Exploring Computer Vision with Cloud Services

[Course Materials]

http://

Introduction of Trainer

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Programme

	Morning	Afternoon

Day 1	• Introduction to Cloud Computer Vision Services
	• Using Off-the-shelf computer vision services.
	     • Activity 1: Google Cloud Vision
		• Using customizable (trainable) computer vision services
		     • Activity 2: Google AutoML Vision

Prerequisites

- Google Cloud Platforms (GCP)
  - Google account with payment details

- Programming Language
  - Python

- Tools / System used
  - Google's Colab
   - https://colab.research.google.com/

Cloud Services

Cloud Services

- Cloud services refers to a wide range of services delivered on demand to companies and customers over the internet. These services are designed to provide easy, affordable access to applications and resources, without the need for internal infrastructure or hardware.
  - Ref: https://www.citrix.com/en-sg/solutions/digital-workspace/what-is-a-cloud-service.html

- Cloud services are infrastructure, platforms, or software that are hosted by third-party providers and made available to users through the internet.
  - Ref: https://www.redhat.com/en/topics/cloud-computing/what-are-cloud-services

Cloud Computing VS Cloud Services

- Cloud computing is the availability of storage, processing power and applications, while cloud service is the service supported by cloud computing

- Sometimes cloud computing and cloud services are used interchangeable

https://simplycoding.in/cloud-computing/
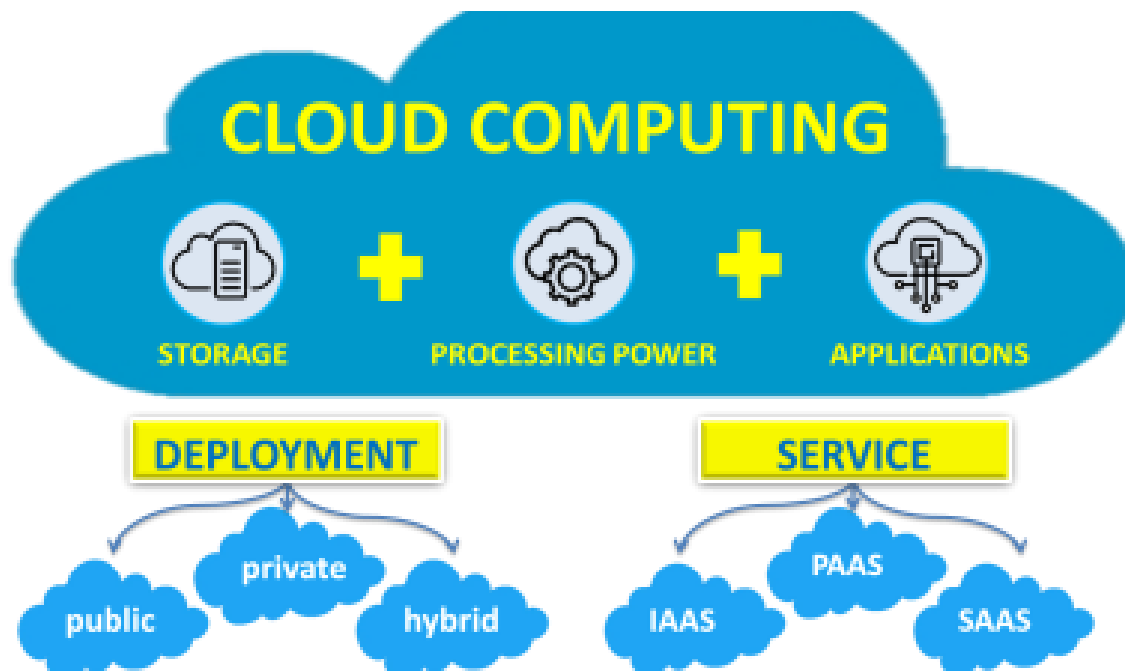
Brief History of Cloud Service

https://simplycoding.in/cloud-computing/
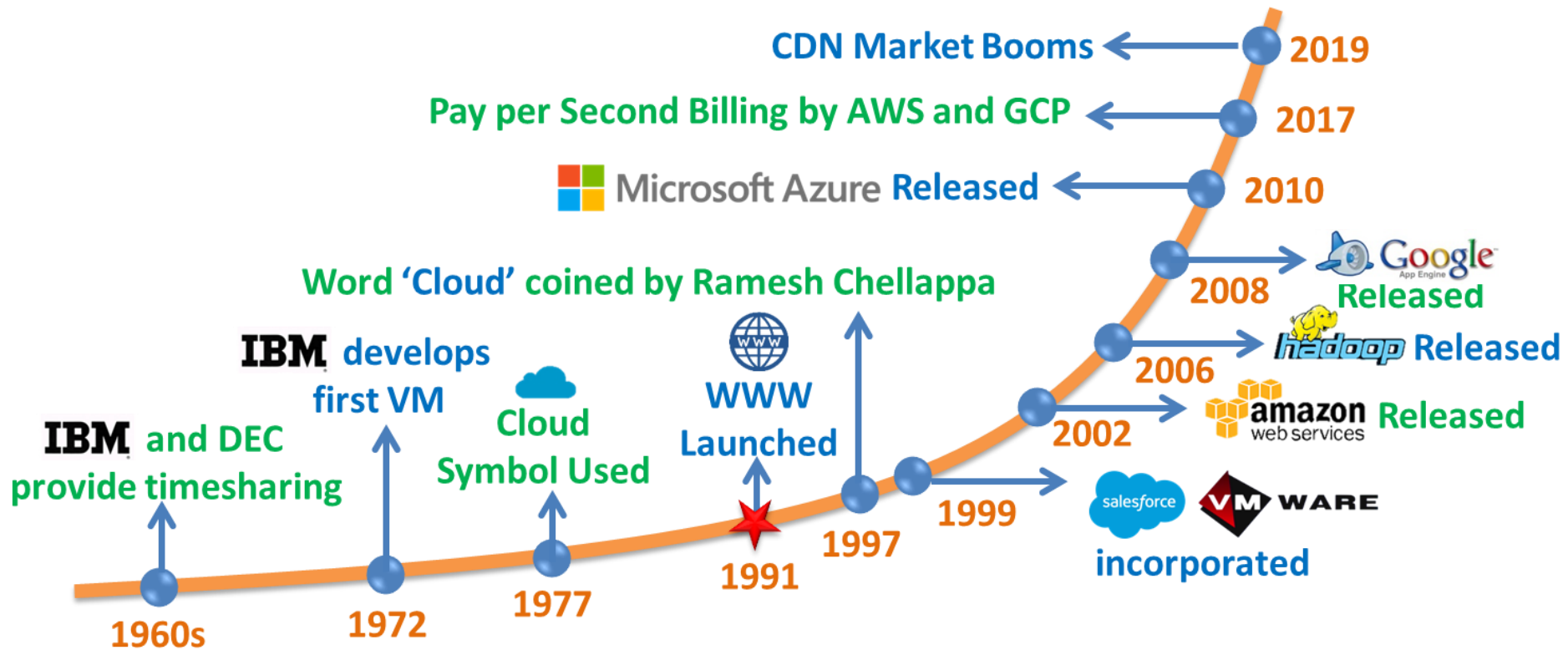
Benefits of Cloud Services

Easily Upgraded + **Lower Cost of Ownership** + **No Maintenance**

Off Site Storage + **Increased Collaboration** + **Pay as you go**

https://simplycoding.in/cloud-computing/

Types of Cloud Services

IAAS — Infrastructure As A Service

PAAS — Platform As A Service

SAAS — Software As A Service
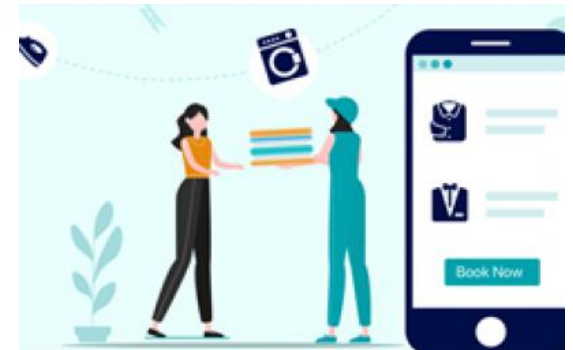
Washing Machine at home — **Self Service Washing Machine** — **Call for Laundry Service**

https://simplycoding.in/cloud-computing/

Types of Cloud Services

https://www.youtube.com/watch?v=36zducUX16w
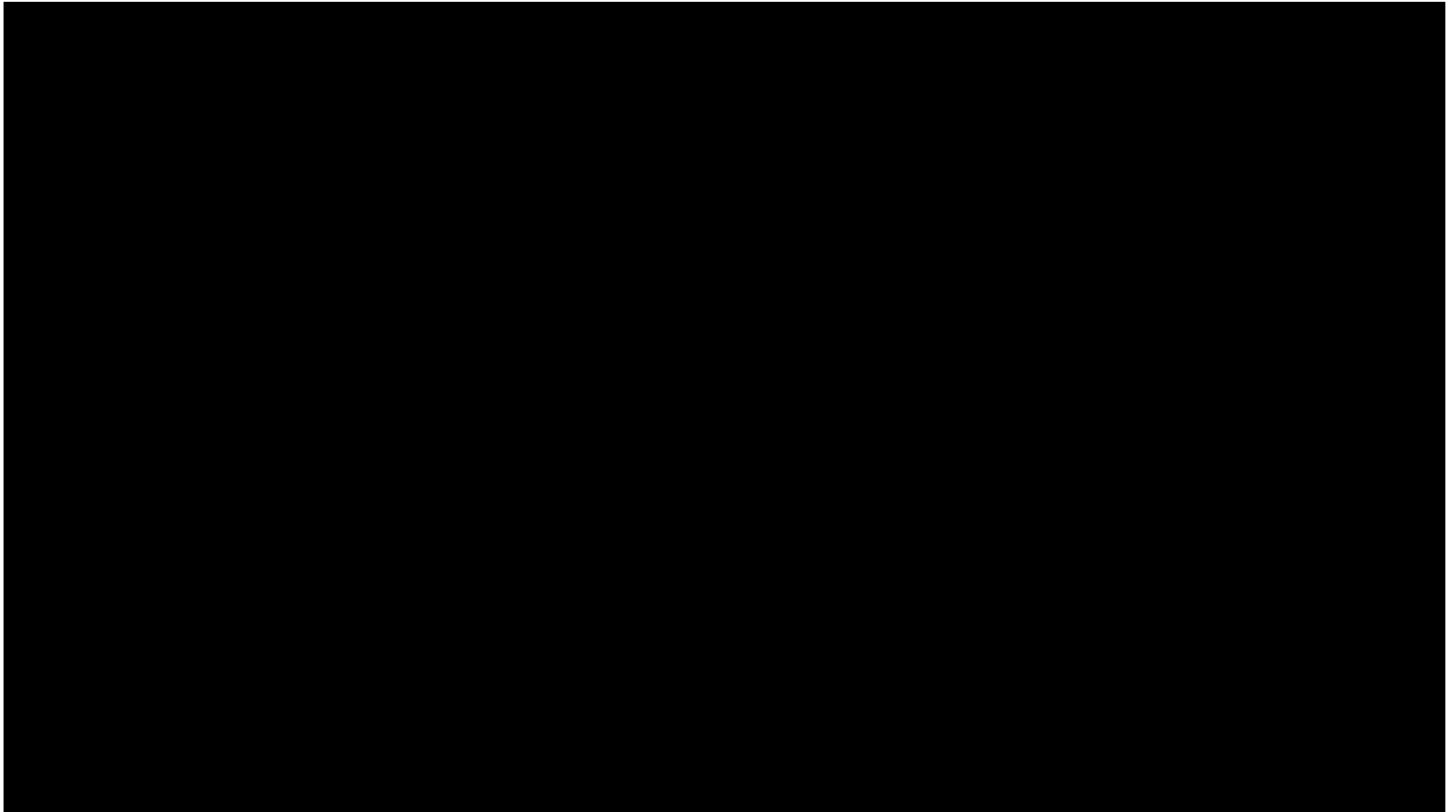
Types of Cloud Services

On-site	IaaS	PaaS	SaaS
Applications	Applications	Applications	Applications
Data	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
O/S	O/S	O/S	O/S
Virtualization	Virtualization	Virtualization	Virtualization
Servers	Servers	Servers	Servers
Storage	Storage	Storage	Storage
Networking	Networking	Networking	Networking

■ You manage

■ Service provider manages

Types of Deployment Model

- **Public Cloud**
  - The cloud resources (like servers and storage) are owned and operated by a third-party cloud service provider and delivered over the internet. With a public cloud, all hardware, software, and other supporting infrastructure are owned and managed by the cloud provider.

- **Private Cloud**
  - A private cloud consists of cloud computing resources used exclusively by one business or organization. The private cloud can be physically located at your organization's on-site datacenter, or it can be hosted by a third-party service provider. But in a private cloud, the services and infrastructure are always maintained on a private network and the hardware and software are dedicated solely to your organization.
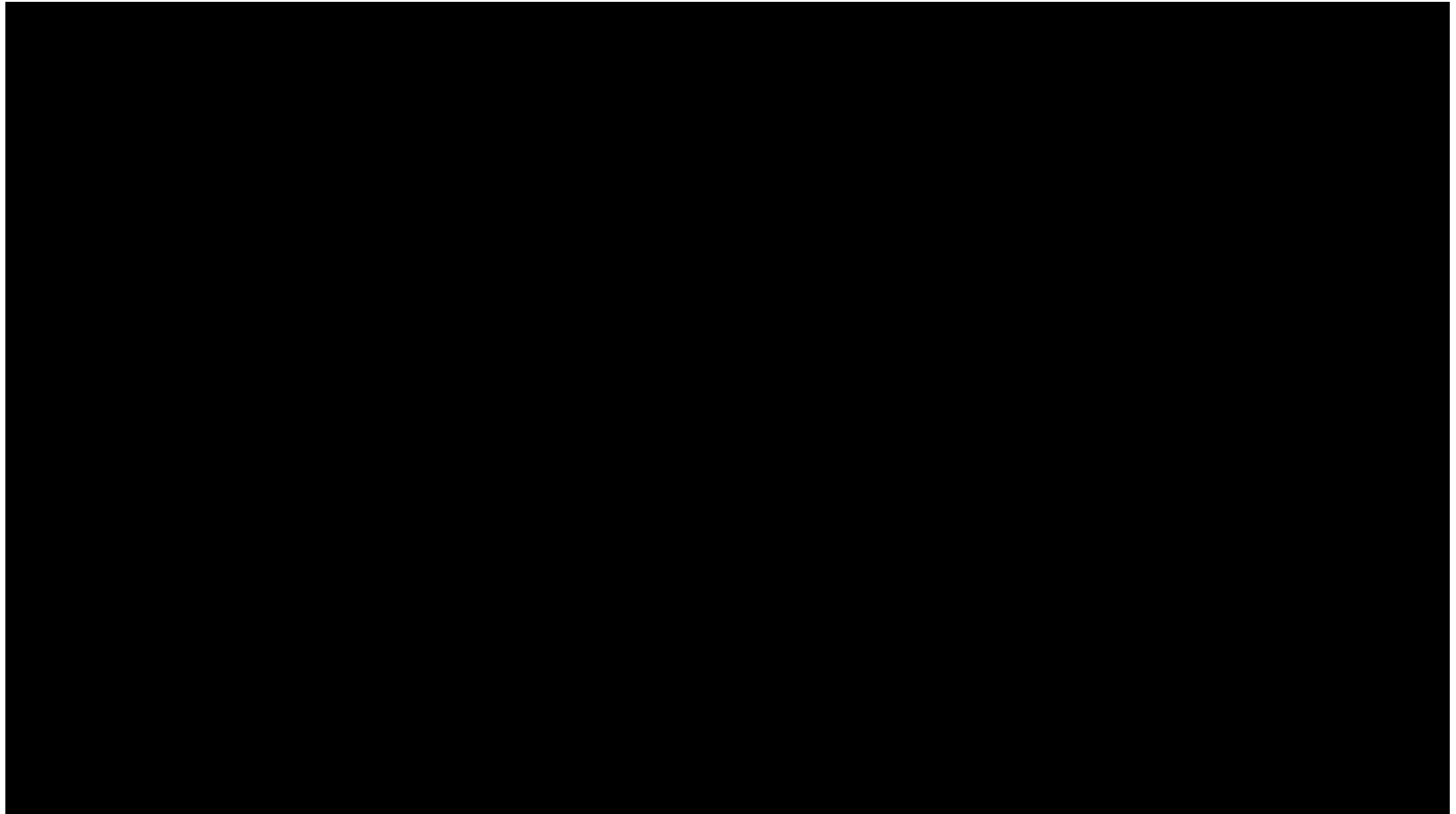
- **Hybrid Cloud**
  - A hybrid cloud is a type of cloud computing that combines on-premises infrastructure—or a private cloud—with a public cloud. Hybrid clouds allow data and apps to move between the two environments.

https://azure.microsoft.com/en-us/overview/what-are-private-public-hybrid-clouds/

Types of Deployment Model

https://www.youtube.com/watch?v=i8lG5HGzMZ8

Types of Deployment Model

TCO – Total Cost of Ownership

bmc
Cloud Comparison
Key benefits & drawbacks of cloud computing types

Public Cloud	Private Cloud	Hybrid Cloud
No maintenance costs	Dedicated, secure	Policy-driven deployment
High scalability, flexibility	Regulation compliant	High scalability, flexibility
Reduced complexity	Customizable	Minimal security risks
Flexible pricing	High scalability	Workload diversity supports high reliability
Agile for innovation	Efficient	Improved security

bmc
Cloud Comparison
Key benefits & drawbacks of cloud computing types

Public Cloud	Private Cloud	Hybrid Cloud
Potential for high TCO	Expensive with high TCO	Potential for high TCO
Decreased security and availability	Minimal mobile access	Compatibility and integration
Minimal control	Limiting infrastructure	Added complexity

Benefits **Drawbacks**

https://www.bmc.com/blogs/public-private-hybrid-cloud/

Cloud Service Providers

- **Amazon Web Services**
  - https://aws.amazon.com/
  - Hybrid cloud - https://aws.amazon.com/hybrid/

- **IBM Watson**
  - https://www.ibm.com/sg-en/watson
  - Hybrid cloud - https://www.ibm.com/cloud/hybrid

- **Microsoft Azure**
  - https://azure.microsoft.com/
  - Hybrid cloud - https://azure.microsoft.com/en-us/solutions/hybrid-cloud-app/

- **Google Cloud**
  - https://cloud.google.com/
  - Hybrid solution - https://cloud.google.com/anthos

- **Alibaba Cloud**
  - https://www.alibabacloud.com/
  - Hybrid cloud - https://www.alibabacloud.com/solutions/hybrid-cloud

- **Huawei Cloud**
  - https://www.huaweicloud.com/intl/en-us/
  - Hybrid cloud - https://www.huaweicloud.com/intl/en-us/solution/hybridcloud/

Cloud Computer Vision

Google **AWS** **Watson** **Azure**

Cloud
Services

Google AI API AWS ML Watson AI Azure ML Studio

Cloud
AI / ML

Azure Cognitive Services

Google Vision AWS Rekognition Watson
Maximo Azure Computer
Vision

Cloud
Computer
Vision

Google AutoML
Vision AWS SageMaker Azure Custom
Vision

30 Mins Tea Break

Tea
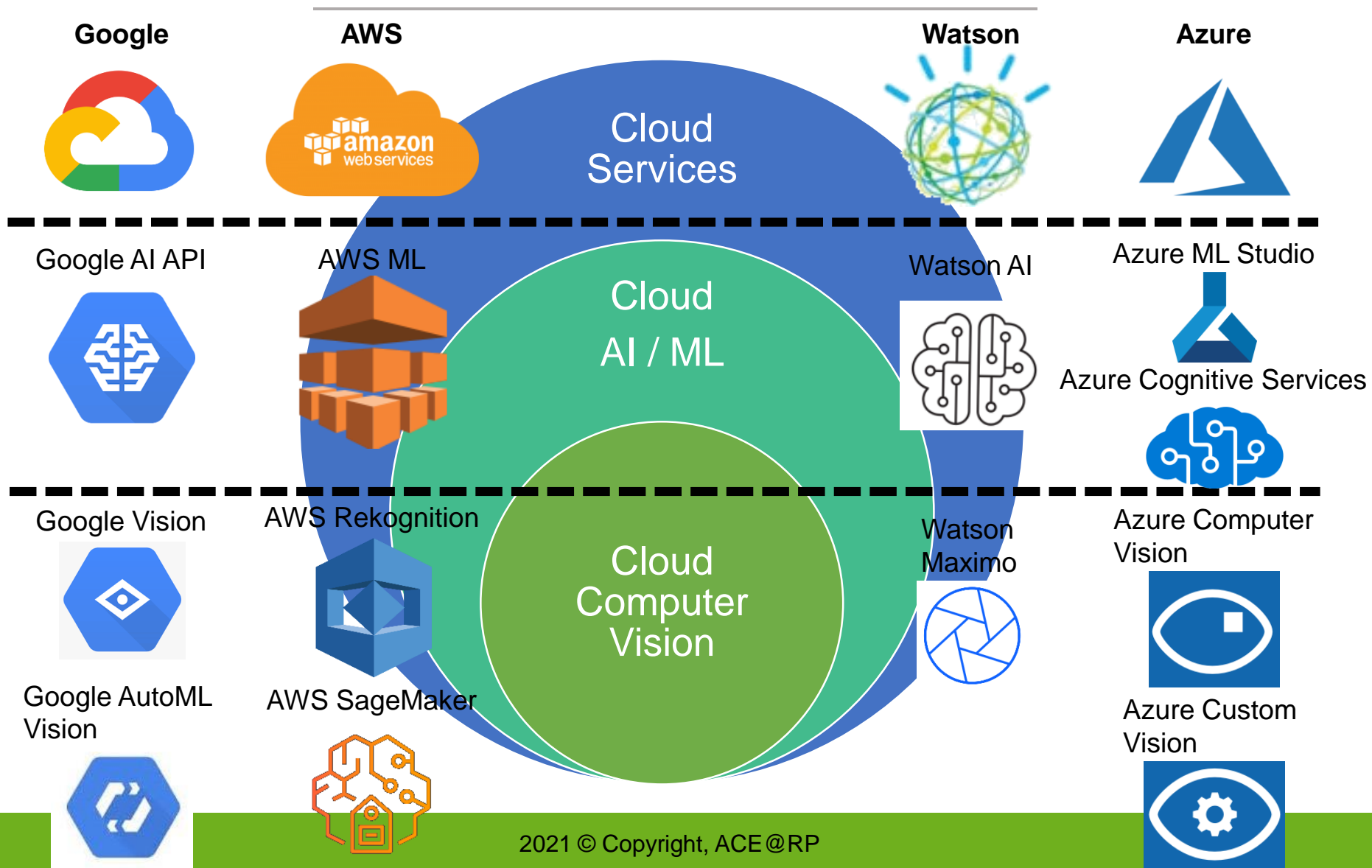
Google Vision API

Google Cloud Vision

"**Vision API** offers powerful pre-trained machine learning models through REST and RPC APIs. Assign labels to images and quickly classify them into millions of predefined categories. Detect objects and faces, read printed and handwritten text, and build valuable metadata into your image catalog."

- https://cloud.google.com/vision

Feature List

1. Face detection

2. Landmark detection

3. Logo detection

4. Label detection

5. Text detection

6. Document text detection

7. Image properties

8. Object localization

9. Crop hint detection

10. Web entities and pages

11. Explicit content detection

https://cloud.google.com/vision/docs/features-list

Guides / Tutorials / Documentations

- All Cloud Services providers include guides, tutorials or documentations in their websites to get users and developers started using their services.

- Guide for Google Vision API - https://cloud.google.com/vision/docs/how-to

Activity 1 – Google Vision API

- Open Chrome

- Go to Google Cloud Platform Console
  - https://console.cloud.google.com/home/dashboard
  - If you do not have a Google account, signup for one
    - https://accounts.google.com/signup/v2/webcreateaccount

- Follow the instructions on this page
  - https://cloud.google.com/vision/docs/before-you-begin
  - Skip step 6

- Copy the downloaded JSON file into your Google Drive

Activity 1 – Google Vision API

- Read the tutorial for detecting multiple objects
  - https://cloud.google.com/vision/docs/object-localizer
- Open the notebook "1_1_Object_Detection_GCP.ipynb"
  - Follow the instructions in the notebook.

- Read the tutorial for face detection
  - https://cloud.google.com/vision/docs/detecting-faces
- Open the notebook "1_2_Face_Detection_GCP.ipynb"
  - Complete the codes to display an image similar to the one below.

60 mins Lunch Break

Lunch break xx:xx – yy:yy

LUNCH BREAK

Google AutoML Vision

Google AutoML

- Cloud AutoML is a suite of machine learning products that enables developers with limited machine learning expertise to train high-quality models specific to their business needs. It relies on Google's state-of-the-art transfer learning and neural architecture search technology.
  - https://cloud.google.com/automl/

Sight	AutoML Vision https://cloud.google.com/vision/overview/docs/#automl-vision
	AutoML Video Intelligence https://cloud.google.com/video-intelligence/automl/docs/
Language	AutoML Natural Language https://cloud.google.com/natural-language/automl/docs/
	AutoML Translation https://cloud.google.com/translate/automl/docs/
Structured data	AutoML Tables https://cloud.google.com/automl-tables/docs/

Google AutoML Vision

Classification
https://cloud.google.com/vision/automl/docs/beginners-guide
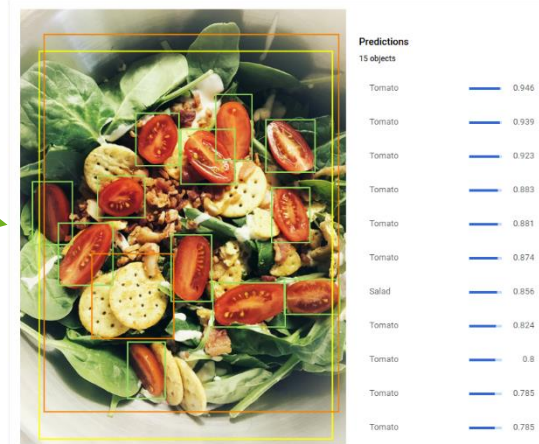
Cloud-hosted model

Edge device model

Object Detection
https://cloud.google.com/vision/automl/object-detection/docs/

Activity 2 - Google AutoML Vision

- **Classification how-to guides**
  - https://cloud.google.com/vision/automl/docs/how-to

- **Perform the necessary setup.**
  - https://cloud.google.com/vision/automl/docs/before-you-begin
  - Step 1: Create a Cloud project
  - Step 2: Enable Billing
  - Step 3: Enable AutoML and Cloud Storage API (click)
  - Step 4: Create a Service Account and download key file
    - you can use the same key created in the morning

Activity 2 - Google AutoML Vision

- **Step 5: Go to Vision Dashboard**
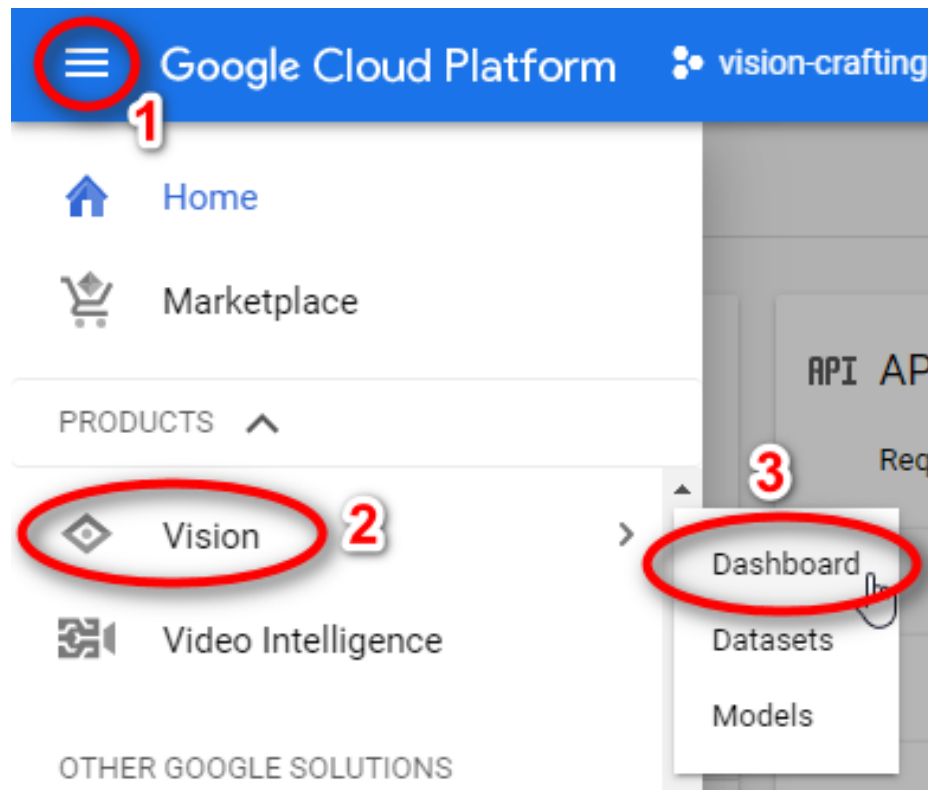
Activity 2 - Google AutoML Vision

- **Step 6: 'Get started'**

Activity 2 - Google AutoML Vision

- **Step 6: Click "NEW DATASET"**
- **Step 7: Give a proper name to the new dataset**
- **Step 8: Select appropriate model objective**
  - Multi-Label Classification
- **Step 9: Create dataset**
- **Step 10: "Upload images from your computer"**
- **Step 11: "SELECT FILES"**
- **Step 12: Select a bucket to upload to, create a new bucket if necessary**
  - Location type: Region
  - Location: us-central1
  - Storage class: Standard
  - Rest: Default Options
- **Step 13: Click on "IMAGES" tab**
  - Wait for the import to be complete

IMPORT   **IMAGES**   TRAIN

⟲ Running: Importing images
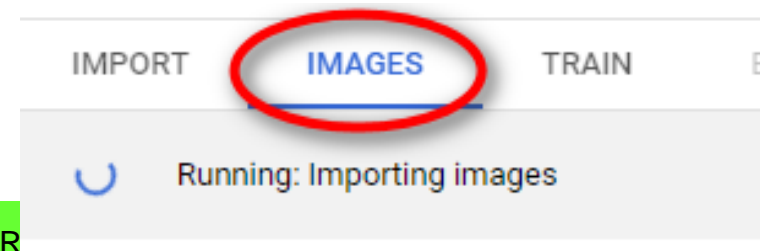
Activity 2 - Google AutoML Vision

- **Step 13: Create labels**
  - Cat
  - Dog

IMPORT	**IMAGES**	TRA
All images		40
Labeled		0
Unlabeled		40

≡ Filter   Filter labels   +   ⋮

ADD NEW LABEL

- **Step 14: Select the images and ASSIGN LABELS**

23 selected   **ASSIGN LABELS**   DELETE
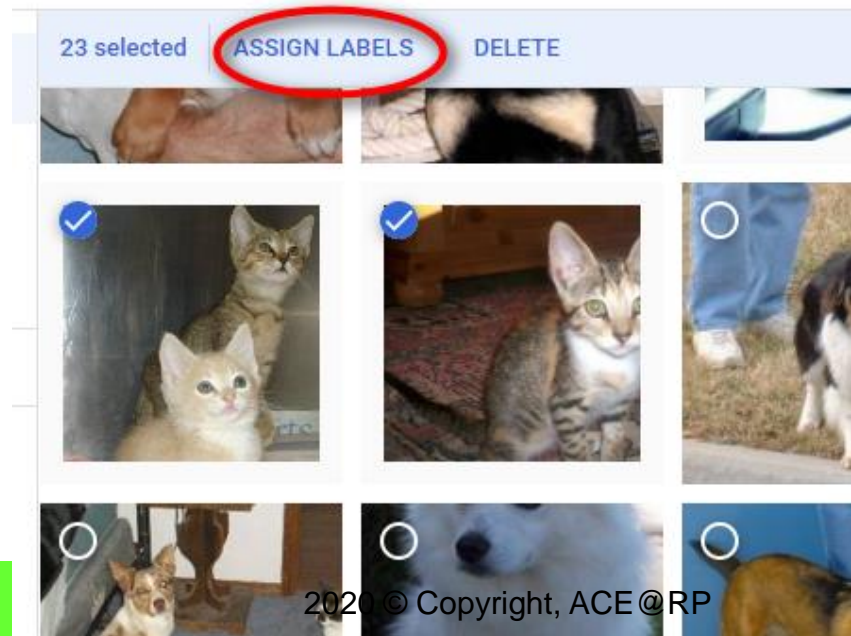
Activity 2 - Google AutoML Vision

- **Step 15: After all images are labelled, go to TRAIN**
- **Step 16: START TRAINING**

Activity 2 - Google AutoML Vision

- **Step 17: Select Cloud hosted, accept the recommended 'node hours' and START TRAINING.**

Train new model

1 Define your model

Model name *
catsNdogs_20210702091620

○ Cloud hosted
Host your model on Google Cloud for online predictions

○ Edge
Download your model for offline/mobile use

CONTINUE

2 Set a node hour budget

START TRAINING   CANCEL

Train new model

✓ Define your model

2 Set a node hour budget

Enter the **maximum** number of node hours you want to spend training your model.

We recommend using 16 node hours for your dataset. However, you can train for as little as 8 node hours. You may also eligible to train with free node hours.
Pricing guide

ⓘ   Note to beta users: AutoML Vision has updated its pricing for node hours.

Set your budget *
16   node hours

Estimated completion date: Jul 2, 2021 12 PM GMT+8

☐ Deploy model to 1 node after training

Make your model available for REST API requests immediately after training. Deployment pricing applies.

START TRAINING   CANCEL

Activity 2 - Google AutoML Vision

- **The training takes a very long time, sometimes will be in HOURS.**
  - Wait for the email…
  - We shall go for our tea break.

30 Mins Break

Activity 2 - Google AutoML Vision

Evaluating Models

- **Step 1: Go to GCP Vision Dashboard (https://console.cloud.google.com/vision)**

- **Step 2: Click on the newly created model**

Activity 2 - Google AutoML Vision

- **Step 3: Click on EVALUATE. The training results will be shown.**
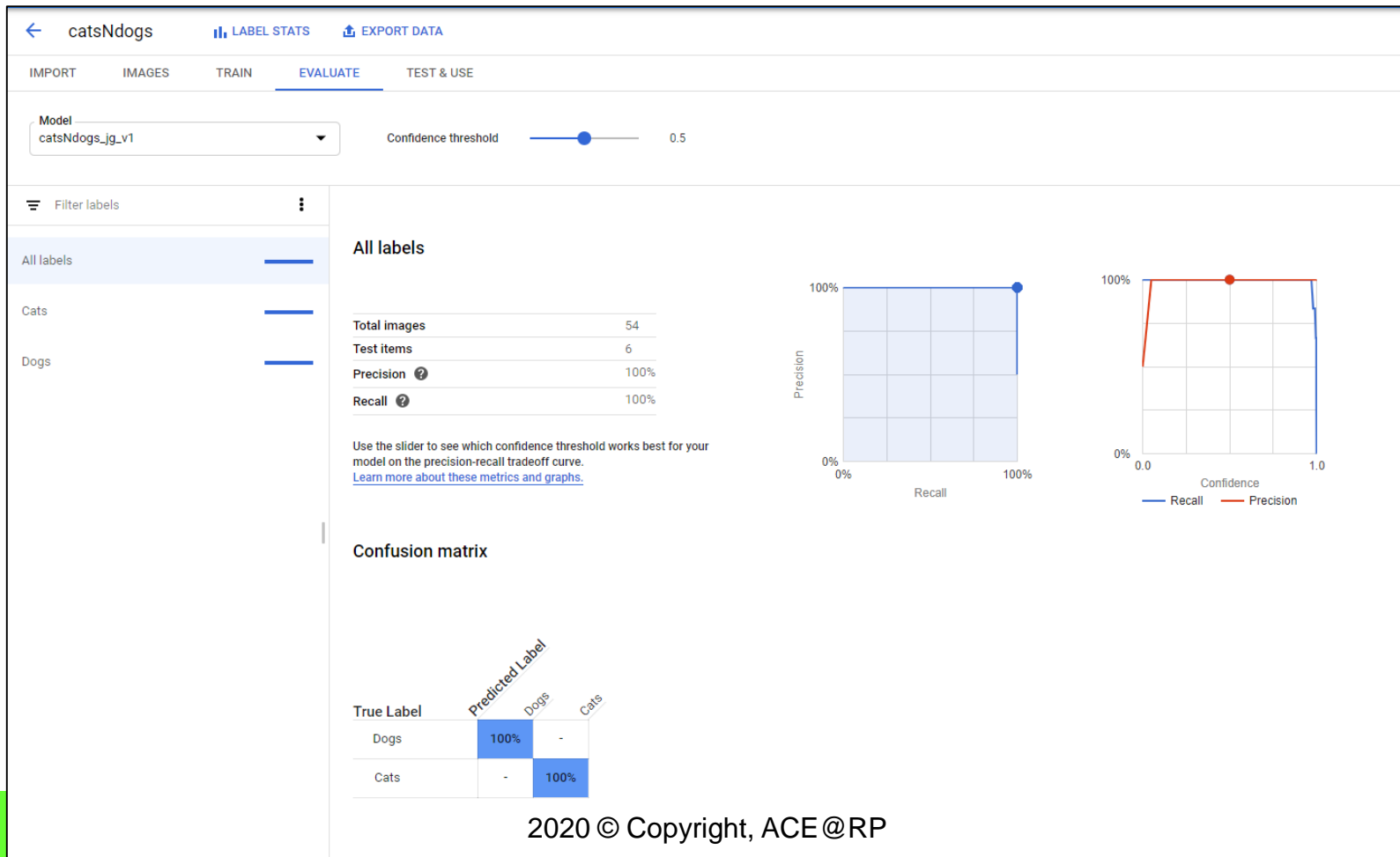
Activity 2 - Google AutoML Vision

Deploy to test and use the model

- **Step 1: Click on TEST & USE**
- **Step 2: Click DEPLOY MODEL**

Activity 2 - Google AutoML Vision

Make a prediction – Using Web UI

- **Step 1: Click UPLOAD IMAGES**

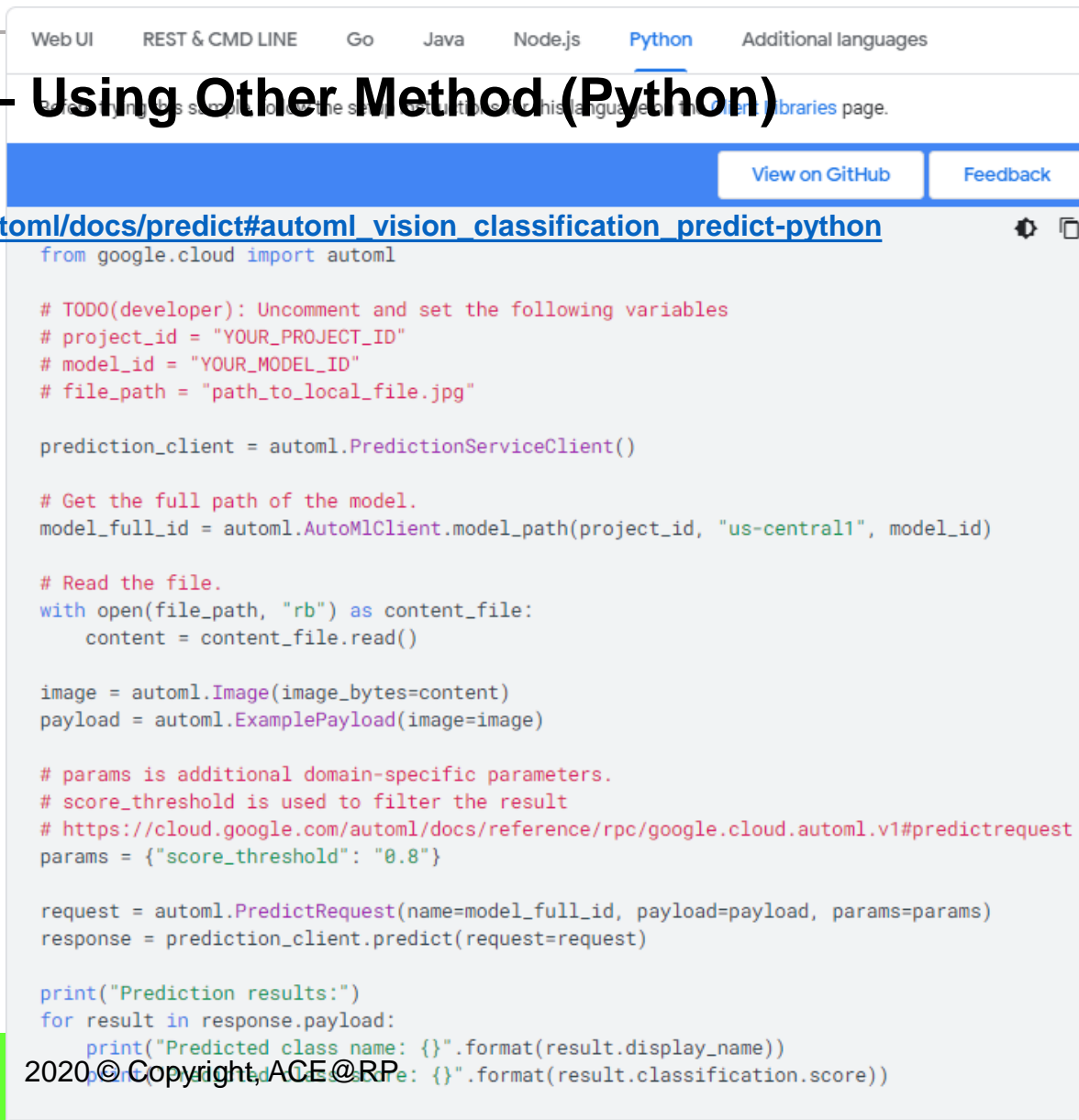# Activity 2 - Google AutoML Vision

- **A prediction will be made**

Activity 2 - Google AutoML Vision

- **Make a prediction – Using Other Method (Python)**

- **Refer to**
  https://cloud.google.com/vision/automl/docs/predict#automl_vision_classification_predict-python

| Web UI | REST & CMD LINE | Go | Java | Node.js | Python | Additional languages |

View on GitHub   Feedback

```python
from google.cloud import automl

# TODO(developer): Uncomment and set the following variables
# project_id = "YOUR_PROJECT_ID"
# model_id = "YOUR_MODEL_ID"
# file_path = "path_to_local_file.jpg"

prediction_client = automl.PredictionServiceClient()

# Get the full path of the model.
model_full_id = automl.AutoMlClient.model_path(project_id, "us-central1", model_id)

# Read the file.
with open(file_path, "rb") as content_file:
    content = content_file.read()

image = automl.Image(image_bytes=content)
payload = automl.ExamplePayload(image=image)

# params is additional domain-specific parameters.
# score_threshold is used to filter the result
# https://cloud.google.com/automl/docs/reference/rpc/google.cloud.automl.v1#predictrequest
params = {"score_threshold": "0.8"}

request = automl.PredictRequest(name=model_full_id, payload=payload, params=params)
response = prediction_client.predict(request=request)

print("Prediction results:")
for result in response.payload:
    print("Predicted class name: {}".format(result.display_name))
    print("Predicted class score: {}".format(result.classification.score))
```

Activity 2 - Google AutoML Vision

- **Un-deploy a model to save cost**
- **Click on REMOVE DEPLOYMENT**

Quiz

- **Go to the following link for the Quiz:**

- **https://forms.office.com/r/FH7PYrTuu1**

Thank you

- **Course Feedback/Survey**
    - Survey forms will be emailed to you.