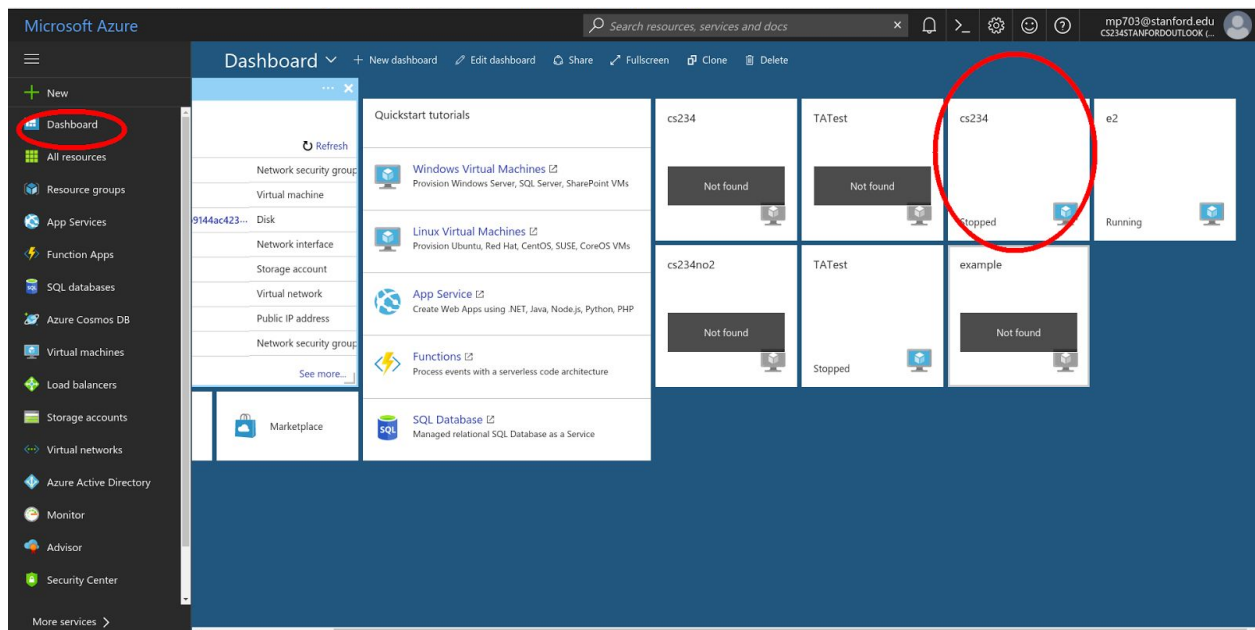
Note: it can take a while. And it will likely look like this for a long time



Using the VM

Finding your VM

Click on dashboard and then click on the machine that you have created.



Setup port

1. Go to all resources

Microsoft Azure

Search resources, services and...

Dashboard ▾ + New dashboard Edit dashboard Share Fullscreen Clone

New

Dashboard

All resources

Resource groups

App Services

Function Apps

SQL databases

Azure Cosmos DB

Virtual machines

Load balancers

Storage accounts

Virtual networks

Azure Active Directory

Monitor

Advisor

Security Center

All resources ALL SUBSCRIPTIONS Refresh

cs234	Virtual machine
cs234_OsDisk_1_85b9144ac423...	Disk
cs234697	Network interface
cs234gpudiag263	Storage account
cs234-gpu-vnet	Virtual network
cs234-ip	Public IP address
cs234-nsg	Network security group
cs234resourcegroup297	Storage account

See more...

Service Health Marketplace

Quickstart tutorials

Windows Virtual Machines Provision Windows Server, SQL Server, SharePoint

Linux Virtual Machines Provision Ubuntu, Red Hat, CentOS, SUSE, CoreOS

App Service Create Web Apps using .NET, Java, Node.js, Python

Functions Process events with a serverless code architecture

SQL Database Managed relational SQL Database as a Service

More services

<https://portal.azure.com/#blade/HubsExtension/Resources/resourceType/Microsoft.Resources%2Fresources>

2. Click the network security group that you are in

The screenshot shows the Microsoft Azure portal's 'All resources' page. The left sidebar contains navigation links for various services. The main area displays a table of resources. The resource 'example-nsg' is highlighted with a red circle.

NAME	TYPE	RESOURCE GROUP	LOCATION
cs234	Virtual machine	cs234ResourceGroup	South Central US
cs234_OsDisk_1_85b9144ac42344ce84b3861722bf2123	Disk	CS234RESOURCEGROUP	South Central US
cs234697	Network interface	cs234ResourceGroup	South Central US
cs234gpudiag263	Storage account	cs234-gpu	South Central US
cs234-gpu-vnet	Virtual network	cs234-gpu	South Central US
cs234-ip	Public IP address	cs234ResourceGroup	South Central US
cs234-nsg	Network security group	cs234ResourceGroup	South Central US
cs234resourcegroup297	Storage account	cs234ResourceGroup	South Central US
cs234ResourceGroup-vnet	Virtual network	cs234ResourceGroup	South Central US
example	Virtual machine	exampleResourceGroup	South Central US
example_OsDisk_1_b618dc704b1d4d3fa1f54ad2d08baaff	Disk	EXAMPLERESOURCEGROUP	South Central US
example386	Network interface	exampleResourceGroup	South Central US
example-ip	Public IP address	exampleResourceGroup	South Central US
example-nsg	Network security group	exampleResourceGroup	South Central US
examplesresourcegroup334	Storage account	exampleResourceGroup	South Central US
exampleResourceGroup-vnet	Virtual network	exampleResourceGroup	South Central US

3. Go to outbound/inbound security rules,

The screenshot shows the Microsoft Azure portal's 'example-nsg' resource page. The left sidebar contains navigation links for various services. The main area displays the 'example-nsg' resource page. The 'Outbound security rules' link is highlighted with a red circle.

example-nsg
Network security group

Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems

SETTINGS

- Inbound security rules
- Outbound security rules**
- Network interfaces
- Subnets
- Properties
- Locks
- Automation script

MONITORING

- Diagnostics logs

SUPPORT + TROUBLESHOOTING

Resource group (change)
exampleResourceGroup

Location
South Central US

Subscription (change)
TASubscription

Subscription ID
4843f08d-f73c-44eb-87c7-21ded58c2043

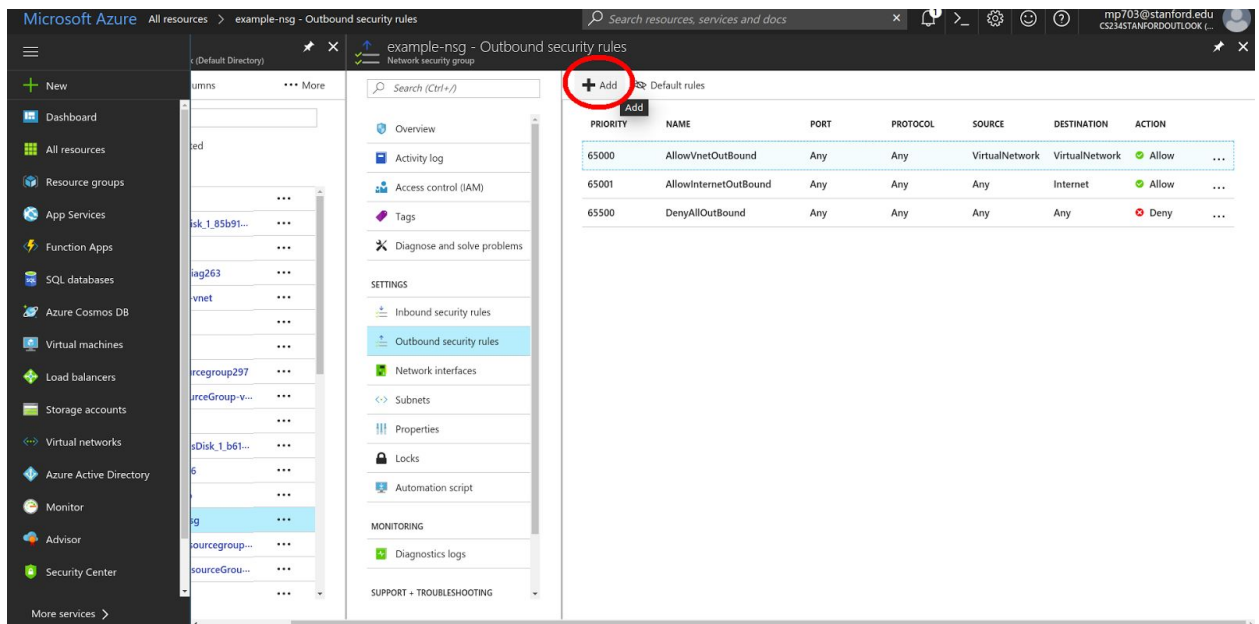
Inbound security rules

PRIORITY	NAME	PORT
1000	default-allow-ssh	22
65000	AllowVnetInBound	Any
65001	AllowAzureLoadBalancerInB...	Any
65500	DenyAllInBound	Any

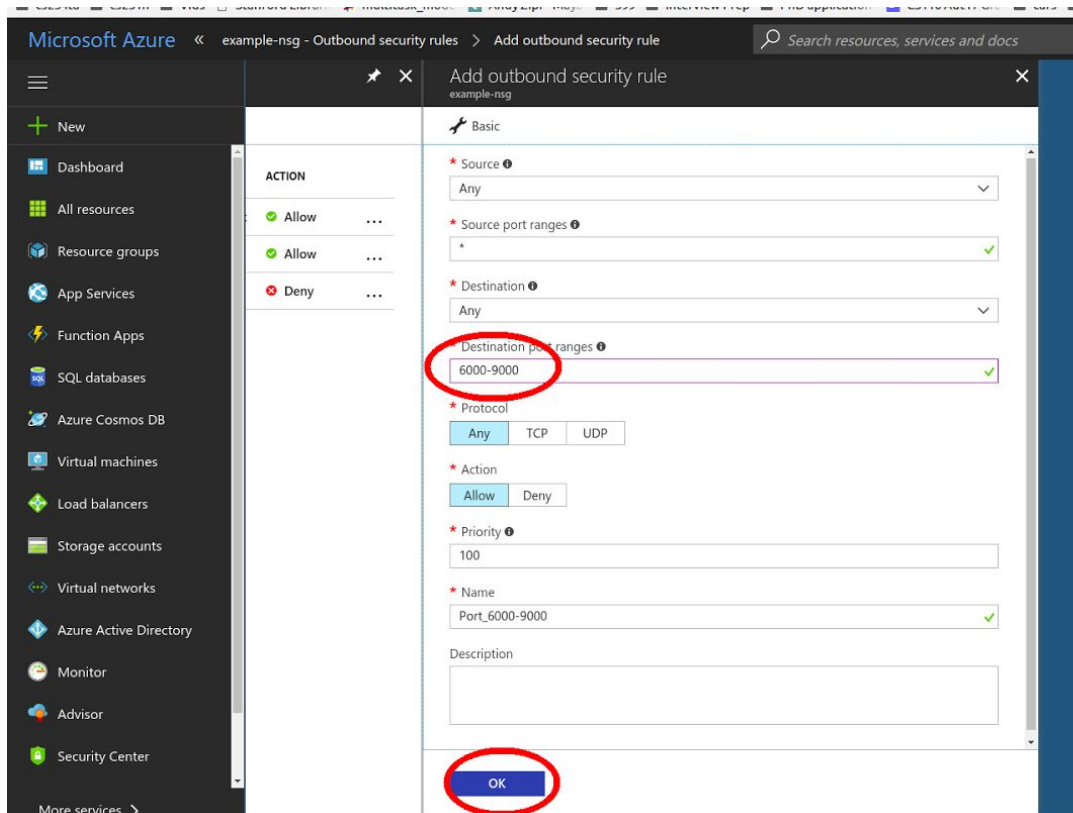
Outbound security rules

PRIORITY	NAME	PORT
65000	AllowVnetOutBound	Any
65001	AllowInternetOutBound	Any
65500	DenyAllOutBound	Any

4. click add.



5. File port ranges, let source port ranges remain "*", and change the destination port ranges to "6000-9000", then click ok.



6. Now, you can access the vm by using ssh tunneling, such as:
ssh vmname@ipaddress -l port:localhost:port
7. This will allow you to use TensorBoard, following this [stack overflow post](#).

Spinning up your VM

If you just completed the previous part and the VM has finished deploying, then your VM should be running already.

The screenshot shows the Microsoft Azure portal interface for a virtual machine named 'cs234'. The top navigation bar includes the 'Start' button, which is circled in red. The VM's status is 'Stopped (deallocated)'. The left sidebar shows the 'Virtual machines' section selected. The main area displays various metrics like CPU, Network, and Disk usage.

Virtual Machine Details:

- Resource group: cs234ResourceGroup
- Status: Stopped (deallocated)
- Location: South Central US
- Subscription: TAsubscription
- Subscription ID: 4843f08d-f73c-44eb-87c7-21ded58c2043
- Computer name: cs234
- Operating system: Linux
- Size: Standard NV6 (6 vcpus, 56 GB memory)
- Public IP address: cs234-ip
- Virtual network/subnet: cs234ResourceGroup-vnet/default
- DNS name: Configure

Metrics (Show data for last: 1 hour):

- CPU (average):** 0% (Percentage CPU)
- Network (total):** 0 B (Network IN, Network OUT)
- Disk bytes (total):** 0 B
- Disk operations/sec (average):** 0

Connecting (SSH) to your VM

Once your VM is started (it may take a few minutes). Click connect and follow the instructions.

The screenshot displays the Azure portal interface for a virtual machine named 'example'. The left-hand navigation pane includes sections for 'Overview', 'Activity log', 'Access control (IAM)', 'Tags', 'Diagnose and solve problems', and 'SETTINGS' (which includes Networking, Disks, Size, Extensions, Availability set, Configuration, Properties, and Locks). The main content area features a toolbar with buttons for 'Connect', 'Start', 'Restart', 'Stop', 'Capture', 'Move', 'Delete', and 'Refresh'. The 'Connect' button is circled in red. Below the toolbar, the 'Connect' section provides instructions for connecting to a Linux VM via SSH, with the command `ssh cs234@13.85.64.39` highlighted by a red circle. An 'OK' button is positioned below the command. Further down, the 'Subscription ID' is listed as 4843f08d-f73c-44eb-87c7-21ded58c2043. The 'Virtual network/subnet' is 'exampleResourceGroup-vnet/default', and the 'DNS name' is 'Configure'. At the bottom, there are two performance charts: 'CPU (average)' and 'Network (total)', both showing data for the last 1 hour.

re example

Search resources, services and docs

example
Virtual machine

Search (Ctrl+ /)

Connect Start Restart Stop Capture Move Delete Refresh

Connect

To connect to your Linux virtual machine using SSH, use the following command: `ssh cs234@13.85.64.39`

OK

Subscription ID
4843f08d-f73c-44eb-87c7-21ded58c2043

Virtual network/subnet
exampleResourceGroup-vnet/default

DNS name
Configure

Show data for last: 1 hour 6 hours 12 hours 1 day 7 days 30 days

CPU (average)

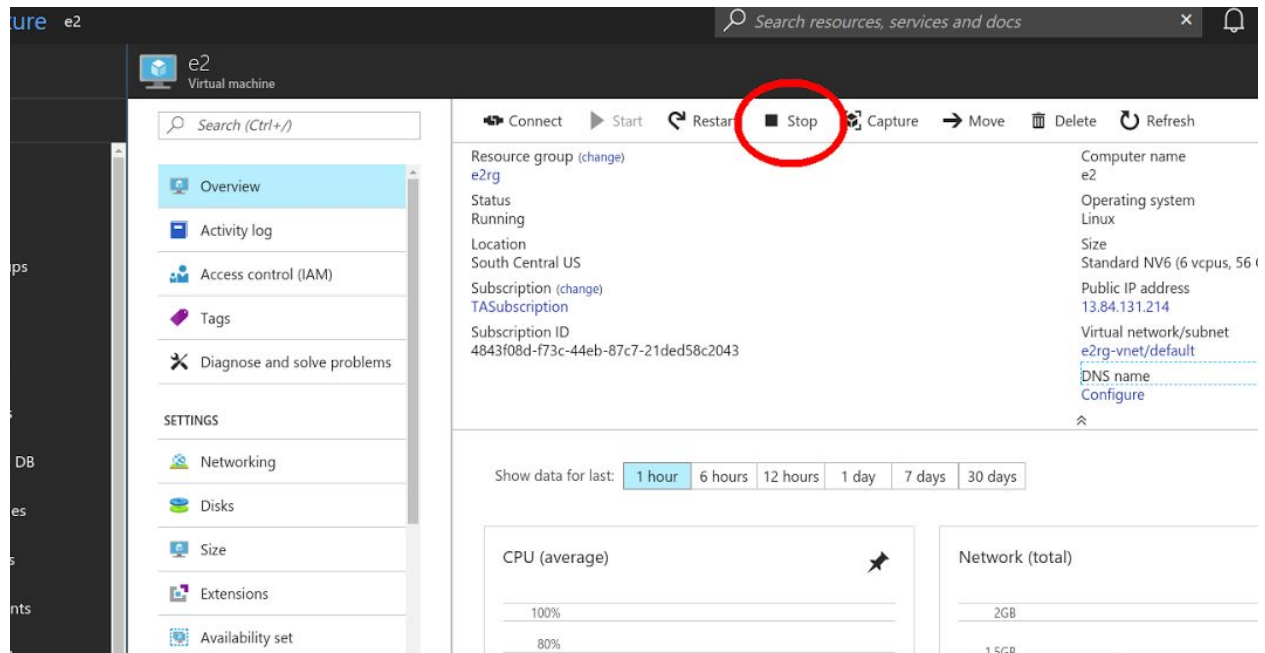
100%
80%
60%
40%
20%
0%

Network (total)

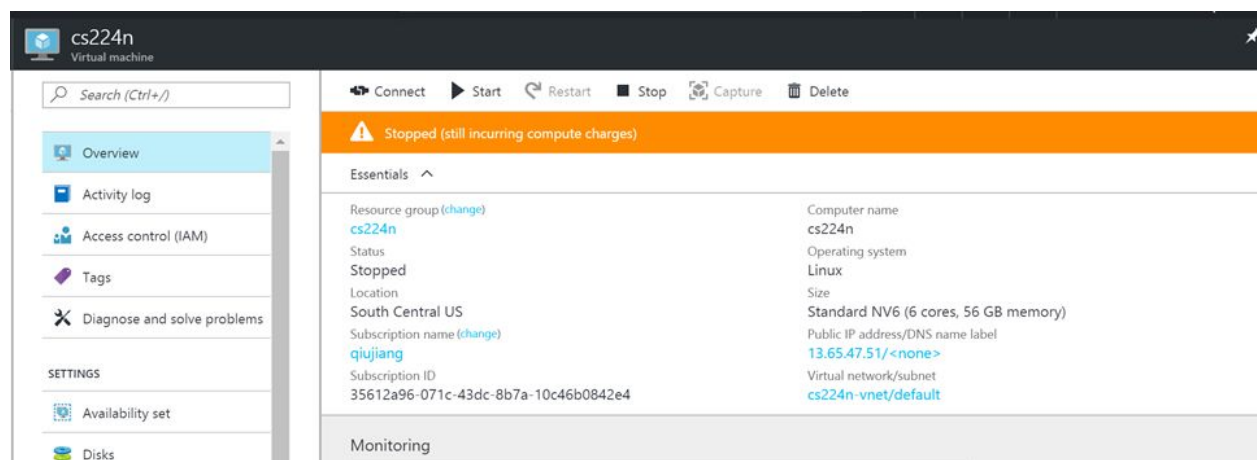
100B
80B
60B
40B
20B
0B

Stopping your VM

Once you are done working, stop your VM. You must do this or your credits will disappear at a rate of \$1+ every hour the VM is on.



Make sure your VM is fully stopped. **If you see “stopped still incurring compute charges”, you must hit stop again.**



Completing CUDA/Tensorflow setup

Now we will finish installing CUDA and Tensorflow dependencies. There are two scripts that you will need to run and your VM will need reboot after running each of them.

Download the setup scripts in the zipped folder **Azure-GPU-Setup.zip** from the piazza post.

You will need to SSH into your VM. First, in your VM do:

```
unzip Azure-GPU-Setup.zip  
cd Azure-GPU-Setup
```

Alternatively to using the zip, you can download the scripts using git, and you would first do:

```
git clone https://github.com/MWPainter/Azure-GPU-Setup.git  
cd Azure-GPU-Setup
```

However, you will need to manually download cuDNN (you need to make an account) from [here](#), and place it in the Azure-GPU-Setup folder.

You should see the following if you use **ls -all**

```
drwxrwxr-x 8 e2 e2      4096 Jan 24 19:45 .git/
-rw-rw-r-- 1 e2 e2         2 Jan 24 19:44 .gitignore
-rwxrwxr-x 1 e2 e2      1480 Jan 25 13:05 gpu-setup-part1.sh*
-rwxrwxr-x 1 e2 e2      2025 Jan 25 13:06 gpu-setup-part2.sh*
-rw-rw-r-- 1 e2 e2       317 Jan 24 19:44 gpu-test.py
-rw-rw-r-- 1 e2 e2       206 Jan 24 19:45 README.MD
```

Run gpu-setup-part1.sh using the following command:

```
./gpu-setup-part1.sh
```

This will install some libraries, fetch and install NVIDIA drivers, and trigger a reboot. (The command will take some time to run.)

If you chose to use the git repository to download the scripts, you will need to download cudnn-6.0 manually. This can be downloaded from Nvidia [here](#), and you will need to create a NVIDIA Account to download it! You need to place the downloaded tgz into your Azure-GPU-Setup folder.

Once your VM has finished restarting. SSH into the VM again.

Now navigate to the setup directory and run the second script.

```
cd Azure-GPU-Setup/  
./gpu-setup-part2.sh
```

This script installs the CUDA toolkit, CUDNN, and Tensorflow. Once the VM has finished restarting for the second time, SSH into the VM again.

Now, to test that Tensorflow and the GPU is properly configured, run the gpu test script by executing:

python gpu-test.py

You should see the following if all went well:

```
-rw-rw-r-- 1 e2 e2      206 Jan 24 19:45 README.MD
e2@e2:~/azure-gpu-setup$ python gpu-test.py
...loaded python test [now attempting to list GPUs]
2018-01-25 13:13:26.896830: I tensorflow/core/platform/cpu_feature_guard.cc:137] Your CPU supports i
2018-01-25 13:13:29.407318: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1030] Found device 0
name: Tesla M60 major: 5 minor: 2 memoryClockRate(GHz): 1.1775
pciBusID: 5884:00:00.0
totalMemory: 7.94GiB freeMemory: 7.86GiB
2018-01-25 13:13:29.407364: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1120] Creating Tensor
[u'/device:GPU:0']
e2@e2:~/azure-gpu-setup$
```

Yes!

Took about 45 minutes

Setting up OpenAI

Use the requirements.txt file and setup instructions from assignment 1 to install OpenAI gym.

Atari gym

Run the following commands to install the Atari environments:

```
sudo apt-get install cmake
sudo apt-get install zlib1g-dev
sudo pip install gym[atari]
sudo apt-get install ffmpeg
```