

KAIST Summer Session 2018

Module 3. Deep Learning with PyTorch

Leveraging Deep Learning on Your Computer

KAIST College of Business

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30 August, 2018

Deep Learning Requires Intense Resource

- Example: Exploration for neural machine translation (Britz et al. 2017)

Massive Exploration of Neural Machine Translation Architectures

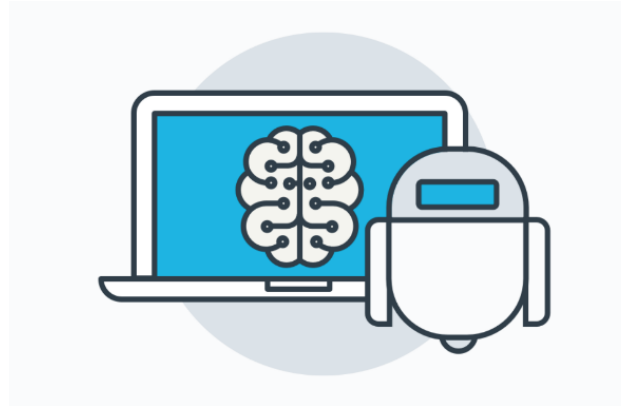
Denny Britz[†], Anna Goldie[‡], Minh-Thang Luong, Quoc Le
{dennybritz, agoldie, thangluong, qvl}@google.com
Google Brain

“One major drawback of current architectures is that they are expensive to train, typically requiring days to weeks of GPU time to converge.”

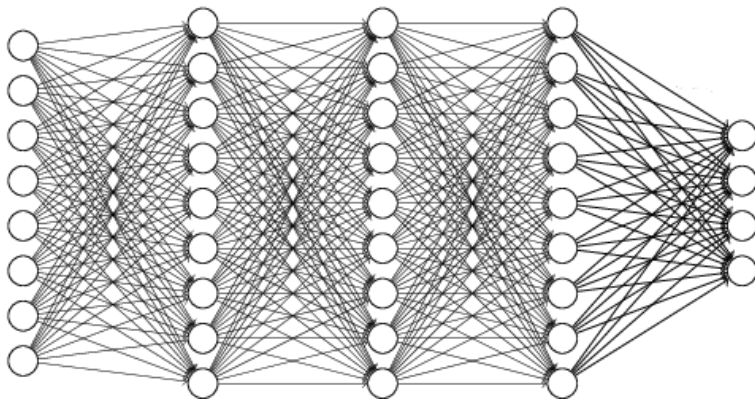
We report empirical results and variance numbers for several hundred experimental runs, corresponding to **over 250,000 GPU hours** on the standard WMT English to German translation task... **consisting of 4.5M sentence pairs**”

Britz, D., Goldie, A., Luong, T. and Le, Q., 2017. Massive Exploration of Neural Machine Translation Architectures. arXiv preprint arXiv:1703.03906.

Can We Leverage Deep Learning on Our Computer?



Your Labtop



Deep Learning

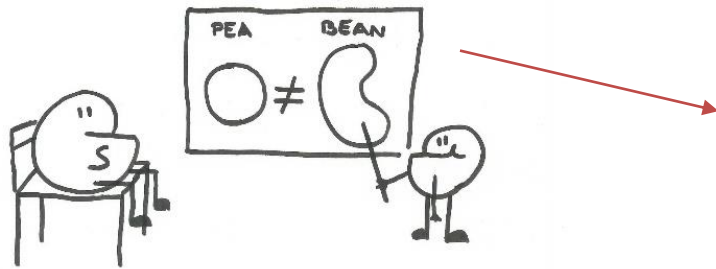


Big Data

Amazon Mechanical Turk

Supervised Learning Needs Labeled Data

- Most research contexts are lacking labeled data.
 - How can we generate labeled dataset to train a supervised learning?



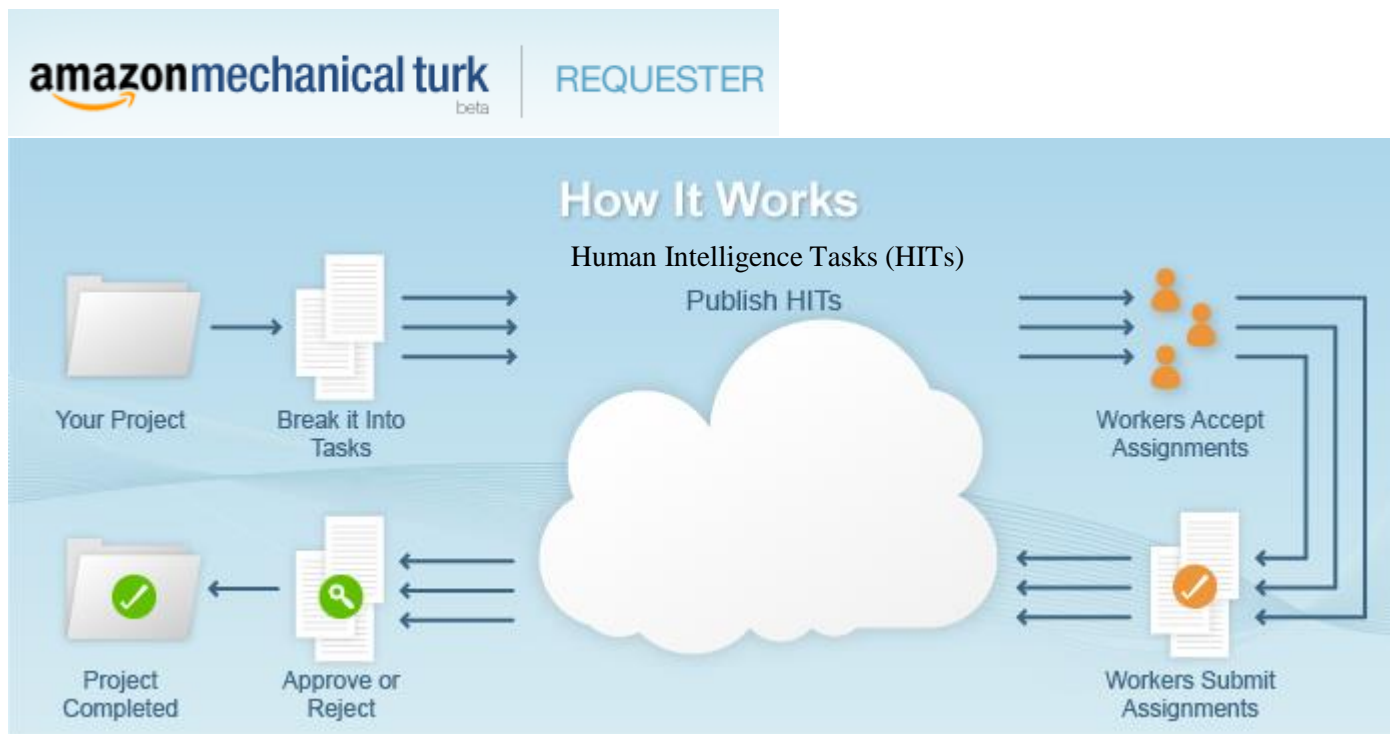
After a while, he will be able to recognize a pea and a bean.



Inputs	Desired outputs
Round shape	Pea
Egg shape	Bean
Round shape	Pea
Round shape	Pea
...	...

How to Label Your Data

- Amazon Mechanical Turk (MTurk) has been very popular in academic research for the goal of data labeling or tagging.



<https://requester.mturk.com/>

How to Label Your Data

- Example: Lee et al. (2018) (See Module 1.8 for more examples)

- Research question

Does the textual advertising content influence consumer engagement on social media?

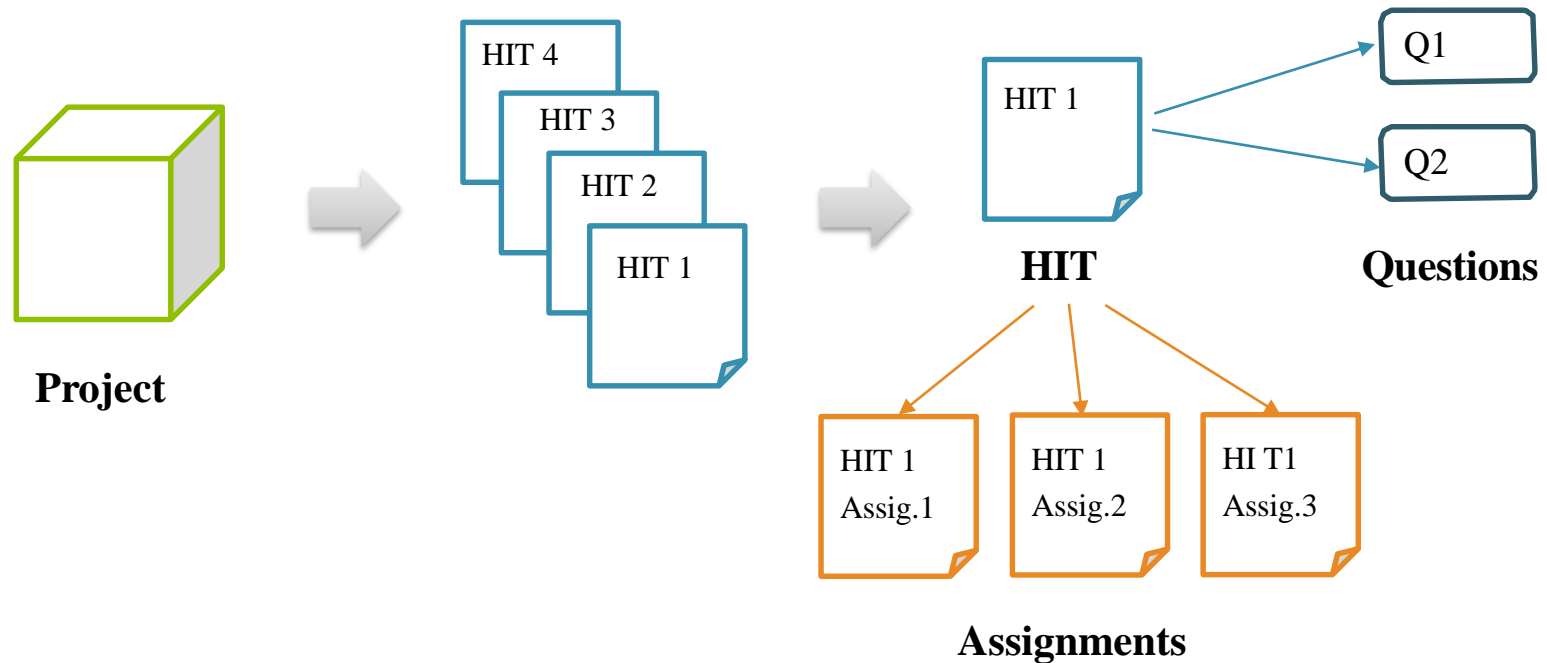
- Economizing approach

- (1) [Labeled data] Human-coding through Amazon Mechanical Turk for 5,000 advertising contents on Facebook
- (2) [Supervised learning] Ensemble learning for content tagging to combine results from the multiple classifiers
- (3) [Prediction] 100,000 text messages

Sample Messages	Content Tags
Welcome to the unveiling of the Pro Staff RF97 that I co-designed with Wilson Tennis. Learn more at http://bit.ly/29JXLdA . #FromFederer	BRANDMENTION, PRODMENTION, PRODLLOCATION, HTTP
Coach Seve and me. Excited to be back in Brisbane! Happy we got the 1st practice of year out of the way!	SMALLTALK, EMOTION
Hello fans from Colombia! I am very happy to see you at the exo I am playing vs Tsonga on Saturday, December 15th! Buy your tickets starting September 12th on www.tuboleta.com . I hope to see you all there!	EMOTION, SMALLTALK, TARGET, PRODAVAIL, PRODLLOCATION, PRODMENTION, HTTP
The Walking Dead Season 1 DVD/Blu-ray is now available, purchase it now!!! http://blogs.amctv.com/the-walking-dead/2011/03/season-1-dvd-blu-ray.php	BRANDMENTION, PRODMENTION, PRODAVAIL, PRODLLOCATION, HTTP
Daryl makes a funny. What are some of your favorite #TheWalkingDead quotes? The highest rated quote will be turned into a graphic! #tbt	SMALLTALK, EMOTION, QUESTION, BRANDMENTION, ASKCOMMENT

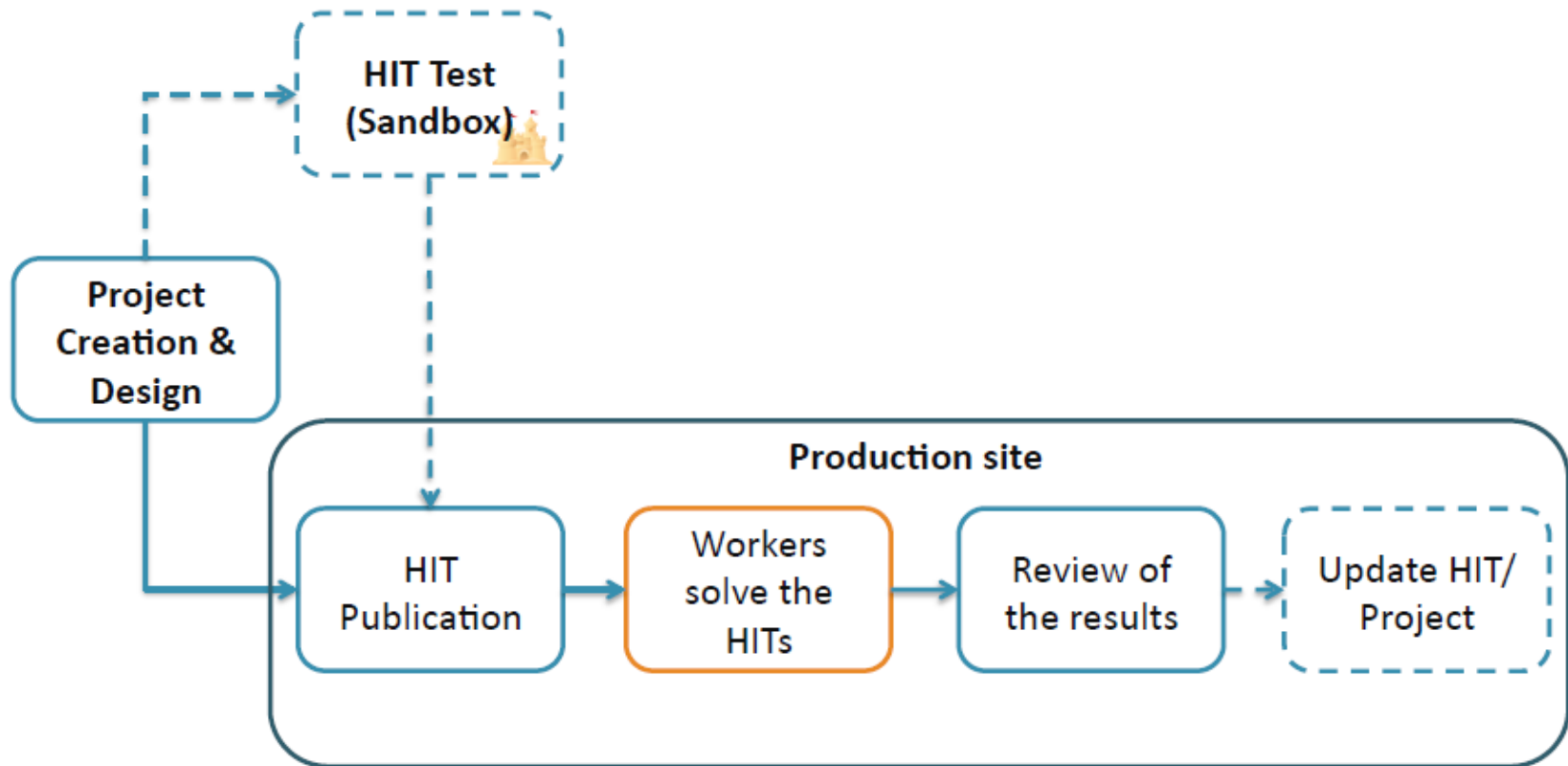
Lee, D., Hosanagar, K. and Nair, H.S., 2018. Advertising Content and Consumer Engagement on Social Media: Evidence from Facebook. *Management Science*. forthcoming

MTurk Basic Elements



Total cost of the project = No. of HITs × No. of Assignments × (Reward per HIT + Fee)

MTurk Workflow for Requesters



Let's Hands-On on MTurk Sandbox

- (1) Create a project using predefined templates

The screenshot shows the Amazon Mechanical Turk Requester interface. The top navigation bar includes 'Home', 'Create', 'Manage', 'Developer', and 'Help'. The 'Create' tab is active, and the 'New Project' link is highlighted. The 'Start a New Project' section displays a list of project templates on the left, with 'Sentiment Project' selected. The main content area shows an 'Example of Sentiment Project' with a 'Sign in to Create Project' button. Below this, there is a 'Sentiment Analysis Instructions' section with a sample text: 'This was the best book I ever read!!! Thank you so much! :)'. A table lists the sentiment categories: Strongly Positive, Positive, Neutral, Negative, and Strongly Negative. A blue box at the bottom states: 'You must ACCEPT the HIT before you can submit the results.'

Sentiment expressed by the content:	
	Strongly Positive
	Positive
	Neutral
	Negative
	Strongly Negative

<https://requestersandbox.mturk.com/>

Let's Hands-On on MTurk Sandbox

- (2) Set up the HIT properties

Setting up your HIT

Reward per assignment

This is how much a Worker will be paid for completing an assignment. Consider how long it will take a Worker to complete each assignment.

Number of assignments per HIT

How many unique Workers do you want to work on each HIT?

Time allotted per assignment

Maximum time a Worker has to work on a single task. Be generous so that Workers can complete the task.

HIT expires in

Maximum time your HIT will be available to Workers on Mechanical Turk.

Auto-approve and pay Workers in

This is the amount of time you have to reject a Worker's assignment after the assignment is approved.

Worker requirements

Require that Workers be Masters to do your HITs ([Who are Mechanical Turk Masters?](#))

☐ Yes ☒ No

Specify any additional qualifications Workers must meet to work on your HITs:

[Remove](#)

[Remove](#)

[\(+\)](#) **Add another criterion** (up to 3 more)

(Premium Qualifications incur additional fees, see [Pricing Details](#) to learn more)

Project contains adult content ([See details](#))

☐ This project may contain potentially explicit or offensive content, for example, nudity.

HIT Visibility ([What is HIT visibility?](#))

☐ Public - All Workers can see and preview my HITs

☒ Private - All Workers can see my HITs, but only Workers that meet all Qualification requirements can preview my HITs

☐ Hidden - Only Workers that meet my HIT Qualification requirements can see and preview my HITs

“We only accepted respondents with a 95% approval rate located within the United States and did not allow repeat participants.” (Younkin and Kuppuswamy 2017)

- (3) Design the project

Edit Project

Use the HTML editor below to design the layout of your HIT. This layout is common for all of the HITs created with this project. You can define variables for data that will vary from HIT to HIT ([Learn more](#)).

① Enter Properties

② Design Layout

③ Preview and Finish

Project Name: This name is not displayed to Workers.

Frame Height: Height in pixels of the frame your HIT will be displayed in to Workers. Adjust the height appropriately to minimize scrolling for Workers.

Font Family

Font Size

Bold

Italic

Text Color

Background Color

Align Left

Align Center

Align Right

Justify

Link

Unlink

Indent

Outdent

Undo

Redo

Fullscreen

Exit Fullscreen

Sentiment Analysis Instructions (Click to expand)

Pick the best sentiment based on the following criterion:

Sentiment	Guidance
Strongly positive	Select this if the item embodies emotion that was extremely happy or excited toward the topic. For example, "Their customer service is the best that I've seen!!!!"
Positive	Select this if the item embodies emotion that was generally happy or satisfied, but the emotion wasn't extreme. For example, "Sure I'll shop there again."
Neutral	Select this if the item does not embody much of positive or negative emotion toward the topic. For example, "Yeah, I guess it's ok." or "Is their customer service open 24x7?"
Negative	Select this if the item embodies emotion that is perceived to be angry or upsetting toward the topic, but not to the extreme. For example, "I don't know if I'll shop there again because I don't trust them."
Strongly negative	Select this if the item embodies negative emotion toward the topic that can be perceived as extreme. For example, "The experience was horrible!!!" or "I will NEVER shop there again!!!"

\$ {content}

Sentiment expressed by the content:

Strongly Positive

Let's Hands-On on MTurk Sandbox

- (4) Publish the HIT

Home Create Manage Developer Help

New Project [New Batch with an Existing Project](#)

Your project was successfully saved.

Start a New Batch with an Existing Project

Project Name	Title	Created ▼	Last Edited	
Sentiment Project	Sentiment analysis	August 23, 2018	August 23, 2018	Publish Batch Edit Copy Delete

2

Publish Batch

Choose a .csv file with the variables you specified in your project. ([learn more](#))

Choose File <no file selected>

Don't have a data file? [Download a sample .csv file.](#)

3

This column will be presented at {\$content}.

	A	B	C
1	content		
2	Hit1_content_data		
3	Hit2_content_data		
4	Hit3_content_data		
5			

Let's Hands-On on MTurk Sandbox

- (4) Publish the HIT

Batch Properties		
Title:	Sentiment analysis	
Description:	Analyze the sentiment of the provided content based on the given criteria	
Batch expires in:	7 Hours	
Results are auto-approved and Workers are paid after:	3 Days	
Workers must meet the following Qualifications to work on these HITs:	<div>HIT Approval Rate (%) score greater than 95</div> <div>Location score is <u>US</u></div>	
HITs		
Number of HITs in this batch:	3	
Number of assignments per HIT:	x 100	
Total number of assignments in this batch:	300	
Cost Summary		
Reward per Assignment:	\$0.20	
	x 300	(total number of assignments in this batch)
Estimated Total Reward:	\$60.00	
Estimated Fees to Mechanical Turk:	+ \$24.00	(fee details)
Estimated Cost:	\$84.00	
Applied Prepaid HITs Balance:	- \$84.00	
Remaining Balance Due:	\$0.00	

Let's Hands-On on MTurk Sandbox

- (5) Useful tips – Divide your work into some pieces
 - For pilot tests, it is recommended to publish the HITs with smaller assignment.
 - (IMPORTANT) The turkers who participated in previous HITs should not be allowed to participate in the subsequent HITs. It is also used for follow-up survey.

The screenshot shows the Amazon Mechanical Turk (MTurk) Requester interface. The main page is titled 'Manage Qualification Types' and includes a navigation bar with 'Home', 'Create', 'Manage', 'Developer', and 'Help'. The 'Manage' tab is selected, and the 'Qualification Types' sub-tab is active. A red box labeled '1' highlights the 'Create New Qualification Type' button. A modal window titled 'Create New Qualification Type' is open, showing a text input field with the text 'Completed My Survey Already' highlighted by a red box labeled '2'. The modal also includes a description field with the text 'Already completed the survey I ran in June 2017.' and 'Cancel' and 'Create' buttons at the bottom.

Let's Hands-On on MTurk Sandbox

- (5) Useful tips – Divide your work into some pieces
 - For pilot tests, it is recommended to publish the HITs with smaller assignment.
 - (IMPORTANT) The turkers who participated in previous HITs should not be allowed to participate in the subsequent HITs. It is also used for follow-up survey.

amazonmechanicalturk **REQUESTER**

Home Create **Manage** Developer Help

Results **Workers** Qualification Types We're Hiring! Learn More

Manage Workers

The Workers who have completed work for you are listed below. Select a Worker ID to bonus, block, unblock, assign a Qualification, or revoke a Qualification. To block, unblock, or change Qualification settings for multiple Workers, select Download CSV. Select Customize View to change which Qualification Types are displayed in the table below.

Customize View **1** Download CSV Upload CSV **3**

Show my Workers by: Lifetime Last 30 days Last 7 days

You currently do not have any Workers who have completed work for you in the selected time period.

Processing File

Manage Workers > Processing File

Please review the following information and confirm your choices:

- Assign 5 Qualification Scores
- Revoke 0 Qualifications
- Block 0 Workers
- Unblock 0 Workers

Would you like to continue?

Yes Cancel

	A	B	C
1	Worker ID	UPDATE-Completed My Survey Already 2	
2	A100OV9D1OY7NI		1
3	A109CH3492UU42		1
4	A108H9PYCUDJ		1
5	A10LQ8RUWWDUI5U		1
6	A1102MP1CZI32V		1
7			

Create a new column with the name of "UPDATE-Qualification Name".

Let's Hands-On on MTurk Sandbox

- (5) Useful tips – Divide your work into some pieces
 - For pilot tests, it is recommended to publish the HITs with smaller assignment.
 - (IMPORTANT) The turkers who participated in previous HITs should not be allowed to participate in the subsequent HITs. It is also used for follow-up survey.

1

Worker requirements

Require that Workers be Masters to do your HITs (Who are Mechanical Turk Masters?)

☐ Yes ☒ No

Specify any additional qualifications Workers must meet to work on your HITs:

Completed My Survey Already

has not been granted

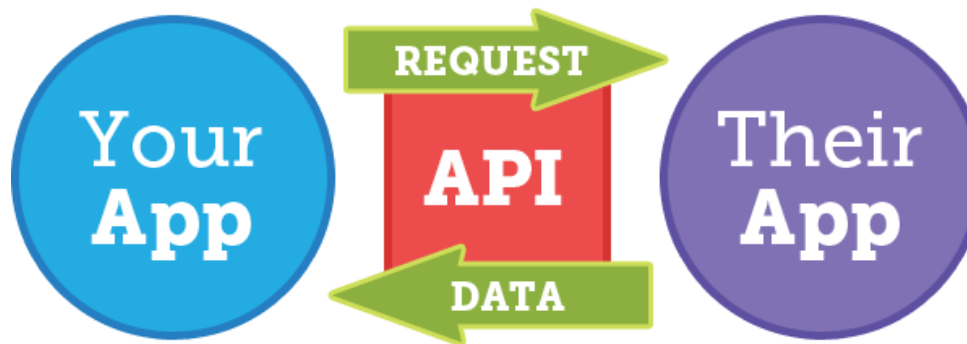
Remove

(+) Add another criterion (up to 4 more)

How to Use Cloud-based APIs

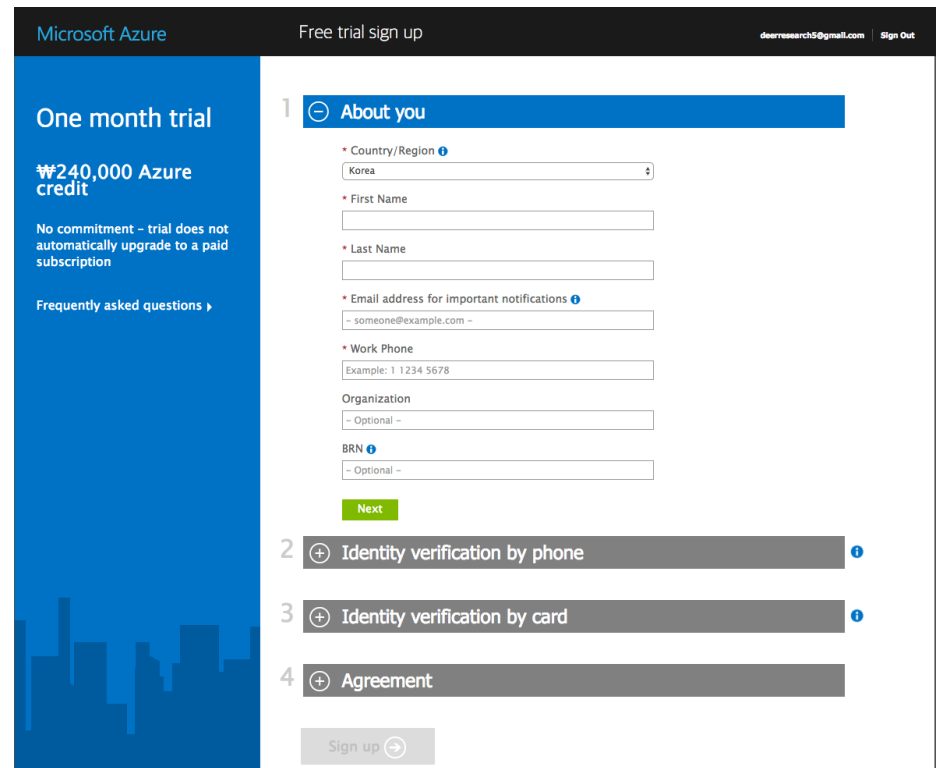
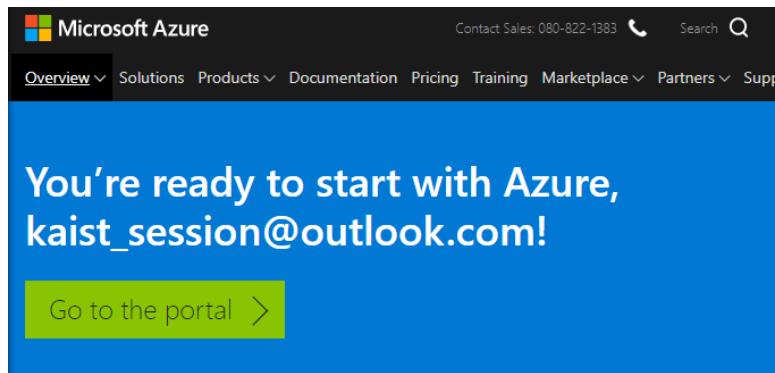
What is an API?

- API is the acronym for Application Programming Interface, which is a software intermediary that allows two applications to talk to each other.
 - Each time you use an app like Facebook, send an instant message, or check the weather on your phone, you're using an API.
 - Recently, many IT companies provide cloud-based APIs for deep learning applications (e.g., [Google Cloud](#), [Microsoft Azure](#), [IBM Watson](#))



Getting an API Key

- Microsoft Azure (<https://azure.microsoft.com/en-us/free/>)



Getting an API Key

1

portal.azure.com

2 Microsoft Azure

3

face

4

Create

Everything

Filter

Results

NAME	PUBLISHER	CATEGORY
Face	Microsoft	AI + Machine Learning
VU Face Recogn - BYOL	VU LLC	Compute
VU Face Recogn	VU LLC	Compute
MX Public Store Edition Server (with SQL)	NDL Software	Compute
MX Public Store Edition Server (without SQL)	NDL Software	Compute
Service Gateway Management Console	Microsoft	Web
CAE Fidesys	Fidesys	Compute
CAE Fidesys Rus (HDD)	Fidesys	Compute
lumify	Altamira	Compute
Apache Solr Certified by Bitnami	Bitnami	Compute
SharePoint 2013 HA Farm	Microsoft	Compute
Information Data Quality 10.1.1 HF2	Informatica	Compute
Azure Active Directory B2C	Microsoft	Identity

Face
Microsoft

Add facial recognition capabilities to detect human faces in images, can also identify attributes, including machine-predicted facial features.

Once faces have been identified, you can identify the same by using a confidence or identical face already exists. traits.

Make facial recognition a key feature of your application.

Save for later

PUBLISHER

USEFUL LINKS

Getting an API Key

1

Home > Everything > Face > Create

Create Face

* Name
MovieActor_Analysis ✓

* Subscription
Free Trial ▼

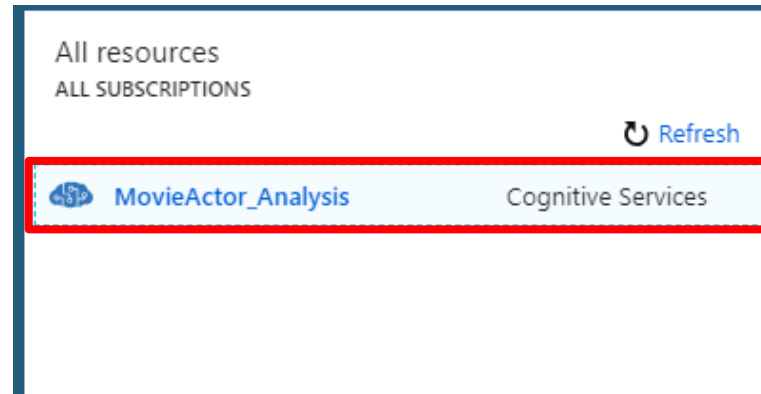
* Location
East Asia ▼

* Pricing tier (View full pricing details)
F0 (20 Calls per minute, 30K Calls per mon... ▼

* Resource group
☒ Create new ☐ Use existing

SummerSession ✓

2



3 KEY

Home > MovieActor_Analysis - Keys

MovieActor_Analysis - Keys
Cognitive Services

Search (Ctrl+/)

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

RESOURCE MANAGEMENT
Keys
Quick start

Regenerate Key1 Regenerate Key2

Notice: It may take up to 10 minutes for the newly (re)generated keys to take effect.

NAME
MovieActor_Analysis

KEY 1
e743

KEY 2
47d0

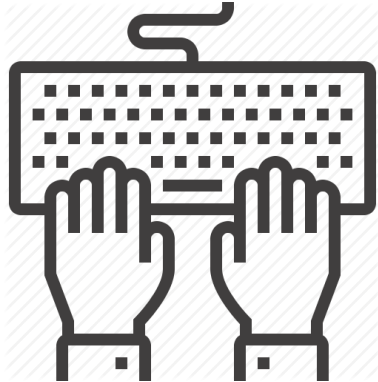
Getting an Endpoint URL

- The endpoint URL you request to API may be different based on location.

The screenshot displays the Azure portal interface for a resource group named 'codehollow-cognitiveservices-rg'. The left sidebar shows the 'Keys' option under 'RESOURCE MANAGEMENT' circled in orange. The main content area shows the 'Essentials' tab with the following details:

- Resource group (change): [codehollow-cognitiveservices-rg](#)
- Status: Active
- Location: West US
- Subscription name (change): [codehollow-cognitiveservices-rg](#)
- Subscription ID: [codehollow-cognitiveservices-rg](#)
- API type: Face API (preview)
- Pricing tier: Free
- Endpoint: <https://westus.api.cognitive.microsoft.com/face/v1.0> (circled in orange)

Below the essentials, there is a section titled 'Total Calls and Total Errors' with a line chart showing data from 8:15 to 9:00. The chart shows a very low number of calls and errors, with a red dashed line at the bottom. An 'Edit' button is visible in the top right corner of the chart area.



How to Use API

M3.8 MS Face API_Face Detection.ipynb

Running Deep Learning on the Cloud

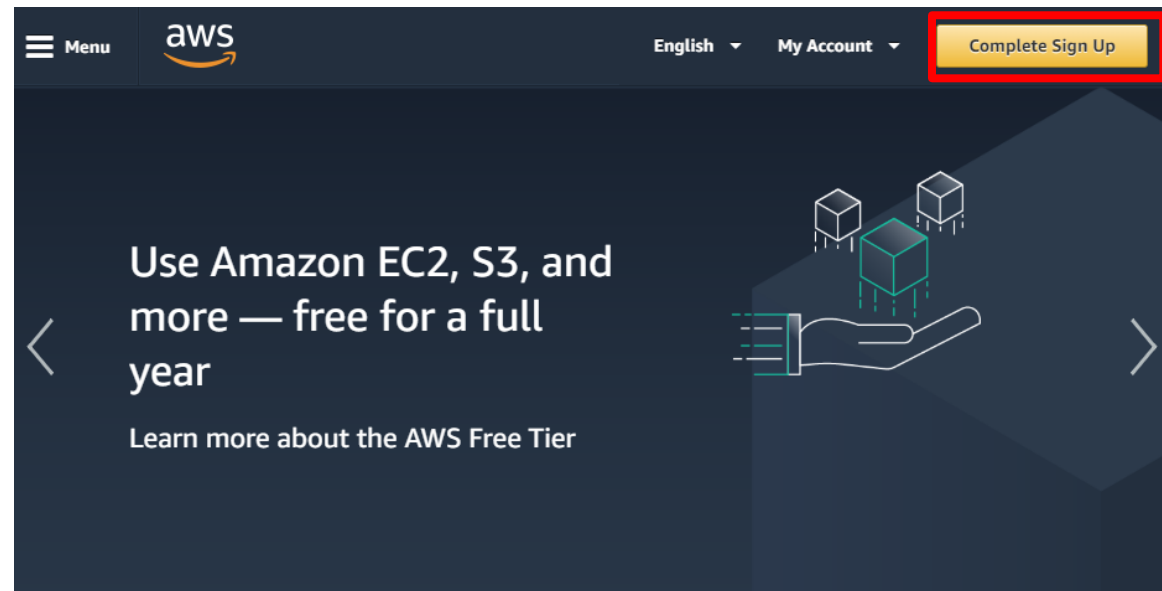
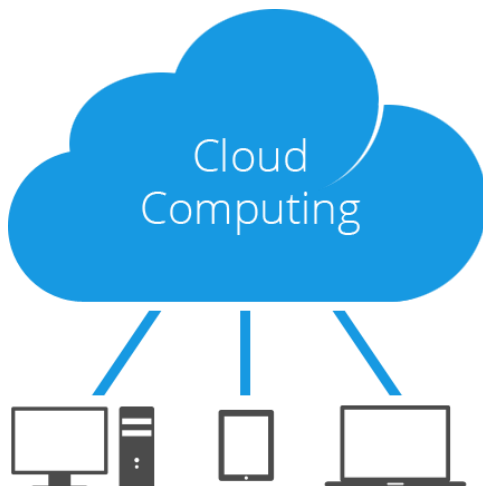
Cloud Computing

- We can run deep learning applications on a virtual machine located in cloud computing which provides shared pools of configurable system resources (e.g., Amazon Web Service).

1

<https://aws.amazon.com/>

2



Launch Instance (Virtual Machine)

The screenshot displays the AWS Management Console interface. On the left sidebar, the 'Compute' category is selected, and 'EC2' is highlighted with a red box and the number '1'. The main content area shows the 'EC2 Dashboard' with a sidebar menu on the left and a 'Resources' section on the right. The 'Resources' section lists various EC2 resources in the Asia Pacific (Seoul) region, including Running Instances, Elastic IPs, Snapshots, Load Balancers, and Security Groups. A 'Launch Instance' button is highlighted with a red box and the number '2'. Below the button, there is a 'Create Instance' section with instructions on how to start using Amazon EC2. The 'Service Health' section shows the status of the service in the Asia Pacific (Seoul) region, indicating it is 'OK'.

1

2

Launch Instance (Virtual Machine)

Step 1: Choose an Amazon Machine Image (AMI)

[Cancel and Exit](#)

(<http://www.ubuntu.com/cloud/services>).

Root device type: ebs Virtualization type: hvm

1



Windows

Free tier eligible

Microsoft Windows Server 2016 Base - ami-09946216dae739979

Microsoft Windows 2016 Datacenter edition. [English]

Root device type: ebs Virtualization type: hvm

Select

64-bit



Deep Learning AMI (Ubuntu) Version 12.0 - ami-6ba21505

Free tier eligible

Comes with latest binaries of deep learning frameworks pre-installed in separate virtual environments: MXNet, TensorFlow, Caffe, Caffe2

PyTorch, Keras, NVIDIA CUDA

Root device type: ebs

Select

64-bit



Amazon Linux

Free tier eligible

Deep Learning AMI (Amazon Linux) Version 2.0 - ami-56a31438

Comes with latest binaries of deep learning frameworks pre-installed in separate virtual environments: MXNet, TensorFlow, Caffe, Caffe2

PyTorch, Keras, NVIDIA CUDA

Root device type: ebs

Step 2: Choose an Instance Type

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instances are virtual servers that can run applications. They have varying combinations of CPU, memory, storage, and networking capacity, and give you the flexibility to choose the appropriate mix of resources for your applications. [Learn more](#) about instance types and how they can meet your computing needs.

Filter by: All instance types Current generation [Show/Hide Columns](#)

Currently selected: t2.micro (Variable ECUs, 1 vCPUs, 2.5 GHz, Intel Xeon Family, 1 GiB memory, EBS only)

	Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
<input type="checkbox"/>	General purpose	t2.nano	1	0.5	EBS only	-	Low to Moderate
<input checked="" type="checkbox"/>	General purpose	t2.micro Free tier eligible	1	1	EBS only	-	Low to Moderate
<input type="checkbox"/>	General purpose	t2.small	1	2	EBS only	-	Low to Moderate
<input type="checkbox"/>	General purpose	t2.medium	2	4	EBS only	-	Low to Moderate
<input type="checkbox"/>	General purpose	t2.large	2	8	EBS only	-	Low to Moderate

2

You can assess the instance via other channels. Here, we will use Window Server.

Launch Instance (Virtual Machine)

Amazon EC2 Instance Types

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instance types comprise varying combinations of CPU, memory, storage, and networking capacity and give you the flexibility to choose the appropriate mix of resources for your applications. Each instance type includes one or more instance sizes, allowing you to scale your resources to the requirements of your target workload.

Get Started with AWS for Free

Create a Free Account

AWS Free Tier includes 750 hours of Linux and Windows t2.micro instances each month for one year. To stay within the Free Tier, use only EC2 Micro instances.

[View AWS Free Tier Details »](#)

General Purpose Compute Optimized Memory Optimized
Accelerated Computing Storage Optimized

Choose the specifications
of virtual machine for
your purpose.

P3

P3 instances are the latest generation of general purpose GPU instances.

Features:

- Up to 8 NVIDIA Tesla V100 GPUs, each pairing 5,120 CUDA Cores and 640 Tensor Cores
- High frequency Intel Xeon E5-2686 v4 (Broadwell) processors
- Supports NVLink for peer-to-peer GPU communication
- Provide Enhanced Networking using Elastic Network Adapter with up to 25 Gbps of aggregate network bandwidth within a Placement Group

Use Cases

Machine/Deep learning, high performance computing, computational fluid dynamics, computational finance, seismic analysis, speech recognition, autonomous vehicles, drug discovery.

Model	GPUs	vCPU	Mem (GiB)	GPU Mem (GiB)	GPU P2P
p3.2xlarge	1	8	61	16	-
p3.8xlarge	4	32	244	64	NVLink
p3.16xlarge	8	64	488	128	NVLink

<https://aws.amazon.com/ec2/instance-types>

Launch Instance (Virtual Machine)

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](#).

Create a new key pair ▼

Key pair name
kaist_session

Download Key Pair

You have to download the **private key file** (*.pem file) before you can continue. **Store it in a secure and accessible location.** You will not be able to download the file again after it's created.

Cancel Launch Instances

Downloaded file will be used to get the password.

aws Services Resource Groups Jiyong Park Seoul Support

Launch Status

✓ Your instances are now launching
The following instance launches have been initiated: i-0b992a8340b87bf14 [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

- Amazon EC2: User Guide
- How to connect to your Windows instance
- Amazon EC2: Microsoft Windows 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

2 [View Instances](#)

Access Instance (Virtual Machine)

- For Windows users

The screenshot illustrates the process of accessing an AWS EC2 instance for Windows users. It includes the AWS Management Console interface and three modal windows with numbered steps:

- Step 1:** In the AWS Management Console, click the **Connect** button for the instance 'Window S...'. A dropdown menu appears with options like 'Connect', 'Get Windows Password', and 'Launch More Like This'.
- Step 2:** In the 'Connect To Your Instance' modal, click the **Get Password** button.
- Step 3:** In the 'Connect To Your Instance > Get Password' modal, click the **Key Pair Path** button to select a file.
- Step 4:** In the 'Connect To Your Instance > Get Password' modal, click the **Decrypt Password** button.
- Step 5:** In the 'Connect To Your Instance' modal, click the **Download Remote Desktop File** button.

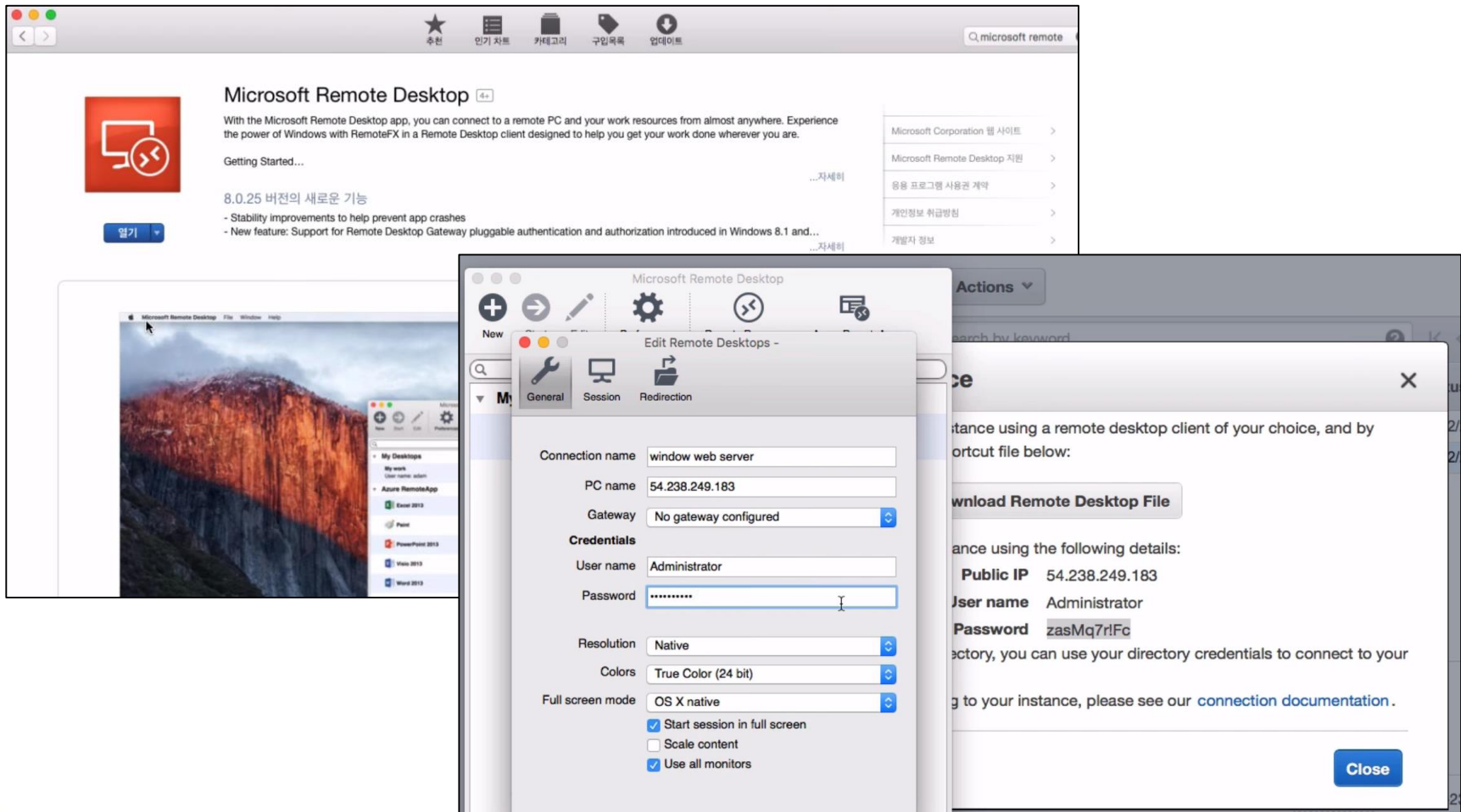
The 'Connect To Your Instance' modal also displays connection details:

- Public DNS:** ec2-13-124-190-182.ap-northeast-2.compute.amazonaws.com
- User name:** Administrator

Additional text in the modal includes: 'You can connect to your Windows instance using a remote desktop client of your choice, and by downloading and running the RDP shortcut file below:', 'When prompted, connect to your instance using the following details:', and 'If you've joined your instance to a directory, you can use your directory credentials to connect to your instance. If you need any assistance connecting to your instance, please see our [connection documentation](#).'

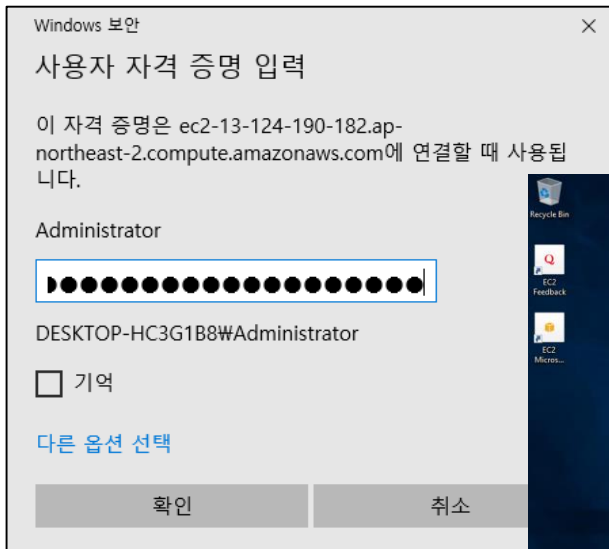
Access Instance (Virtual Machine)

- For macOS users, you may use “Microsoft Remote Desktop”



Access Instance (Virtual Machine)

- You can access a new window running on the cloud.
 - Install Python and keep training your model

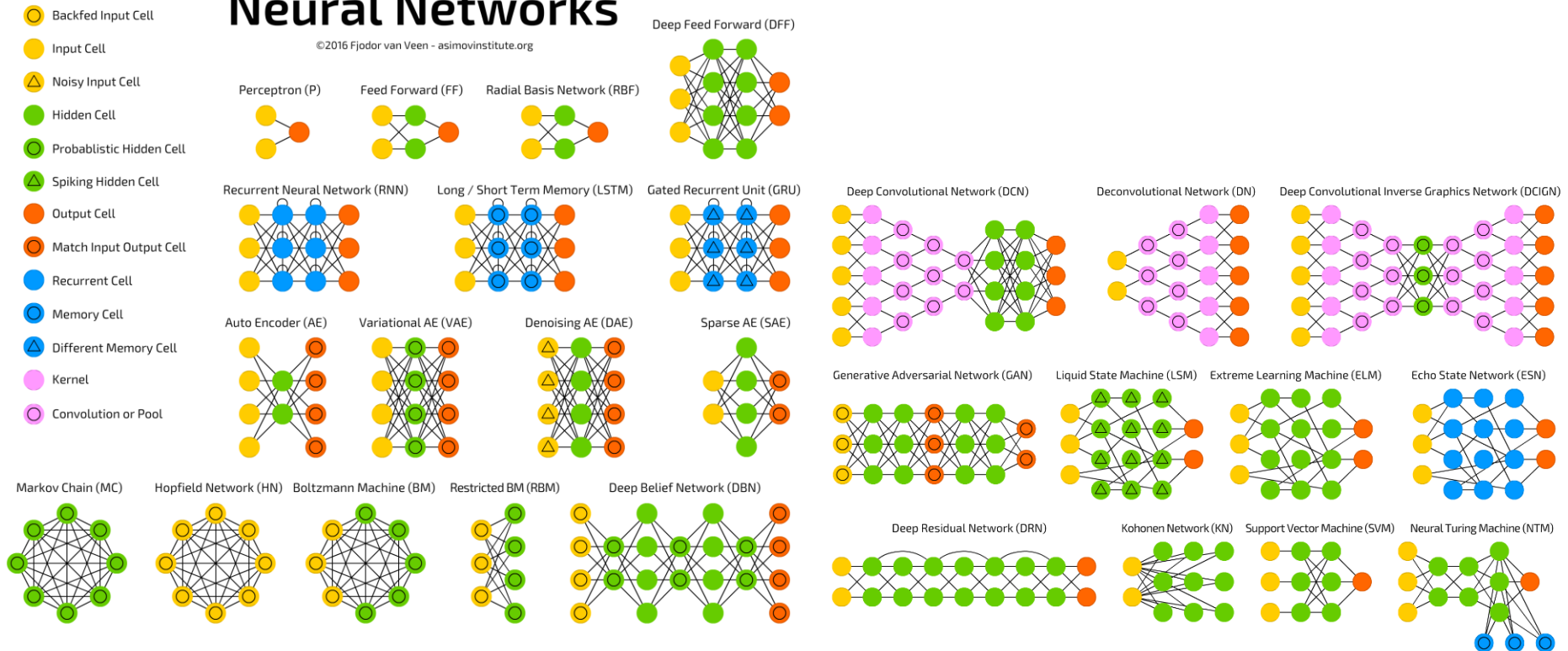


Conclusion

Enjoy Your Deep Learning!

A mostly complete chart of Neural Networks

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<https://becominghuman.ai/cheat-sheets-for-ai-neural-networks-machine-learning-deep-learning-big-data-678c51b4b463>

End of Document