

Deep Learning Walkthrough - 00

Code in github.com/google-aai/sc17

Cassie Kozyrkov

Chief Decision Scientist, Google Cloud

GitHub: [kozyrkov](https://github.com/kozyrkov); Twitter: [@quaesita](https://twitter.com/quaesita)

Google Cloud





Alex
Davies



Brian
Foo



Cassie
Kozyrkov



Kevin
Kissell



Michael
Marano



Nicholas
Harteau



Ron
Bodkin



Scott
Penberthy

Technical Contributors



Alex
Davies



Brian
Foo



Cassie
Kozyrkov



Kevin
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Harteau



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Bodkin



Scott
Penberthy

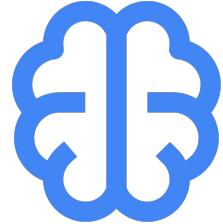
Technical Contributors

Check that you need ML | Step 0

Want to produce many labels automatically? Data to learn from? Hardware?



Chief actors:



Decision maker



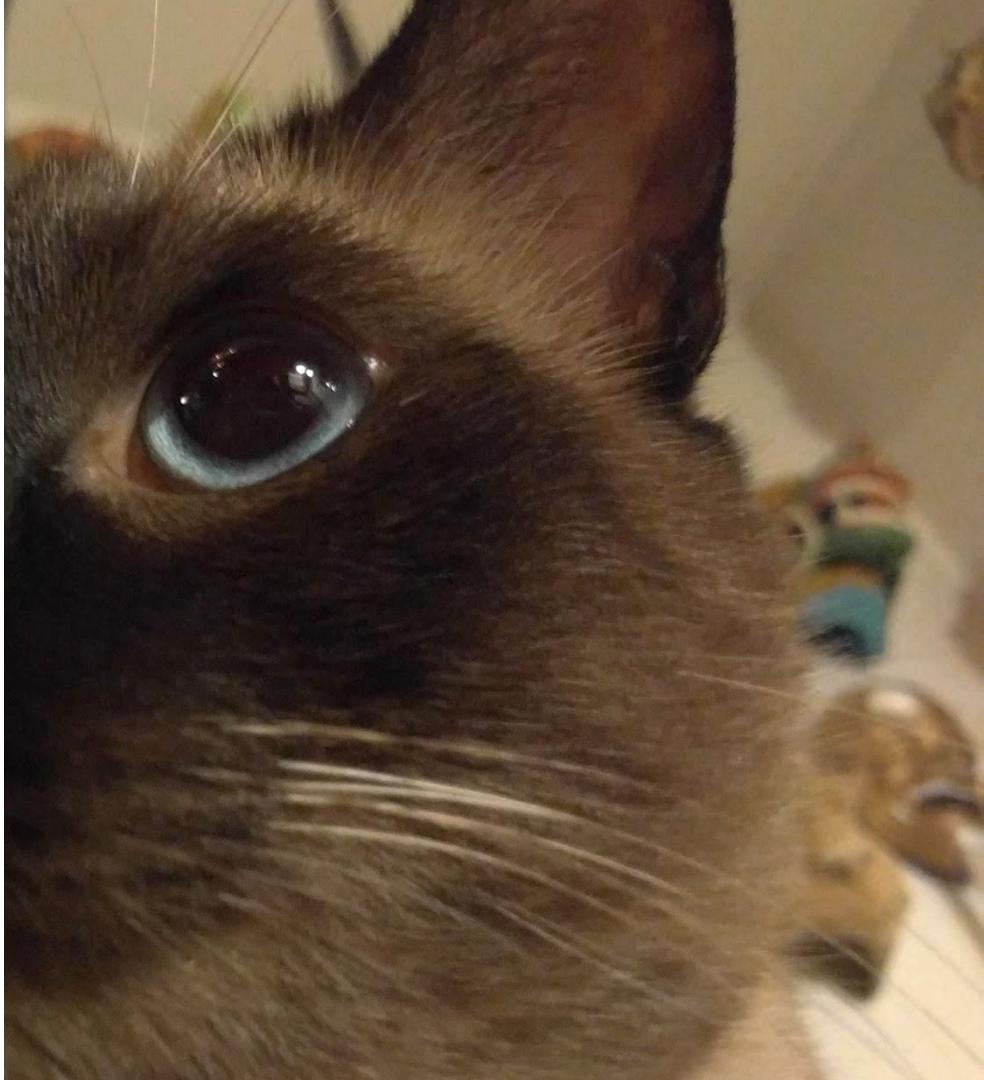
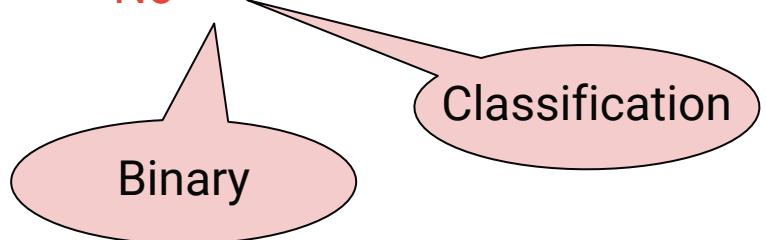
Domain expert

Labels/outputs

Task: Does my photo have a cat in it?

Desired labels?

- Yes
- No



Learning type

All photos we'll learn from have a label (cat/not cat)

Task type?

Supervised
Learning



Computing

Let's do data science with Google
Cloud Platform!





GCP Data Science Setup

Sign up for a free GCP trial and create a project

Follow these instructions:

codelabs.developers.google.com/codelabs/cpb100-free-trial

Or:

www.youtube.com/watch?v=76IHbUMwz9k

1. Overview

In this lab you sign up for the Google Cloud free trial and create a project used to complete the labs. Be aware that you need a credit card in order to register for the trial. This is to confirm your identity.

What you need

To complete this lab, you need:

Internet access

Access to a supported Internet browser:

- The latest version of Google Chrome
- The latest version of Firefox
- Microsoft Internet Explorer 11+

A credit card to register for the free trial

What you learn

In this lab, you:

- Register for the Google Cloud Platform free trial
- Create a project using the Google Developers Console

Check that Compute Engine is ready

Sometimes this takes a few minutes.



DATA

ACTIVITY

CUSTOMIZE

Project info

Project name

super

Project ID

super-188716

Project number

142124835107

[Go to project settings](#)

Resources

Data unavailable

Trace

No trace data from the past 7 days

[Get started with Stackdriver Trace](#)

Getting Started

APIs

Requests (requests/sec)



Requests:

[Go to APIs overview](#)

Google Cloud Platform status

All services normal

[Go to Cloud status dashboard](#)

Billing

Estimated charges

For the billing period Dec 1 – 11, 2017

USD \$0.00

[View detailed charges](#)

Error Reporting

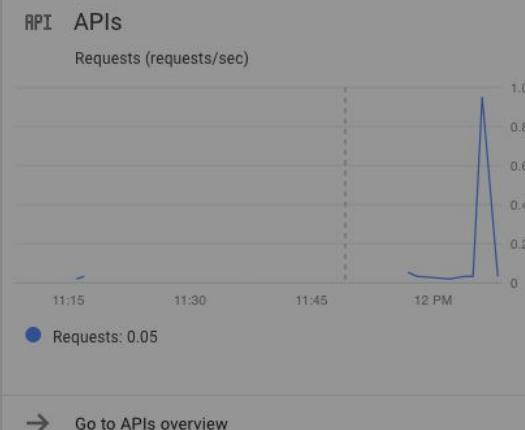
No sign of any errors. Have you set up Error Reporting?

[Learn how to set up Error Reporting](#)

News

Expanding our partner ecosystem with managed services providers

Forgot how to get here? Try:
console.cloud.google.com/home/

[Home](#)[Compute Engine](#)[VM instances](#)[Instance groups](#)[Instance templates](#)[Disks](#)[Snapshots](#)[Images](#)[Committed use discounts](#)[Metadata](#)[Health checks](#)[Zones](#)[Operations](#)[Quotas](#)[Settings](#)[PRODUCTS ▾](#)[Cloud Launcher](#)[Billing](#)[APIs & services](#)[Support](#)[IAM & admin](#)

Google Cloud Platform status

All services normal

→ Go to Cloud status dashboard

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Expanding our partner ecosystem with managed services providers



Compute Engine

VM instances

VM instances

Instance groups

Instance templates

Disks

Snapshots

Images

Committed use discounts

Metadata

Health checks

Zones

Operations

Quotas

Settings

Compute Engine
VM instances

Compute Engine lets you use virtual machines that run on Google's infrastructure. You can choose from micro-VMs to large instances running Debian, Windows, or other standard images. Create your first VM instance, import it by CloudEndure migration service or try the quickstart to build a sample app.

[Create](#) or [Import](#) or [Take the quickstart](#)

You're ready to proceed when you see a screen that looks like this.

Edit Quotas

Additional Info:

<https://cloud.google.com/compute/quotas>

 Home Compute Engine SQL Storage Billing BigQuery ML Engine IAM & admin

PRODUCTS ▾

 Cloud Launcher Billing APIs & services Support IAM & admin

VM instances

Compute Engine
VM instances

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IAM

Identity

Quotas

Service accounts

Labels

GCP Privacy & Security

Settings

Encryption keys

Identity-Aware Proxy

Roles

Manage resources



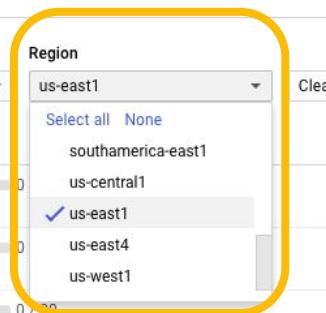
 IAM & admin

Quotas

+ EDIT QUOTAS

-  IAM
 -  Identity
 -  Quotas
 -  Service accounts
 -  Labels
 -  GCP Privacy & Security
 -  Settings
 -  Encryption keys
 -  Identity-Aware Proxy
 -  Roles
-
-  Manage resources

Quota type	Service	Metric	Region
All quotas	All services	All metrics	us-east1
<input type="checkbox"/> Service		Used	
<input type="checkbox"/> Google Compute Engine API Persistent Disk SSD (GB) ⓘ	us-east1	0 / 0	
<input type="checkbox"/> Google Compute Engine API Static IP addresses	us-east1	0 / 0	
<input type="checkbox"/> Google Compute Engine API Regional managed instance groups	us-east1	0 / 20	
<input type="checkbox"/> Google Compute Engine API In-use IP addresses	us-east1	0 / 8	
<input type="checkbox"/> Google Compute Engine API Regional autoscalers	us-east1	0 / 20	
<input type="checkbox"/> Google Compute Engine API Local SSD (GB) ⓘ	us-east1	0 / 6,000	
<input type="checkbox"/> Google Compute Engine API Managed instance groups	us-east1	0 / 50	
<input type="checkbox"/> Google Compute Engine API Instance groups	us-east1	0 / 100	
<input type="checkbox"/> Google Compute Engine API Persistent Disk Standard (GB) ⓘ	us-east1	0 / 4,096	
<input type="checkbox"/> Google Compute Engine API CPUs	us-east1	0 / 24	



IAM & admin

IAM

Identity

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GCP Privacy & Security

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Manage resources

Quotas

EDIT QUOTAS

<input type="checkbox"/> Google Compute Engine API Regional autoscalers	us-east1	0 / 20
<input type="checkbox"/> Google Compute Engine API Local SSD (GB)	us-east1	0 / 6,000
<input type="checkbox"/> Google Compute Engine API Managed instance groups	us-east1	0 / 50
<input type="checkbox"/> Google Compute Engine API Instance groups	us-east1	0 / 100
<input type="checkbox"/> Google Compute Engine API Persistent Disk Standard (GB)	us-east1	0 / 4,096
<input type="checkbox"/> Google Compute Engine API CPUs	us-east1	0 / 24
<input type="checkbox"/> Google Compute Engine API Autoscalers	us-east1	0 / 50
<input type="checkbox"/> Google Compute Engine API Preemptible CPUs	us-east1	- / 0
<input type="checkbox"/> Google Compute Engine API Preemptible Local SSD (GB)	us-east1	- / 0
<input checked="" type="checkbox"/> Google Compute Engine API NVIDIA P100 GPUs	us-east1	- / 0
<input checked="" type="checkbox"/> Google Compute Engine API NVIDIA K80 GPUs	us-east1	- / 0
<input type="checkbox"/> Google Compute Engine API Commitments	us-east1	- / 0



IAM & admin



IAM



Identity



Quotas



Service accounts



Labels



GCP Privacy & Security



Settings



Encryption keys



Identity-Aware Proxy



Roles



Manage resources

Quotas

+ EDIT QUOTAS

<input type="checkbox"/> Google Compute Engine API Regional autoscalers	us-east1	<div style="width: 100px;"></div>
<input type="checkbox"/> Google Compute Engine API Local SSD (GB) ⓘ	us-east1	<div style="width: 100px;"></div>
<input type="checkbox"/> Google Compute Engine API Managed instance groups	us-east1	<div style="width: 100px;"></div>
<input type="checkbox"/> Google Compute Engine API Instance groups	us-east1	<div style="width: 100px;"></div>
<input type="checkbox"/> Google Compute Engine API Persistent Disk Standard (GB) ⓘ	us-east1	<div style="width: 100px;"></div>
<input type="checkbox"/> Google Compute Engine API CPUs	us-east1	<div style="width: 100px;"></div>
<input type="checkbox"/> Google Compute Engine API Autoscalers	us-east1	<div style="width: 100px;"></div>
<input type="checkbox"/> Google Compute Engine API Preemptible CPUs ⓘ	us-east1	<div style="width: 100px;"></div>
<input type="checkbox"/> Google Compute Engine API Preemptible Local SSD (GB) ⓘ	us-east1	<div style="width: 100px;"></div>
<input checked="" type="checkbox"/> Google Compute Engine API NVIDIA P100 GPUs	us-east1	<div style="width: 100px;"></div>
<input checked="" type="checkbox"/> Google Compute Engine API NVIDIA K80 GPUs	us-east1	<div style="width: 100px;"></div>
<input type="checkbox"/> Google Compute Engine API Commitments	us-east1	<div style="width: 100px;"></div>

X 2 quotas selected

Edit quotas

Name

Cassie Kozyrkov

Email

censored :)

Phone ⓘ

censored :)

Next

IAM & admin
IAM
Identity
Quotas
Service accounts
Labels
GCP Privacy & Security
Settings
Encryption keys
Identity-Aware Proxy
Roles
Manage resources

Quotas	+ EDIT QUOTAS
<input type="checkbox"/> Google Compute Engine API Regional autoscalers	us-east1
<input type="checkbox"/> Google Compute Engine API Local SSD (GB) ⓘ	us-east1
<input type="checkbox"/> Google Compute Engine API Managed instance groups	us-east1
<input type="checkbox"/> Google Compute Engine API Instance groups	us-east1
<input type="checkbox"/> Google Compute Engine API Persistent Disk Standard (GB) ⓘ	us-east1
<input type="checkbox"/> Google Compute Engine API CPUs	us-east1
<input type="checkbox"/> Google Compute Engine API Autoscalers	us-east1
<input type="checkbox"/> Google Compute Engine API Preemptible CPUs ⓘ	us-east1
<input type="checkbox"/> Google Compute Engine API Preemptible Local SSD (GB) ⓘ	us-east1
<input checked="" type="checkbox"/> Google Compute Engine API NVIDIA P100 GPUs	us-east1
<input checked="" type="checkbox"/> Google Compute Engine API NVIDIA K80 GPUs	us-east1
<input type="checkbox"/> Google Compute Engine API Commitments	us-east1

2 quotas selected

Google Compute Engine API

NVIDIA P100 GPUs - us-east1

Change to
Your request requires approval. ⓘ

1

NVIDIA K80 GPUs - us-east1

Change to
Your request requires approval. ⓘ

1

Justification

Required ⓘ

Data science computing setup.

Next Cancel

Submit Request Back

 IAM & admin

IAM

Identity

Quotas

Service accounts

Labels

GCP Privacy & Security

Settings

Encryption keys

Identity-Aware Proxy

Roles

Manage resources

Quotas

+ EDIT QUOTAS

<input type="checkbox"/> Google Compute Engine API Regional autoscalers	us-east1	<div style="width: 10%;"> </div>
<input type="checkbox"/> Google Compute Engine API Local SSD (GB) 	us-east1	<div style="width: 10%;"> </div>
<input type="checkbox"/> Google Compute Engine API Managed instance groups	us-east1	<div style="width: 10%;"> </div>
<input type="checkbox"/> Google Compute Engine API Instance groups	us-east1	<div style="width: 10%;"> </div>
<input type="checkbox"/> Google Compute Engine API Persistent Disk Standard (GB) 	us-east1	<div style="width: 10%;"> </div>
<input type="checkbox"/> Google Compute Engine API CPUs	us-east1	<div style="width: 10%;"> </div>
<input type="checkbox"/> Google Compute Engine API Autoscalers	us-east1	<div style="width: 10%;"> </div>
<input type="checkbox"/> Google Compute Engine API Preemptible CPUs 	us-east1	<div style="width: 10%;"> </div>
<input type="checkbox"/> Google Compute Engine API Preemptible Local SSD (GB) 	us-east1	<div style="width: 10%;"> </div>
<input type="checkbox"/> Google Compute Engine API NVIDIA P100 GPUs	us-east1	<div style="width: 10%;"> </div>
<input type="checkbox"/> Google Compute Engine API NVIDIA K80 GPUs	us-east1	<div style="width: 10%;"> </div>
<input type="checkbox"/> Google Compute Engine API Commitments	us-east1	<div style="width: 10%;"> </div>

X Edit quotas

Google Compute Engine API

A request (ID:500f200001BGIVQAAK) has been made for the following quotas

- NVIDIA P100 GPUs - us-east1
- NVIDIA K80 GPUs - us-east1

Check your email
for next steps.



IAM & admin

Quotas

+ EDIT QUOTAS



IAM



Identity



Quotas



Service accounts



Labels



GCP Privacy & Security



Settings



Encryption keys



Identity-Aware Proxy



Roles



Manage resources



Quota type	Service	Metric	Region
All quotas	All services	All metrics	us-central1
<input type="checkbox"/> Service		Region	Used
<input type="checkbox"/> Google Compute Engine API Persistent Disk SSD (GB)		us-central1	 0 / 20
<input type="checkbox"/> Google Compute Engine API Static IP addresses		us-central1	 0 / 20
<input type="checkbox"/> Google Compute Engine API Regional managed instance groups		us-central1	 0 / 20
<input checked="" type="checkbox"/> Google Compute Engine API In-use IP addresses		us-central1	 0 / 8
<input type="checkbox"/> Google Compute Engine API Regional autoscalers		us-central1	 0 / 20
<input type="checkbox"/> Google Compute Engine API Local SSD (GB)		us-central1	 0 / 6,000
<input type="checkbox"/> Google Compute Engine API Managed instance groups		us-central1	 0 / 50
<input type="checkbox"/> Google Compute Engine API Instance groups		us-central1	 0 / 100
<input checked="" type="checkbox"/> Google Compute Engine API Persistent Disk Standard (GB)		us-central1	 0 / 4,096
<input checked="" type="checkbox"/> Google Compute Engine API CPUs		us-central1	 0 / 24

- IAM & admin
- IAM
- Identity
- Quotas
- Service accounts
- Labels
- GCP Privacy & Security
- Settings
- Encryption keys
- Identity-Aware Proxy
- Roles

- Manage resources

Quotas

[+ EDIT QUOTAS](#)

Quota type

Service

Metric

Region

All quotas

All services

All metrics

2 regions

[Clear](#)[Select all](#) [None](#) Global

asia-east1

asia-northeast1

asia-south1

asia-southeast1

 Service

Region

Used

 Google Compute Engine API Networks

Global

 Google Compute Engine API Subnetworks

Global

 Google Compute Engine API Routes

Global

 Google Compute Engine API Firewall rules

Global

 Google Compute Engine API VPN tunnels

Global

 Google Compute Engine API URL maps

Global

 Google Compute Engine API CPUs (all regions)

Global

 Google Compute Engine API Target VPN gateways

Global

 Google Compute Engine API Target TCP proxies

Global

 Google Compute Engine API Target SSL proxies

Global

IAM & admin
IAM
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Quotas
Service accounts
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Settings
Encryption keys
Identity-Aware Proxy
Roles
Manage resources

Quotas		
Quota type	Service	Metric
All quotas	All services	All metrics
<input type="checkbox"/> Service		Region
<input type="checkbox"/> Google Compute Engine API Networks		Global
<input type="checkbox"/> Google Compute Engine API Subnetworks		Global
<input type="checkbox"/> Google Compute Engine API Routes		Global
<input type="checkbox"/> Google Compute Engine API Firewall rules		Global
<input type="checkbox"/> Google Compute Engine API VPN tunnels		Global
<input type="checkbox"/> Google Compute Engine API URL maps		Global
<input checked="" type="checkbox"/> Google Compute Engine API CPUs (all regions)		Global
<input type="checkbox"/> Google Compute Engine API Target VPN gateways		Global
<input type="checkbox"/> Google Compute Engine API Target TCP proxies		Global
<input type="checkbox"/> Google Compute Engine API Target SSL proxies		Global

4 quotas selected

Google Compute Engine API

Persistent Disk Standard (GB) - us-central1

Change to
Your request requires approval. 

65536

In-use IP addresses - us-central1

Change to
Your request requires approval. 

100

CPUs - us-central1

Change to
Your request requires approval. 

400

CPUs (all regions)

Change to
Your request requires approval. 

400

Justification

Required 

Dataflow setup.



IAM

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GCP Privacy & Security

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Identity-Aware Proxy

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Manage resources

Quotas

+ EDIT QUOTAS

Quota type

Service

Metric

All quotas

All services

All metrics

 Service

Region

U

 Google Compute Engine API Networks

Global

G

 Google Compute Engine API Subnetworks

Global

G

 Google Compute Engine API Routes

Global

G

 Google Compute Engine API Firewall rules

Global

G

 Google Compute Engine API VPN tunnels

Global

G

 Google Compute Engine API URL maps

Global

G

 Google Compute Engine API CPUs (all regions)

Global

G

 Google Compute Engine API Target VPN gateways

Global

G

 Google Compute Engine API Target TCP proxies

Global

G

 Google Compute Engine API Target SSL proxies

Global

G

X Edit quotas

Google Compute Engine API

A request (ID:500f200001BGlxbAAH) has been made for the following quotas

- Persistent Disk Standard (GB) - us-central1
- In-use IP addresses - us-central1
- CPUs - us-central1
- CPUs (all regions)

Check your email
for next steps.

DASHBOARD

ACTIVITY

CUSTOMIZE

Project info

Project name

super

Project ID

super-188716

Project number

142124835107

[Go to project settings](#)

Resources

Data unavailable

Trace

No trace data from the past 7 days

[Get started with Stackdriver Trace](#)

Getting Started

Google Cloud

API APIs

Requests (requests/sec)



Requests:

[Go to APIs overview](#)

Google Cloud Platform status

All services normal

[Go to Cloud status dashboard](#)

Billing

Estimated charges

For the billing period Dec 1 – 11, 2017

USD \$0.00

[View detailed charges](#)

Error Reporting

No sign of any errors. Have you set up Error Reporting?

[Learn how to set up Error Reporting](#)

News

Extracting value from your logs with Stackdriver logs-based metrics

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Project name

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Project ID

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API APIs

Requests (requests/sec)



Google Cloud Platform status

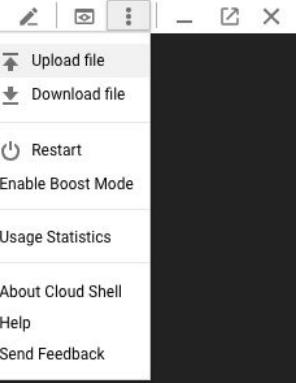
All services normal

→ Go to Cloud status dashboard

Billing

super-188716 x +

Welcome to Cloud Shell! Type "help" to get started.
user @super-188716:~\$



DASHBOARD

ACTIVITY

CUSTOMIZE

Project info

Project name

super

Project ID

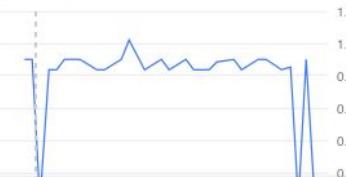
super-188716

Project number

142124835107

API APIs

Requests (requests/sec)



Google Cloud Platform status

All services normal

[Go to Cloud status dashboard](#)

Billing

super-188716 x +

```
user  @super-188716:~$ chmod 777 setup_step_1_cloud_project.sh
user  @super-188716:~$ ./setup_step_1_cloud_project.sh super-188716 P100 us-east1 us-central1
```

Edit | View | More | Minimize | Maximize | Close

Transfer 1 of 1 complete

setup_step_1_cloud_project.sh

Finished

X

DASHBOARD

ACTIVITY

CUSTOMIZE

Project info

Project name

super

Project ID

super-188716

Project number

142124835107

API APIs

Requests (requests/sec)



Google Cloud Platform status

All services normal

[Go to Cloud status dashboard](#)

Billing

```
super-188716 x +  
user @super-188716:~$ chmod 777 setup_step_1_cloud_project.sh  
user @super-188716:~$ ./setup_step_1_cloud_project.sh super-188716 P100 us-east1 us-central1  
Checking quotas for us-central1:  
Checking global quotas:  
GPUs are available for creating a new VM!  
All quota requirements passed!  
Using zone us-east1-c for data science VM creation  
Checking and Enabling Google APIs...  
Waiting for async operation operations/tmo-acf.f4ece514-9046-48dc-a26c-a0aa7acc33a3 to complete...  
  
Transfer 1 of 1 complete  
setup_step_1_cloud_project.sh Finished
```

Project info

Project name

super

Project ID

super-188716

Project number

142124835107

API APIs

Requests (requests/sec)



Google Cloud Platform status

All services normal

[Go to Cloud status dashboard](#)

Billing

super-188716 x +

```
Created [https://www.googleapis.com/compute/v1/projects/super-188716/zones/us-east1-c/instances/super-188716-compute-instance].  
NAME          ZONE      MACHINE_TYPE PREEMPTIBLE INTERNAL_IP  EXTERNAL_IP    STATUS  
super-188716-compute-instance us-east1-c  n1-highmem-2           10.142.0.2   35.196.157.144  RUNNING  
Compute instance created successfully! GPU=P100  
SSH retries: 0  
Creating firewall...  
.....Created [https://www.googleapis.com/compute/v1/projects/super-188716/global/firewalls/temp-ssh].  
done.  
NAME      NETWORK DIRECTION PRIORITY ALLOW    DENY  
temp-ssh  default  INGRESS   1000     tcp:22  
Updating project ssh metadata...  
.....Updated [https://www.googleapis.com/compute/v1/projects/super-188716].  
done.  
Waiting for SSH key to propagate.  
Warning: Permanently added 'compute.2857867100633079092' (ECDSA) to the list of known hosts.  
Pseudo-terminal will not be allocated because stdin is not a terminal.  
Deleted [https://www.googleapis.com/compute/v1/projects/super-188716/global/firewalls/temp-ssh].  
Creating a storage bucket and dataset...  
Creating gs://super-188716-bucket/...  
Dataset 'super-188716:dataset' successfully created.  
Done!  
user  r@super-188716:~$
```

[Home](#)[Compute Engine](#)[SQL](#)[Storage](#)[Billing](#)[BigQuery](#)[ML Engine](#)[IAM & admin](#)

PRODUCTS ▾

[Cloud Launcher](#)[Billing](#)[APIs & services](#)[Support](#)[IAM & admin](#)[VM instances](#)[Instance groups](#)[Instance templates](#)[Disks](#)[Snapshots](#)[Images](#)[Committed use discounts](#)[Metadata](#)[Health checks](#)[Zones](#)[Operations](#)[Quotas](#)[Settings](#)

API APIs

Requests (requests/sec)

[Go to APIs overview](#)

Google Cloud Platform status

All services normal

[Go to Cloud status dashboard](#)

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Estimated charges

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USD \$0.00

[View detailed charges](#)

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News

Extracting value from your logs with Stackdriver logs-based metrics



Compute Engine

VM instances

CREATE INSTANCE

IMPORT VM

REFRESH

START

STOP

RESET

DELETE

SHOW INFO PANEL

VM instances

Instance groups

Instance templates

Disks

Snapshots

Images

Committed use discounts

Metadata

Health checks

Zones

Operations

Quotas

Settings

Filter VM instances

Columns ▾

Name ^

Zone

Recommendation

Internal IP

External IP

Connect

 super-188716-compute-instance

us-east1-c

10.142.0.2

35.196.157.144

SSH

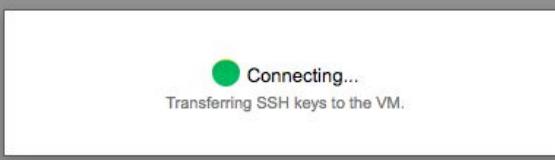
⋮

- Open in browser window
- Open in browser window on custom port
- View gcloud command
- Use another SSH client



SSH: super-188716-compute-instance @ super-188716

Secure | https://ssh.cloud.google.com/projects/super-188716/zones/us-east1-c/instances/super-188716-compute-instance?authus...



Connected, host fingerprint: ssh-rsa 2048 F0:C3:26:F8:44:E1:73:08:9F:3E:41:1A:06:10:65:96:F4:52:3F:B0:21:80:6F:6D
A:C7:5B:B9:4B:0B:CB:5E

Welcome to Ubuntu 16.04.3 LTS (GNU/Linux 4.10.0-42-generic x86_64)

```
* Documentation: https://help.ubuntu.com
* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/advantage
```

```
Get cloud support with Ubuntu Advantage Cloud Guest:
http://www.ubuntu.com/business/services/cloud
```

```
0 packages can be updated.
```

```
0 updates are security updates.
```

```
[ ] user @super-188716-compute-instance:~$
```

Compute Engine

VM instances

Instance groups

Instance templates

Disks

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CREATE

SHOW INFO PANEL

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PRODUCTS ▾

 Cloud Launcher Billing APIs & services > Support > IAM & admin >

VM instances

 CREATE INSTANCE IMPORT VM REFRESH START STOP RESET DELETE

SHOW INFO PANEL

Filter VM instances

Columns ▾

Browser

Transfer

Transfer Appliance

Settings

	Zone	Recommendation	Internal IP	External IP	Connect
compute-instance	us-east1-c		10.142.0.2	35.196.157.144	SSH

 Storage

Browser

 CREATE BUCKET REFRESH DELETE

SHOW INFO PANEL

 Browser Filter by prefix...

Columns ▾

 Transfer Transfer Appliance Settings

Buckets

<input type="checkbox"/> Name	Default storage class 	Location	Lifecycle 	Labels 	Requester pays 	⋮
<input type="checkbox"/> super-188716-bucket	Regional	US-EAST1	None	 Off		

Storage

Browser

UPLOAD FILES

UPLOAD FOLDER

CREATE FOLDER

REFRESH

SHARE PUBLICLY

DELETE

Browser

Filter by prefix...

Transfer

Transfer Appliance

Settings

Buckets / super-188716-bucket



Drop files here
or use the upload button

Storage

Browser

UPLOAD FILES

UPLOAD FOLDER

CREATE FOLDER

REFRESH

SHARE PUBLICLY

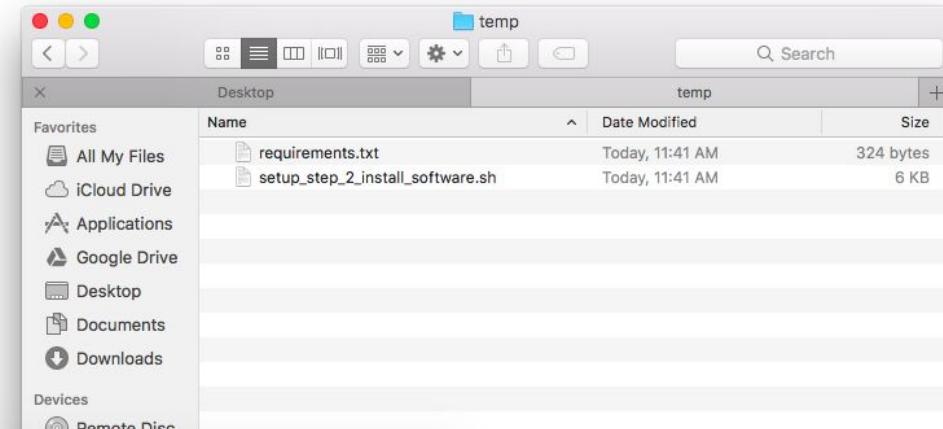
DELETE

Browser

Filter by prefix...

Buckets / super-188716-bucket

<input type="checkbox"/> Name	Size	Type	Storage class	Last modified	Share publicly
<input type="checkbox"/> requirements.txt	324 B	text/plain	Regional	12/11/17, 7:43 PM	<input type="checkbox"/>
<input type="checkbox"/> setup_step_2_install_software.sh	5.73 KB	text/x-sh	Regional	12/11/17, 7:43 PM	<input type="checkbox"/>



Secure | https://ssh.cloud.google.com/projects/super-188716/zones/us-east1-c/instances/super-188716-compute-instance?authuser=1
Connected, host fingerprint: ssh-rsa 2048 F0:C3:26:F8:44:E1:73:08:9F:3E:41:1A:06:10:65:96:F4:52:3F:B0:21:80:6F:6D:1
A1C7:5B:B9:4B:0B:CB:5E

Welcome to Ubuntu 16.04.3 LTS (GNU/Linux 4.10.0-42-generic x86_64)

* Documentation: <https://help.ubuntu.com>
* Management: <https://landscape.canonical.com>
* Support: <https://ubuntu.com/advantage>

Get cloud support with Ubuntu Advantage Cloud Guest:
<http://www.ubuntu.com/business/services/cloud>

Buckets

0 packages can be updated.
0 updates are security updates.

```
user r@super-188716-compute-instance:~$ gsutil cp gs://super-188716-bucket/* .
Copying gs://super-188716-bucket/requirements.txt...
Copying gs://super-188716-bucket/setup_step_2_install_software.sh...
/ [2 files][ 6.0 KiB/ 6.0 KiB]
Operation completed over 2 objects/6.0 KiB.
user r@super-188716-compute-instance:~$ ls
requirements.txt  setup_step_2_install_software.sh
user r@super-188716-compute-instance:~$
```

Share publicly

– ×

Finished	×
Finished	×

user@super-188716-compute-instance:~\$ sh setup_step_2_install_software.sh

Storage

Browser

Transfer

Transfer Appliance

Settings

Bro



Bucket



Storage

Browser

Transfer

Transfer Appliance

Settings

Downloading tensorflow_transform==0.1.10-py2-none-any.whl (117kB)
100% [██████████] 122kB 10.9MB/s
Collecting opencv-python==3.3.0.10 (from -r ./requirements.txt (line 4))
Downloaded opencv_python-3.3.0.10-cp27-cp27mu-manylinux1_x86_64.whl (15.4MB)
100% [██████████] 15.5MB 94kB/s
Collecting opencv-contrib-python==3.3.0.10 (from -r ./requirements.txt (line 5))
Downloaded opencv_contrib_python-3.3.0.10-cp27-cp27mu-manylinux1_x86_64.whl (21.4MB)
100% [██████████] 21.4MB 69kB/s
Collecting scikit-learn==0.19.0 (from -r ./requirements.txt (line 6))
Downloaded scikit_learn-0.19.0-cp27-cp27mu-manylinux1_x86_64.whl (12.2MB)
100% [██████████] 12.2MB 122kB/s
Collecting sklearn (from -r ./requirements.txt (line 7))
Downloaded sklearn-0.0.tar.gz
Collecting statsmodels==0.8.0 (from -r ./requirements.txt (line 8))
Downloaded statsmodels-0.8.0-cp27-cp27mu-manylinux1_x86_64.whl (6.2MB)
100% [██████████] 6.2MB 245kB/s
Collecting pandas==0.20.3 (from -r ./requirements.txt (line 9))
Downloaded pandas-0.20.3-cp27-cp27mu-manylinux1_x86_64.whl (22.4MB)
100% [██████████] 22.4MB 69kB/s
Collecting jupyter==1.0.0 (from -r ./requirements.txt (line 10))
Downloaded jupyter-1.0.0-py3-none-any.whl
Collecting grpc-google-iam-v1==0.11.1 (from -r ./requirements.txt (line 11))
Downloaded grpc-google-iam-v1-0.11.1.tar.gz
Collecting google-cloud-storage==1.4.0 (from -r ./requirements.txt (line 12))
Downloaded google_cloud_storage-1.4.0-py2.py3-none-any.whl (46kB)
100% [██████████] 51kB 11.6MB/s
Collecting google-compute-engine==2.7.0 (from -r ./requirements.txt (line 13))
Downloaded google-compute-engine-2.7.0.tar.gz
Collecting matplotlib==2.1.0 (from -r ./requirements.txt (line 14))
Downloaded matplotlib-2.1.0-cp27-cp27mu-manylinux1_x86_64.whl (14.9MB)
100% [██████████] 14.9MB 101kB/s
Collecting seaborn==0.8.1 (from -r ./requirements.txt (line 15))
Downloaded seaborn-0.8.1.tar.gz (178kB)
100% [██████████] 184kB 7.6MB/s
Collecting scipy==0.19.1 (from -r ./requirements.txt (line 16))
Downloaded scipy-0.19.1-cp27-cp27mu-manylinux1_x86_64.whl (45.0MB)
100% [██████████] 45.0MB 31kB/s
Collecting mock>=2.0.0 (from tensorflow==1.3.0->-r ./requirements.txt (line 2))
Downloaded mock-2.0.0-py2.py3-none-any.whl (56kB)
100% [██████████] 61kB 10.5MB/s
Collecting numpy>=1.11.0 (from tensorflow==1.3.0->-r ./requirements.txt (line 2))
Downloaded numpy-1.13.3-cp27-cp27mu-manylinux1_x86_64.whl (16.6MB)
0% [██████████] 81kB 52.5MB/s eta 0:00:01

Share publicly

Finished

Finished

```
Secure | https://ssh.cloud.google.com/projects/super-188716/zones/us-east1-c/instances/super-188716-compute-instance?authuser=0
widgetsnbextension-3.0.8
setup_step_2_install_software.sh: 131: setup_step_2_install_software.sh: -z: not found
Collecting tensorflow-gpu==1.3.0
  Downloading tensorflow_gpu-1.3.0-cp27-cp27mu-manylinux1_x86_64.whl (158.8MB)
    100% |████████████████████████████████| 158.8MB 8.3kB/s
Requirement already satisfied: mock>=2.0.0 in ./env/lib/python2.7/site-packages (from tensorflow-gpu==1.3.0)
Requirement already satisfied: numpy>=1.11.0 in ./env/lib/python2.7/site-packages (from tensorflow-gpu==1.3.0)
Requirement already satisfied: backports.weakref>=1.0rc1 in ./env/lib/python2.7/site-packages (from tensorflow-gpu==1.3.0)
Requirement already satisfied: wheel in ./env/lib/python2.7/site-packages (from tensorflow-gpu==1.3.0)
Requirement already satisfied: tensorflow-tensorboard<0.2.0,>=0.1.0 in ./env/lib/python2.7/site-packages (from tensorflow-gpu==1.3.0)
Requirement already satisfied: six>=1.10.0 in ./env/lib/python2.7/site-packages (from tensorflow-gpu==1.3.0)
Requirement already satisfied: protobuf>=3.3.0 in ./env/lib/python2.7/site-packages (from tensorflow-gpu==1.3.0)
Requirement already satisfied: funcsigs>=1; python_version < "3.3" in ./env/lib/python2.7/site-packages (from mock>=2.0.0->tensorflow-gpu==1.3.0)
Requirement already satisfied: pbr>=0.11 in ./env/lib/python2.7/site-packages (from mock>=2.0.0->tensorflow-gpu==1.3.0)
Requirement already satisfied: bleach==1.5.0 in ./env/lib/python2.7/site-packages (from tensorflow-tensorboard<0.2.0,>=0.1.0->tensorflow-gpu==1.3.0)
Requirement already satisfied: html5lib==0.9999999 in ./env/lib/python2.7/site-packages (from tensorflow-tensorboard<0.2.0,>=0.1.0->tensorflow-gpu==1.3.0)
Requirement already satisfied: markdown>=2.6.8 in ./env/lib/python2.7/site-packages (from tensorflow-tensorboard<0.2.0,>=0.1.0->tensorflow-gpu==1.3.0)
Requirement already satisfied: werkzeug>=0.11.10 in ./env/lib/python2.7/site-packages (from tensorflow-tensorboard<0.2.0,>=0.1.0->tensorflow-gpu==1.3.0)
Requirement already satisfied: setuptools in ./env/lib/python2.7/site-packages (from protobuf>=3.3.0->tensorflow-gpu==1.3.0)
Installing collected packages: tensorflow-gpu
Successfully installed tensorflow-gpu-1.3.0
Creating firewall...
.....Created [https://www.googleapis.com/compute/v1/projects/super-188716/global/firewalls/allow-jupyter]
.
done.
NAME      NETWORK DIRECTION PRIORITY ALLOW      DENY
allow-jupyter default INGRESS  1000    tcp:5000
Writing default config to: /home/ user  ./jupyter/jupyter_notebook_config.py
Enter password:
Verify password:
[NotebookPasswordApp] Wrote hashed password to /home/ user  ./jupyter/jupyter_notebook_config.json
Done with jupyter setup!
Done with installation! Make sure to type: . ~/bashrc to finish setup.
user  @super-188716-compute-instance:~$
```



Secure | https://ssh.cloud.google.com/projects/super-188716/zones/us-east1-c/instances/super-188716-compute-instance?authuser...

```
(env) user @super-188716-compute-instance:~$ . ~/.bashrc
(super-188716-compute-instance:~$ )
```



Storage

Browser

Transfer

Transfer Appliance

Settings


```
Secure | https://ssh.cloud.google.com/projects/super-188716/zones/us-east1-c/instances/super-188716-compute-instance?authuser=1
(env) user r@super-188716-compute-instance:~$ gsutil cp -r gs://super-188716-bucket/cats/ .
Copying gs://super-188716-bucket/cats/DATAFLOW_TUTORIAL.md...
Copying gs://super-188716-bucket/cats/LICENSE...
Copying gs://super-188716-bucket/cats/README.md...
Copying gs://super-188716-bucket/cats/run_step_2a_query.sh...
/ [4 files] [ 22.9 KiB/ 22.9 KiB]
=> NOTE: You are performing a sequence of gsutil operations that may
run significantly faster if you instead use gsutil -m -o ... Please
see the -m section under "gsutil help options" for further information
about when gsutil -m can be advantageous.
Bucket
Copying gs://super-188716-bucket/cats/run_step_2b_get_images.sh...
Copying gs://super-188716-bucket/cats/run_step_3_split_images.sh...
 Copying gs://super-188716-bucket/cats/setup.py...
 Copying gs://super-188716-bucket/cats/step_0_to_0.ipynb...
 Copying gs://super-188716-bucket/cats/step_1_to_3.ipynb...
 Copying gs://super-188716-bucket/cats/step_2a_query.sql...
 Copying gs://super-188716-bucket/cats/step_2b_get_images.py...
 Copying gs://super-188716-bucket/cats/step_3_split_images.py...
 Copying gs://super-188716-bucket/cats/step_4_to_4_part1.ipynb...
 Copying gs://super-188716-bucket/cats/step_4_to_4_part2.ipynb...
 Copying gs://super-188716-bucket/cats/step_5_to_5_part1.ipynb...
 Copying gs://super-188716-bucket/cats/step_5_to_5_part2.ipynb...
 Copying gs://super-188716-bucket/cats/step_5_to_6_part3.ipynb...
 Copying gs://super-188716-bucket/cats/step_5_to_7_part4.ipynb...
 Copying gs://super-188716-bucket/cats/step_8_to_9.ipynb...
| [19 files] [182.7 KiB/182.7 KiB]
Operation completed over 19 objects/182.7 KiB.
(env) user r@super-188716-compute-instance:~$ jupyter notebook
```

run_step_3_split_images.sh	Finished	X
	Finished	X

```
[env] user @super-188716-compute-instance:~$ jupyter notebook
[I 16:42:06.617 NotebookApp] Writing notebook server cookie secret to /run/user/1001/jupyter/notebook_cookie_secret
[W 16:42:06.912 NotebookApp] WARNING: The notebook server is listening on all IP addresses and not using encryption
VM This is not recommended.
[I 16:42:06.920 NotebookApp] Serving notebooks from local directory: /home/kozyrkov
[I 16:42:06.920 NotebookApp] 0 active kernels
[I 16:42:06.920 NotebookApp] The Jupyter Notebook is running at:
[I 16:42:06.920 NotebookApp] http://[all ip addresses on your system]:5000/
[I 16:42:06.920 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
```



Compute Engine

VM instances

Instance groups

Instance templates

Disks

Snapshots

Images

Committed use discounts

Metadata

Health checks

Zones

Operations

Quotas

Settings



VM instances

CREATE INSTANCE IMPORT VM REFRESH START STOP RESET DELETE SHOW INFO PANEL

Compute Engine > VM instances

Instance groups
Instance templates
Disks
Snapshots
Images
Committed use discounts
Metadata
Health checks
Zones
Operations
Quotas
Settings

	Zone	Recommendation	Internal IP	External IP	Connect
instance	us-east1-c		10.142.0.2	35.196.157.144	SSH

Copy this IP address and enter it in a new tab/window, followed by :5000.

If you got a message in your shell like the one below, you'll need to copy the text after :5000 and append it to your URL on the next slide.

Copy/paste this URL into your browser when you connect for the first time,
to login with a token:

`http://localhost:5000/?token=7e999f2878066f31c6ad586dbf50eb94cb164b1d609702c0`

`[I 12:28:29.875 NotebookApp] 302 GET /?token=7e999f2878066f31c6ad586dbf50eb94cb164b1d609702c0 (74.66.135.209) 0.48m`

New Tab

35.196.157.144:5000

35.196.157.144:5000

35.196.157.144:5000 - Google Search

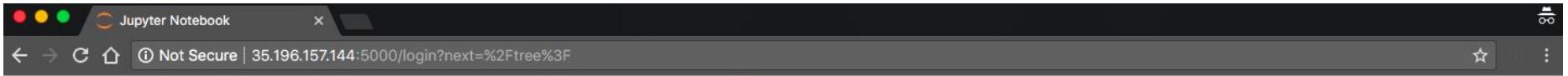


You've gone incognito

Now you can browse privately, and other people who use this device won't see your activity. However, downloads and bookmarks will be saved. [Learn more](#)

Chrome won't save the following information:	Your activity might still be visible to:
<ul style="list-style-type: none">• Your browsing history• Cookies and site data• Information entered in forms	<ul style="list-style-type: none">• Websites you visit• Your employer or school• Your internet service provider

Trouble connecting? Try running the following in your VM:
gcloud compute firewall-rules create allow-jupyter --allow=tcp:5000 --description="allow jupyter on port 5000"



Enter the password you set
when you ran the script.

[Files](#) [Running](#) [Clusters](#)

Select items to perform actions on them.

		Upload	New ▾	↻
Notebook:				
Python 2				
Python 3				
Other:				
Text File				
Folder				
Terminal				
		16 hours ago		
		17 hours ago		
		17 hours ago		

0

cats

env

cuda-repo-ubuntu1604_8.0.61-1_amd64.deb

libcudnn6-dev_6.0.21-1+cuda8.0_amd64.deb

libcudnn6_6.0.21-1+cuda8.0_amd64.deb

requirements.txt

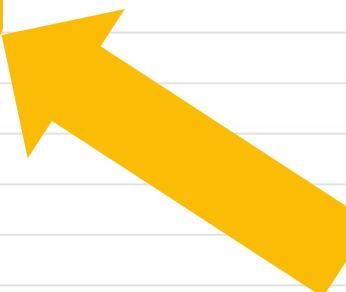
setup_step_2_install_software.sh

Files Running Clusters

Select items to perform actions on them.

Upload New  

<input type="checkbox"/>	0	 / cats	Name 	Last Modified
		 ..		seconds ago
<input type="checkbox"/>		 old_notebooks		9 minutes ago
<input type="checkbox"/>		 nn_demo_part1.ipynb		11 days ago
<input type="checkbox"/>		 nn_demo_part2.ipynb		20 days ago
<input type="checkbox"/>		 step_0_to_0.ipynb		20 days ago
<input type="checkbox"/>		 step_1_to_3.ipynb		11 days ago
<input type="checkbox"/>		 step_4_to_4_part1.ipynb		11 days ago
<input type="checkbox"/>		 step_4_to_4_part2.ipynb		11 days ago
<input type="checkbox"/>		 step_5_to_6_part1.ipynb		11 days ago
<input type="checkbox"/>		 step_5_to_7_part4.ipynb		20 days ago
<input type="checkbox"/>		 step_8_to_9.ipynb		20 days ago
<input type="checkbox"/>		 DATAFLOW_TUTORIAL.md		20 days ago
<input type="checkbox"/>		 LICENSE		20 days ago
<input type="checkbox"/>		 README.md		20 days ago
<input type="checkbox"/>		 run_step_2a_query.sh		20 days ago



File Edit View Insert Cell Kernel Help

Not Trusted

Python 2



Let's Get Started With Data Science, World!

Author(s): kozyr@google.com

Reviewer(s): nrh@google.com

It's a beautiful day and we can do all kinds of pretty things. Here are some little examples to get you started.

Print: ...something

```
In [0]: print('Hello world!')
```

Numpy: make some noise!

numpy is the essential package for working with numbers. Simulate some noise and make a straight line.

```
In [0]: import numpy as np
n = 20
intercept = -10
slope = 5
noise = 10
error = np.random.normal(0, noise, 20)
x = np.array(range(n))
v = intercept + slope * x + error
```

Numpy: make some noise!

`numpy` is the essential package for working with numbers. Simulate some noise and make a straight line.

```
In [2]: import numpy as np
n = 20
intercept = -10
slope = 5
noise = 10
error = np.random.normal(0, noise, 20)
x = np.array(range(n))
y = intercept + slope * x + error
print(x)
print(np.round(y, 2))
```

[0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19]
[-2.81 -3.73 15.69 3.7 4.44 16.3 29.91 38.4 25.8 21.51
 37.91 21.69 52.97 45.63 38.01 65.72 80.98 85.25 72. 89.06]

Pandas: not just for chewing bamboo

`pandas` is the essential package for working with dataframes. Make a convenient dataframe for using our feature to predict our label.

```
In [3]: import pandas as pd
df = pd.DataFrame({'feature': x, 'label': y})
print(df)
```

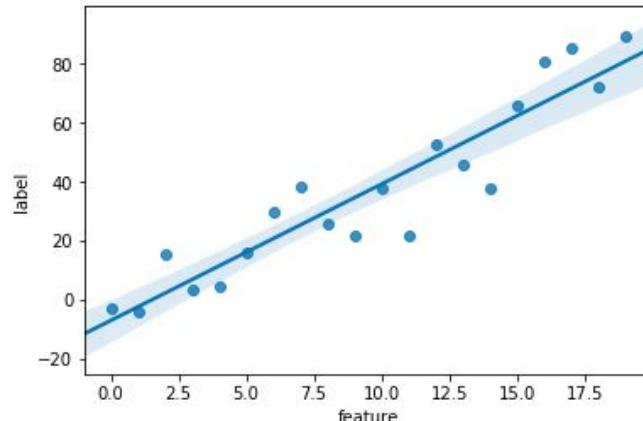
	feature	label
0	0	-2.806122
1	1	-3.732571
2	2	15.685329
3	3	3.701831
4	4	4.444708

Seaborn: pretty plotting

A picture is worth a thousand numbers. `seaborn` puts some glamour in your plotting style.

```
In [4]: import seaborn as sns  
%matplotlib inline  
sns.regplot(x="feature", y="label", data=df)
```

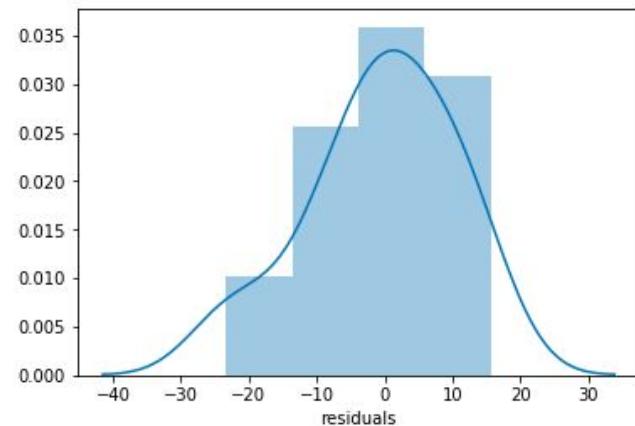
```
Out[4]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd5bd49e550>
```



```
In [5]: %matplotlib inline  
sns.distplot(error, xlabel="residuals")
```

```
Out[5]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd5bd4bb750>
```





TensorFlow: built for speed

`tensorflow` is the essential package for training neural networks efficiently at scale. In order to be efficient at scale, it only runs when it's required to. Let's ask it to greet us...

```
In [8]: import tensorflow as tf  
  
c = tf.constant('Hello, world!')  
  
with tf.Session() as sess:  
  
    print(c.eval())
```

Hello, world!

TensorFlow: built for speed

`tensorflow` is the essential package for training neural networks efficiently at scale. In order to be efficient at scale, it only runs when it's required to. Let's ask it to greet us...

```
In [7]: import tensorflow as tf  
  
c = tf.constant('Hello, world!')  
  
with tf.Session() as sess:  
  
    print sess.run(c)  
  
Hello, world!
```

Finally, let's greet our tensorflow supported devices! Say hello to our CPU, and our GPU if we invited it to the party!

```
In [8]: from tensorflow.python.client import device_lib  
  
def get_devices():  
    devices = device_lib.list_local_devices()  
    return [x.name for x in devices]  
  
print(get_devices())  
  
[u'/cpu:0', u'/gpu:0']
```



Google Cloud Platform Data Science Setup Complete!

Data access

We have hardware, but
do we have data?



Data access

We have hardware, but
do we have data?

Yes

Cloud Platform's public datasets

cloud.google.com/bigquery/public-data/openimages

Google Cloud Platform

Why Google Products Solutions Launcher Pricing Customers Documentation **Support** Partners CONTACT SALES

BigQuery > Documentation

Open Images Data

How to query public data sets using BigQuery

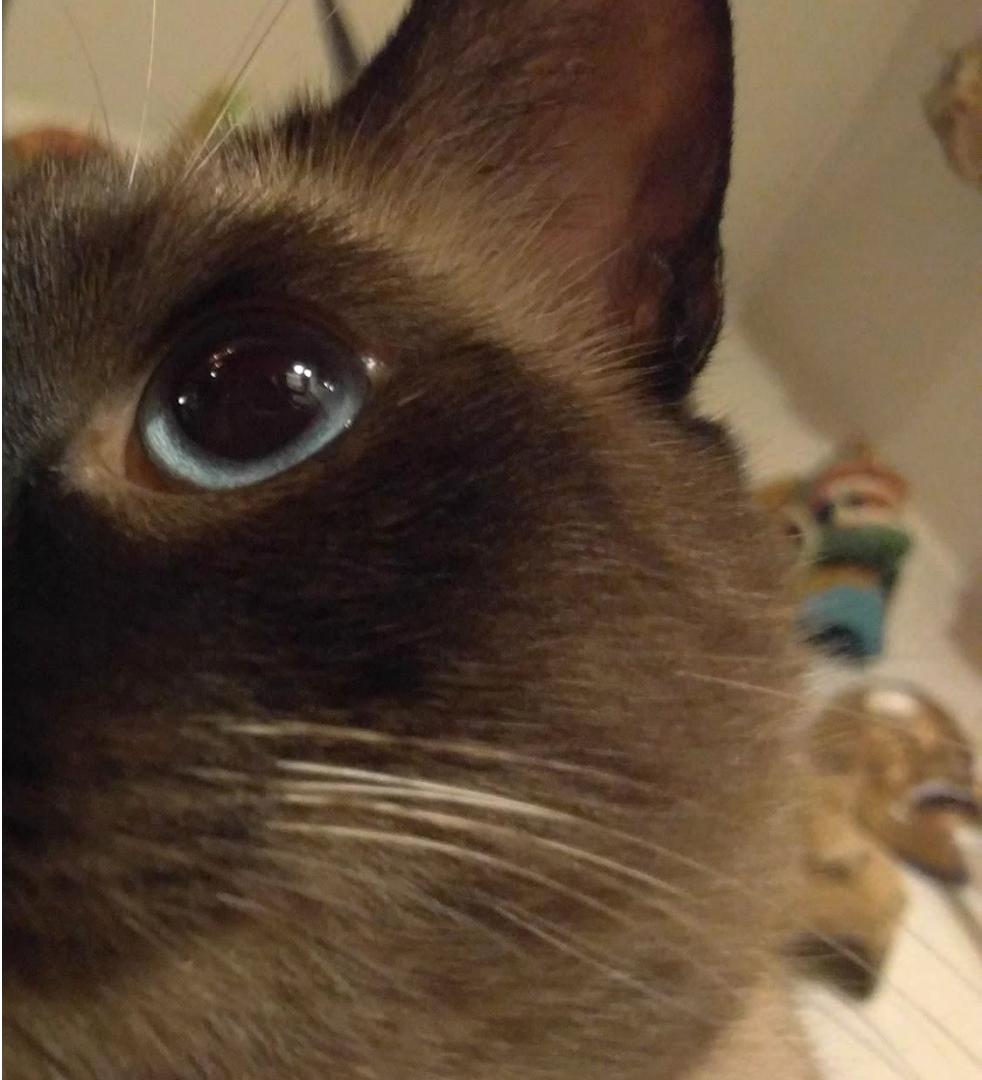
BigQuery is a fully managed data warehouse and analytics platform. Public datasets are available for you to analyze using SQL queries. You can access BigQuery public data sets using the web UI, the command-line tool, or by making calls to the BigQuery REST API using a variety of client libraries such as Java, .NET, or Python.

SEND FEEDBACK

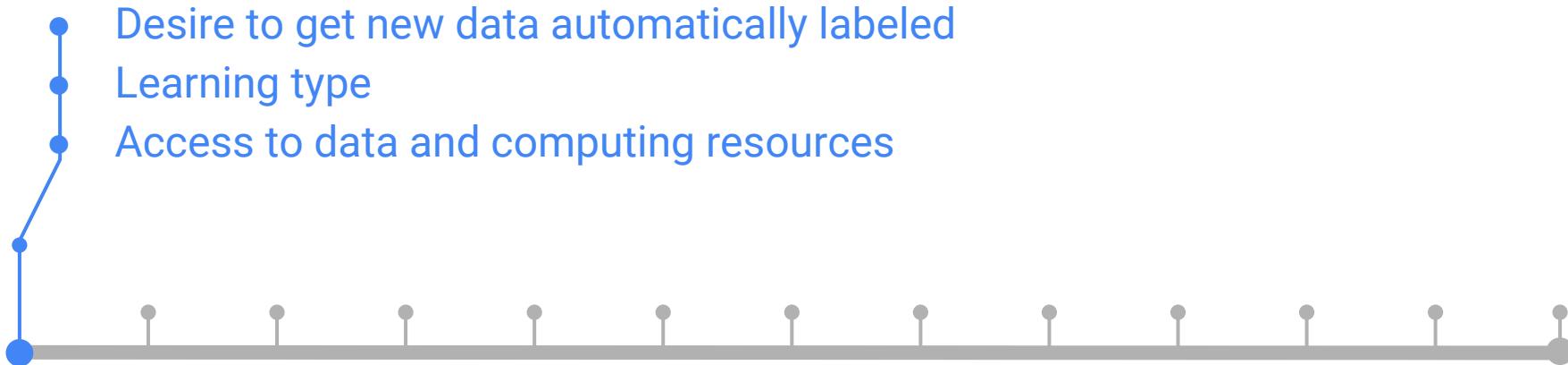
Contents

- How to query public data sets using BigQuery
- Dataset overview
- Sample queries
 - Which labels are in the dataset?
 - Which labels have "bus" in their display names?
 - How many Images of a trolleybus are in the dataset?

Google Cloud



Step 0 is finished | You can use ML if you have identified



Chief actors:



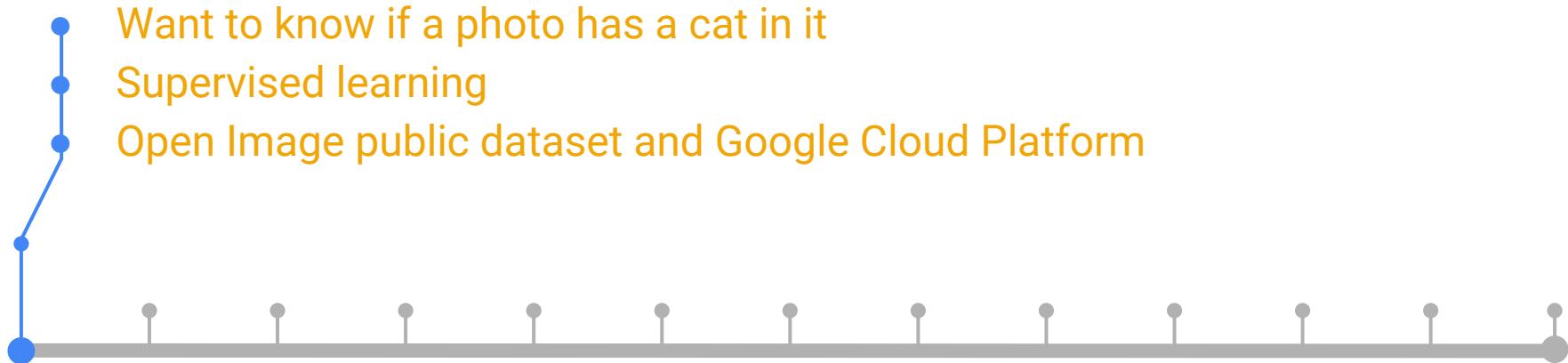
Google Cloud



Domain expert

Decision maker

Step 0 is finished | You can use ML if you have identified



Chief actors:

Google Cloud



Decision maker



Domain expert