In This Video

aws training and certification

- Service Introduction
- Overview
- Usage of Amazon Rekognition
- Demonstration

Searchable Image Library

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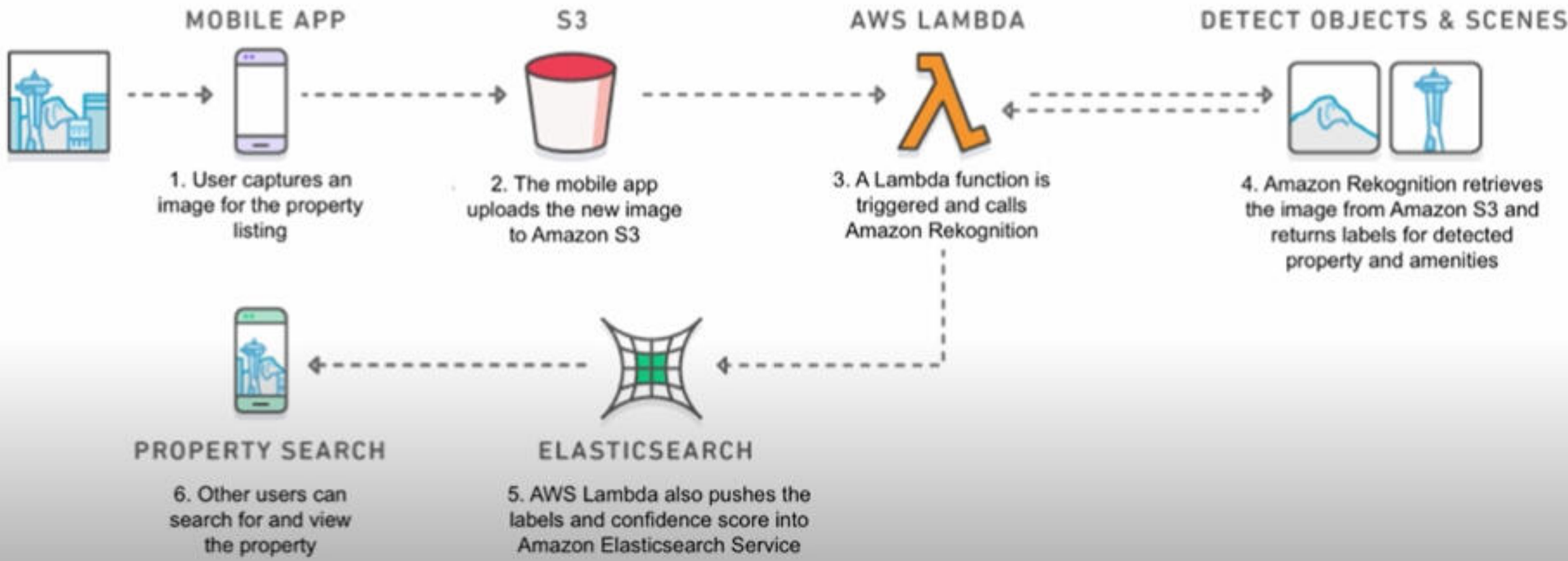
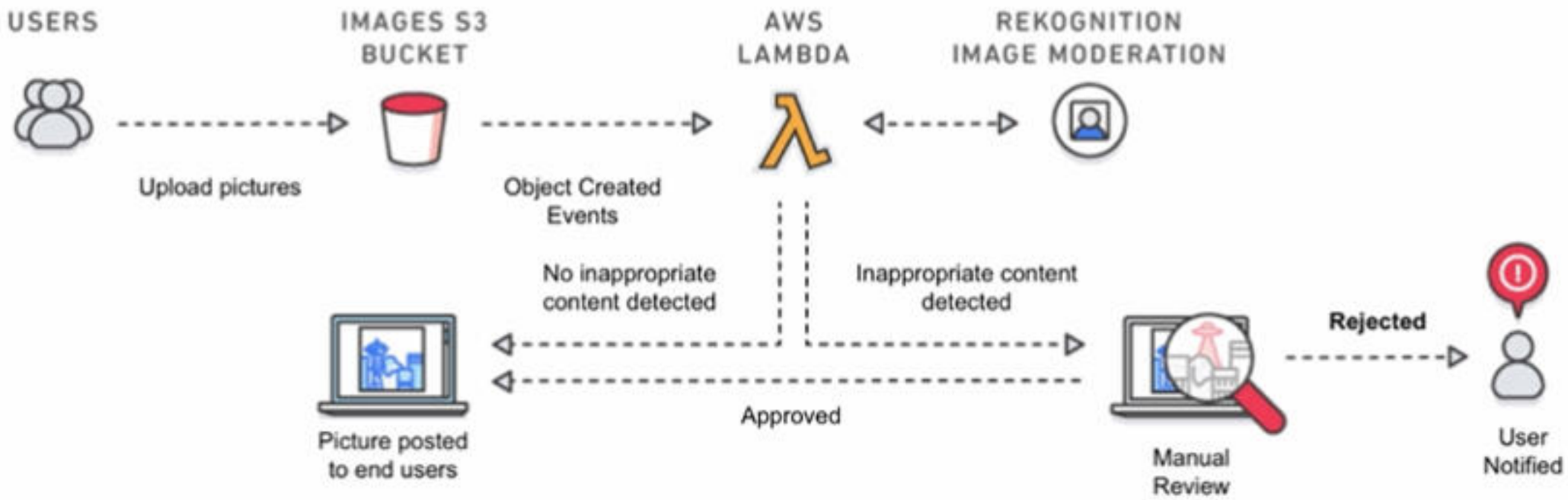


Image Moderation



Sentiment Analysis

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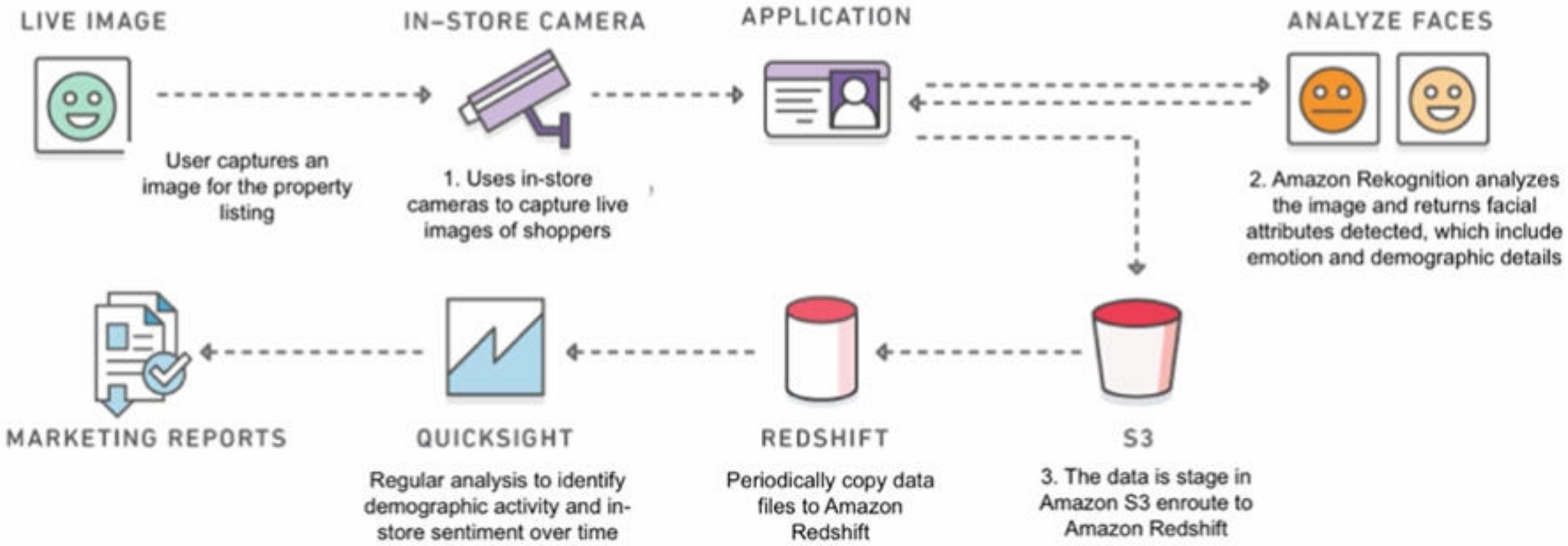

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Find a service by name or feature (for example, EC2, S3 or VM, storage).

Recently visited services

Rekognition CloudWatch EC2

All services

Build a solution

Get started with simple wizards and automated workflows.

Launch a virtual machine
With EC2 or Lightsail
~1-2 minutes

Build a web app
With Elastic Beanstalk
~6 minutes

Host a static website
With S3, CloudFront, Route 53
~5 minutes

Connect an IoT device
With AWS IoT
~5 minutes

Start a development project
With CodeStar
~5 minutes

Register a domain
With Route 53
~3 minutes

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Learn to deploy your solutions through step-by-step guides, labs, and videos.

Websites	DevOps	Backup and recovery
3 videos, 3 tutorials, 3 labs	6 videos, 2 tutorials, 3 labs	3 videos, 2 tutorials, 3 labs
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Manage your costs

Get real-time billing alerts based on your cost and usage budgets. Start now

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Use AWS Organizations for policy-based management of multiple AWS accounts. Start now

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Get started with the most scalable framework for deep learning in the cloud. Learn more.

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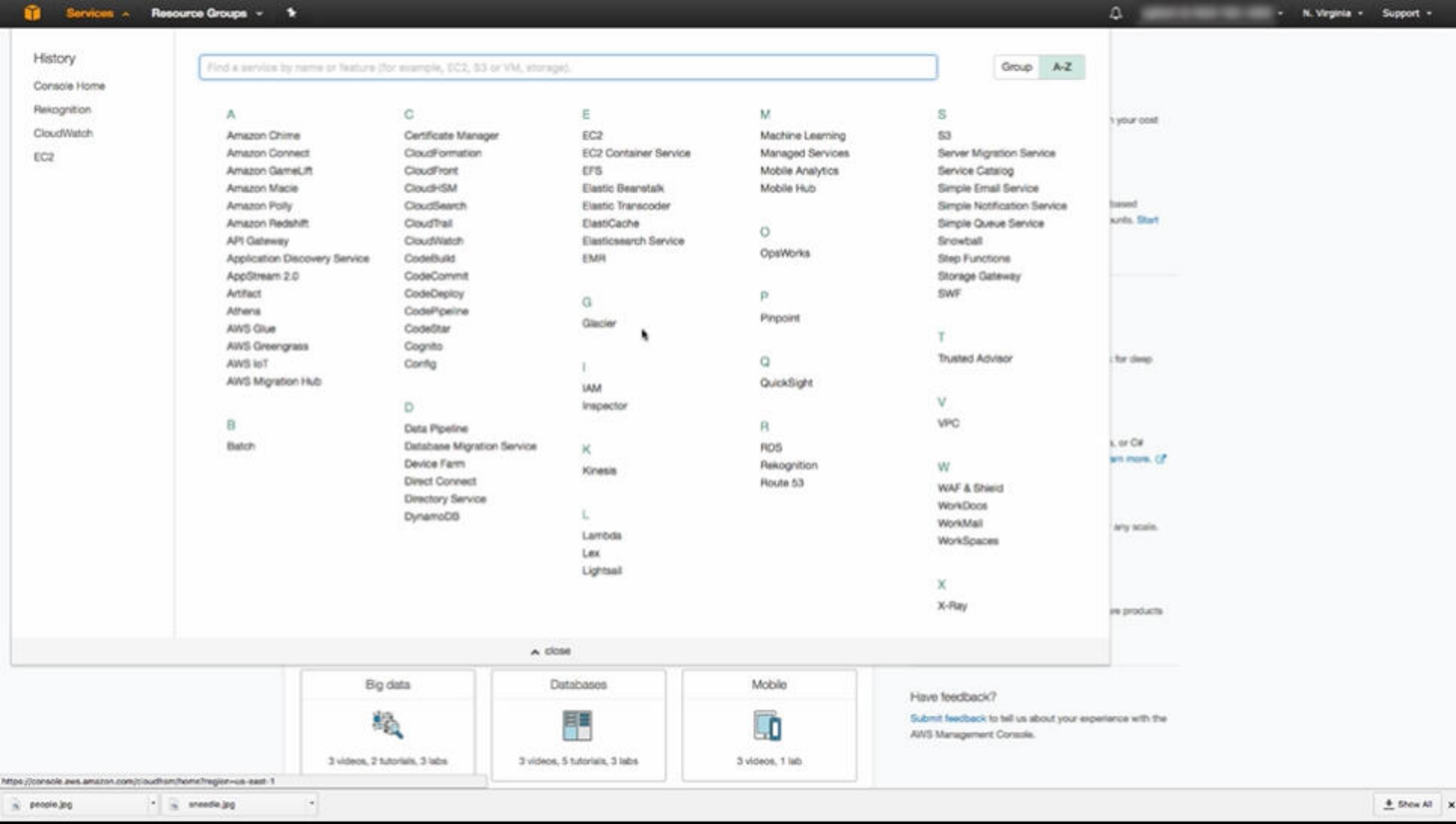
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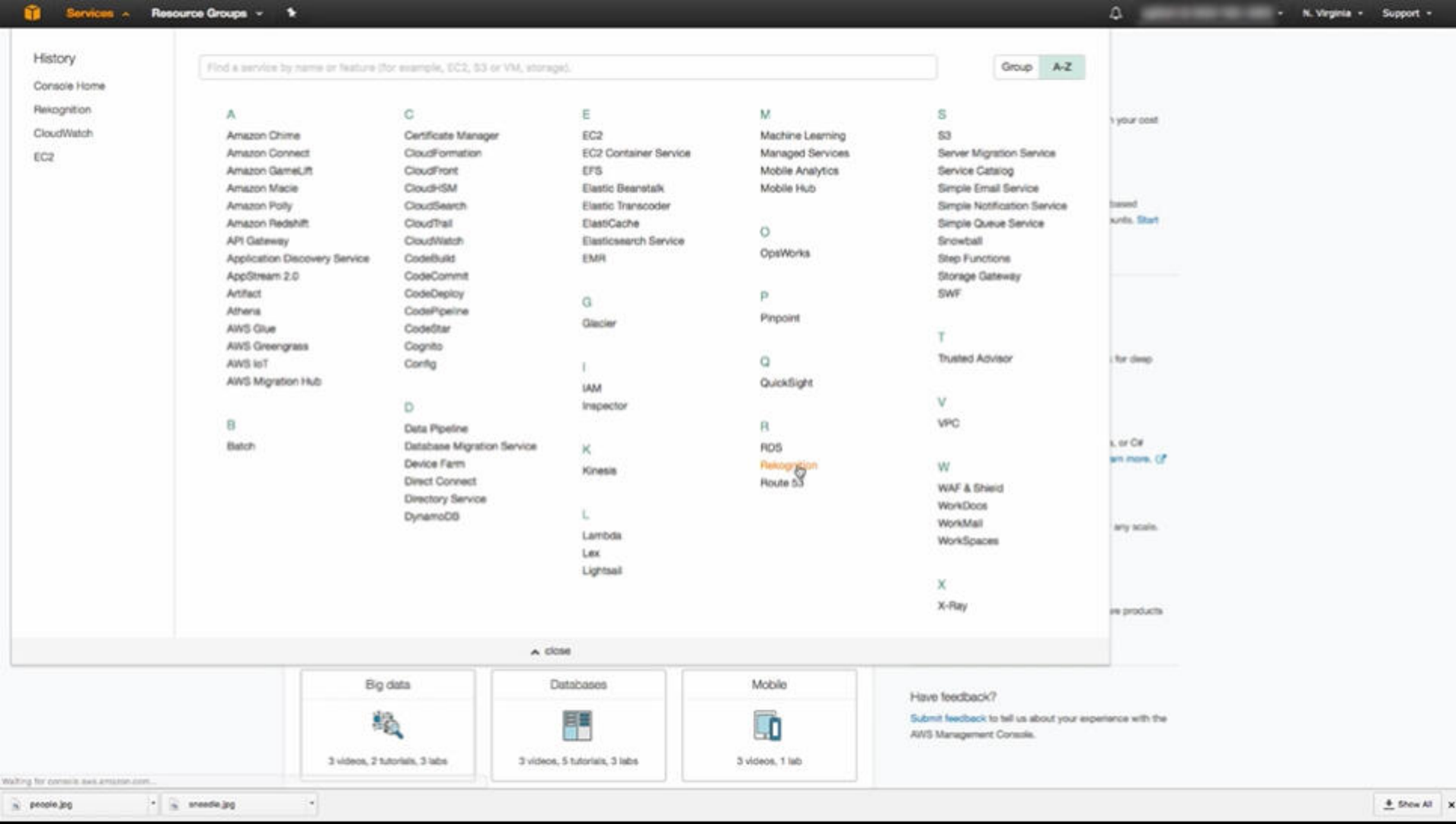
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Amazon Rekognition

Deep learning-based image recognition service
Search, verify, and organize millions of images

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Get Context and Information from Images

Amazon Rekognition enables your applications to gain a high-level understanding of the content of images. With Rekognition, your applications can detect objects, scenes, and faces in images. With this rich context and information, you can enable visual search, discovery, and authentication in your applications.

Scalable Deep Learning-based Image Analysis

Amazon Rekognition is designed to use deep learning technology to analyze billions of images daily. The APIs find and compare faces, detect thousands of objects. We continue to add new objects and make improvements to facial analysis so you can focus on building applications.

Integrated with AWS Services

Amazon Rekognition is designed to work seamlessly with other AWS services. Rekognition integrates directly with Amazon S3 and AWS Lambda so you can build scalable, affordable, and reliable image analysis applications. You can start analyzing images stored in Amazon S3 without moving any data. Support for Identity and Access Management (IAM) makes it easy to assign unique security credentials to each user and control their access to Amazon Rekognition APIs.

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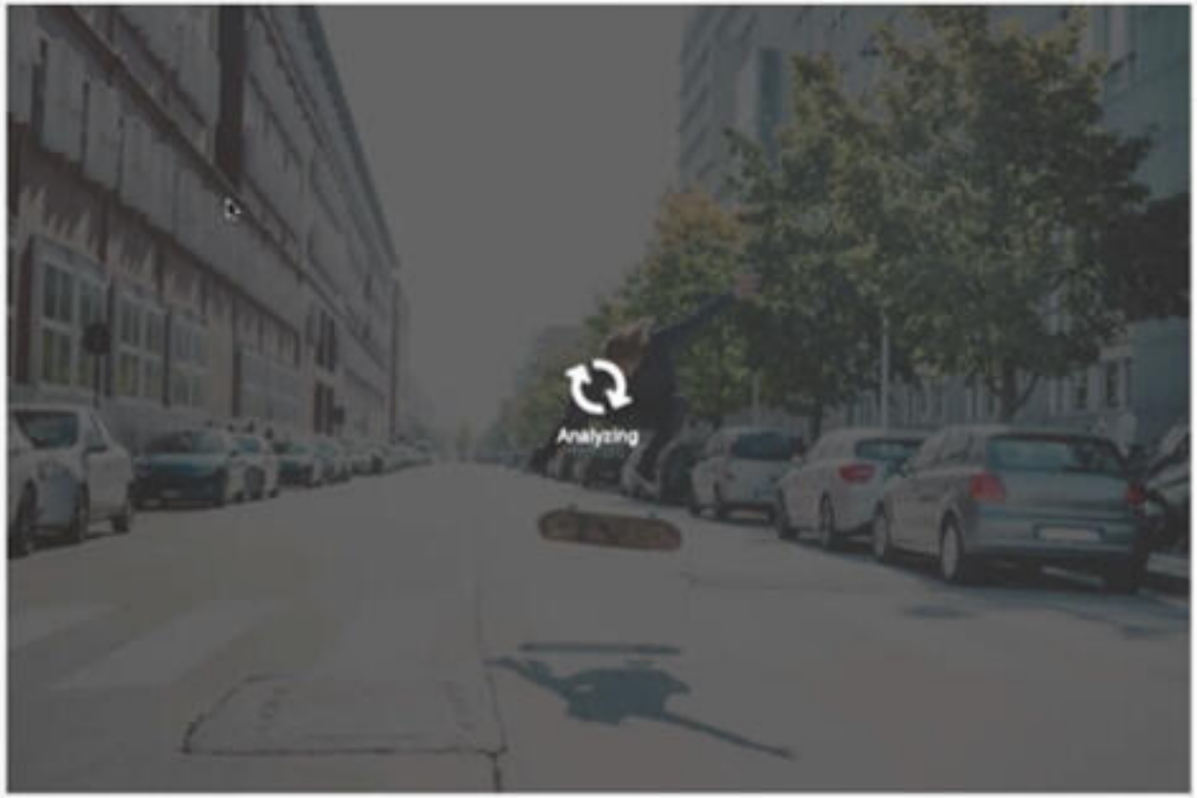

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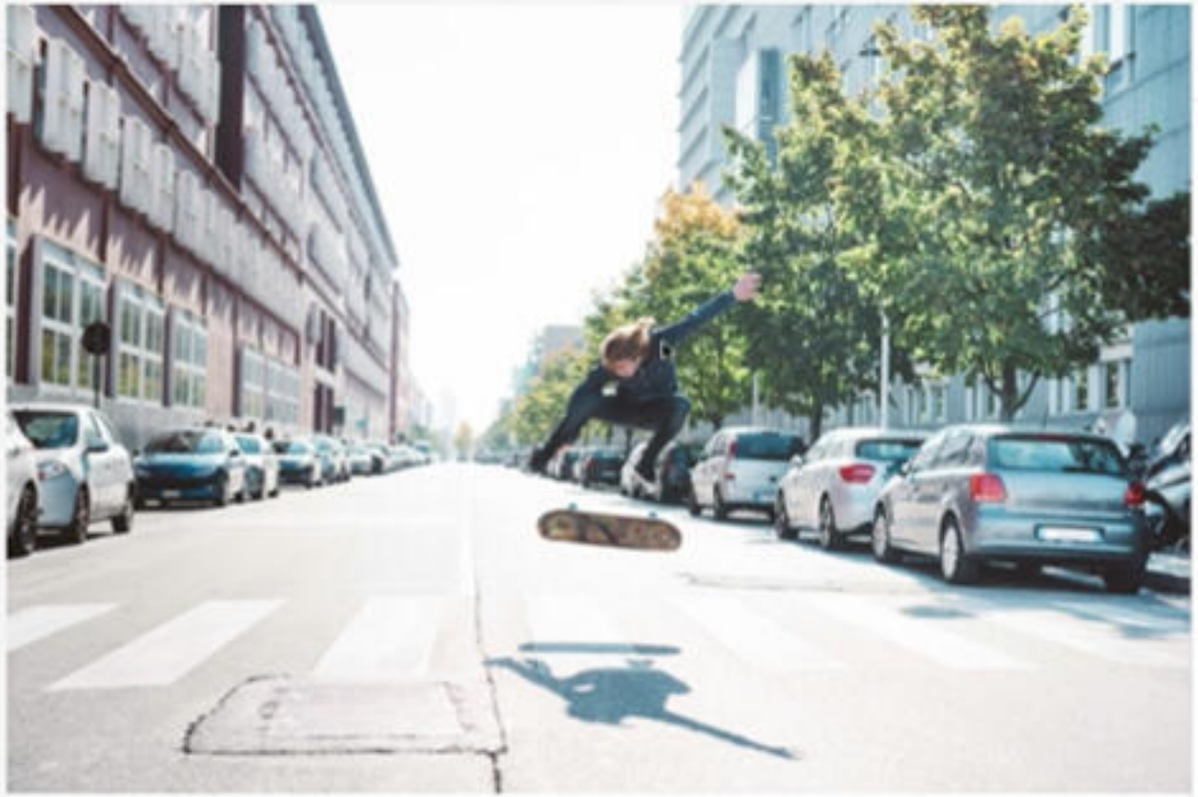

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Results

Skateboard	99.2%
Sport	99.2%
People	99.2%
Person	99.2%
Human	99.2%
Parking	97.4%

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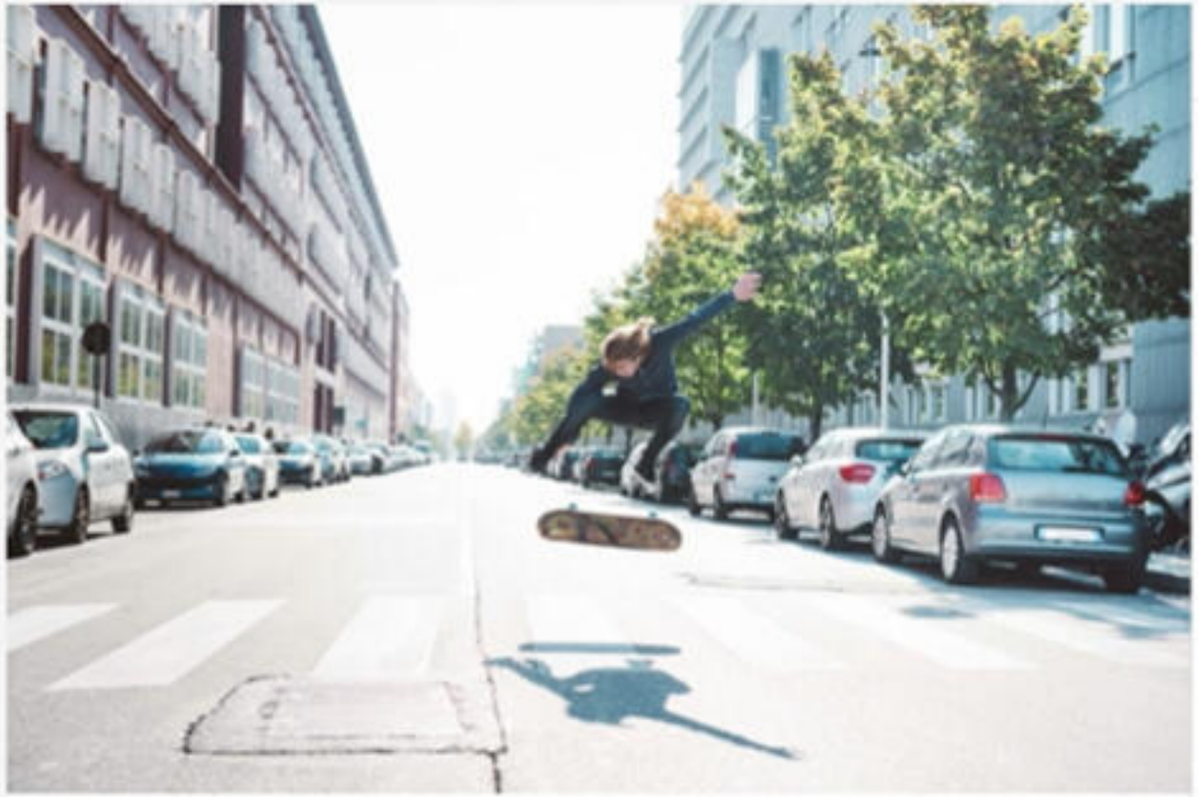

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Sport	99.2%
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Person	99.2%
Human	99.2%
Parking	97.4%
Parking Lot	97.4%
Automobile	91.5%
Car	91.5%
Vehicle	91.5%
Intersection	76.8%
Road	76.8%
Boardwalk	76.2%
Path	76.2%
Pavement	76.2%
Sidewalk	76.2%
Walkway	76.2%

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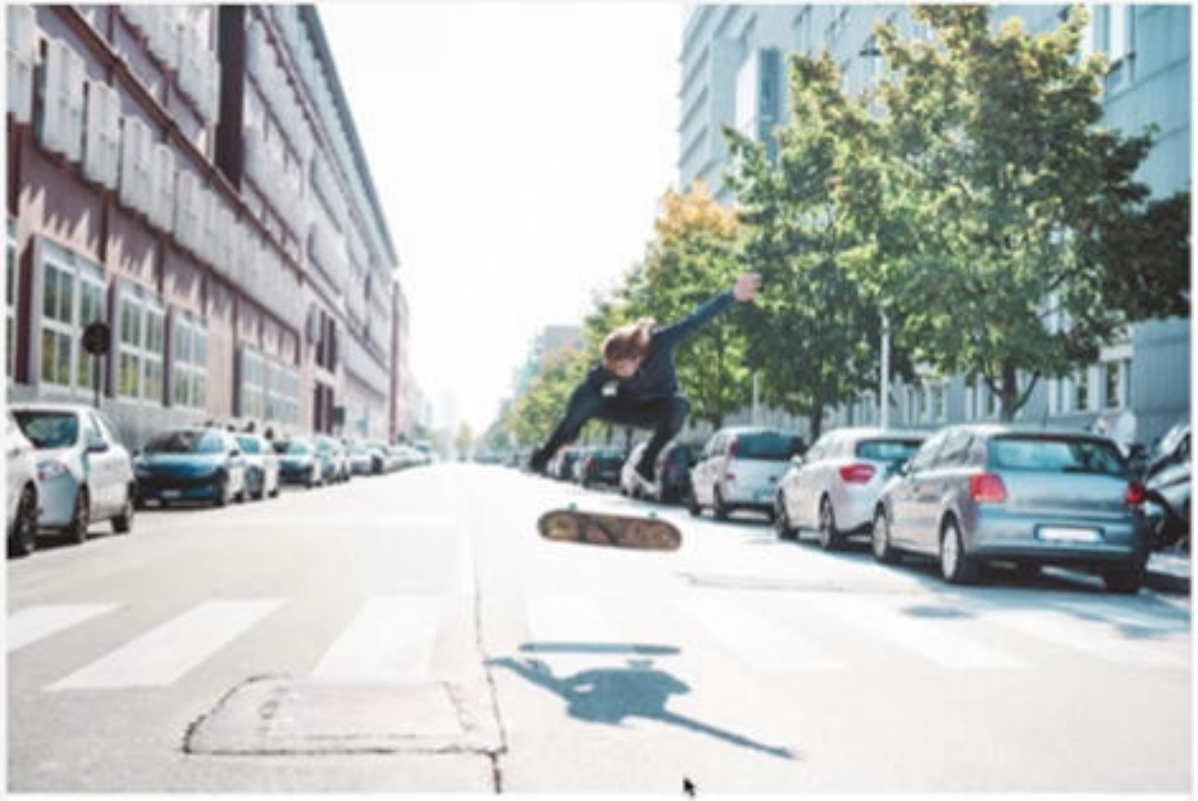

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Results

Architecture	98.3%
City	98.3%
Downtown	98.3%
High Rise	98.3%
Skyscraper	98.3%
Metropolis	86%

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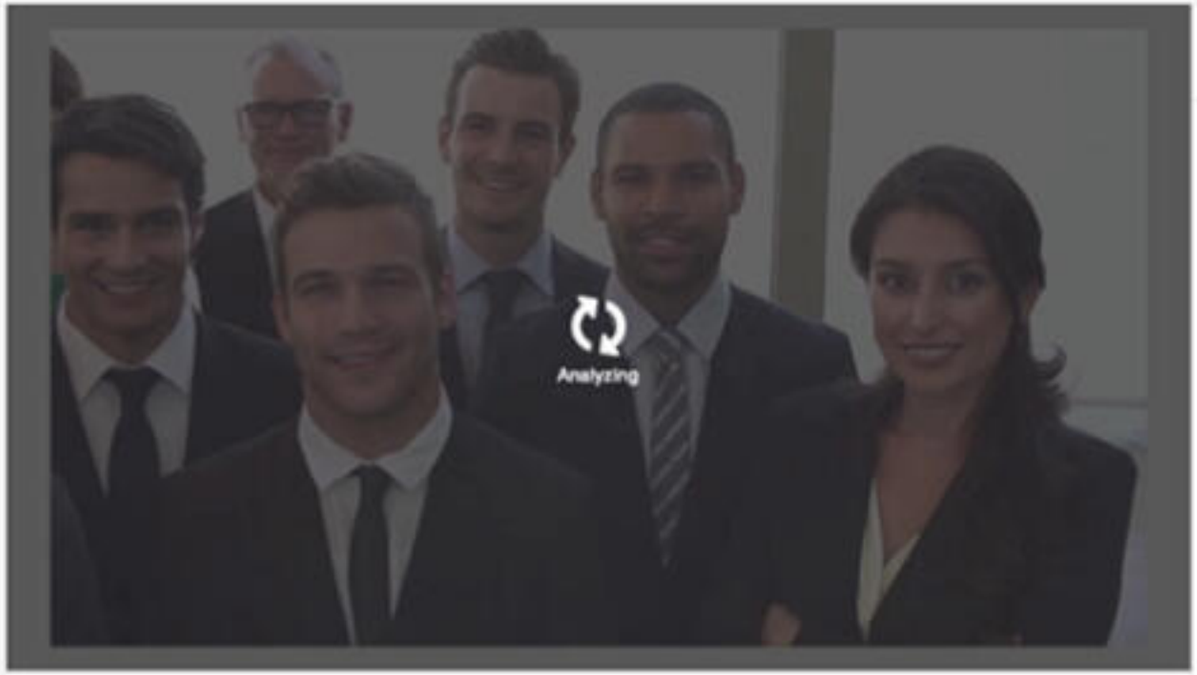

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Human	99.2%
Clothing	93.9%
Overcoat	93.9%
Suit	93.9%

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Use your own image

Upload or drag and drop

Use image URL Go

Done with the demo?
Download SDKs

Results

People	99.2%
Person	99.2%
Human	99.2%
Clothing	93.9%
Overcoat	93.9%
Suit	93.9%

Show more

Request

Response

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https://console.aws.amazon.com/rekognition/home?region=us-east-1#/face-detection

people.jpg sneadle.jpg Show All

Amazon Rekognition
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Image moderation
Facial analysis
Celebrity recognition
Face comparison

Additional Resources
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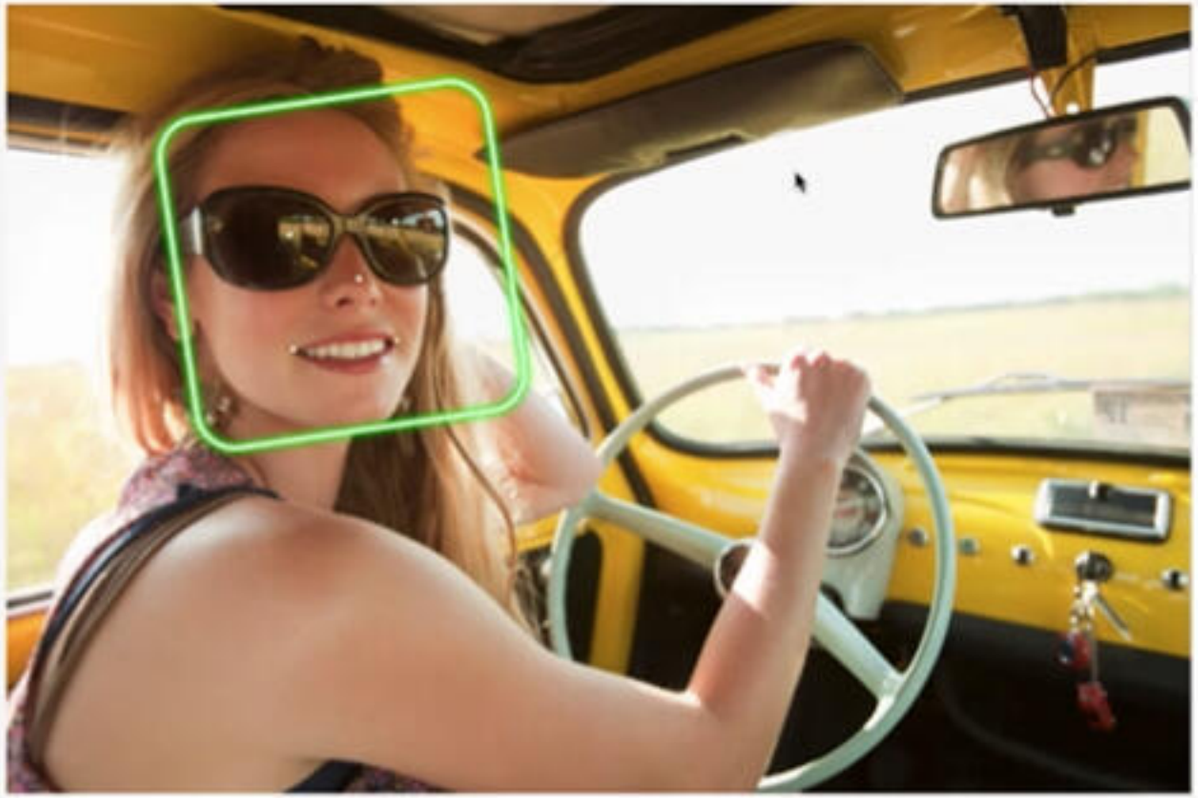
FAQ
Forum

Facial analysis

Get a complete analysis of facial attributes, including confidence scores. (Your images aren't stored.)



Choose a sample image


Use your own image

Upload or drag and drop

Use image URL Go

Done with the demo?
Download SDKs

Results

looks like a face	99.8%
appears to be female	100%
age range	23 - 38 years old
smiling	99.4%
appears to be happy	93.2%
wearing glasses	99.9%

Show more

Request

Response

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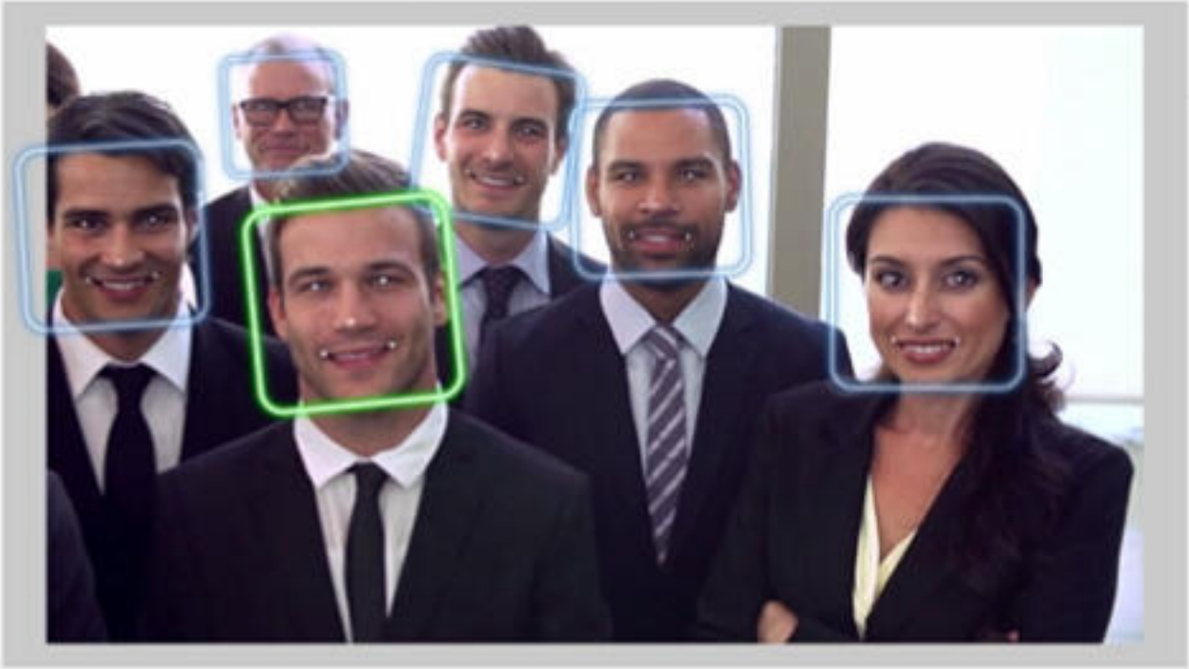

Choose a sample image


Use your own image

Upload or drag and drop

Use image URL Go

Done with the demo?
Download SDKs

Results

looks like a face	100%
appears to be male	99.9%
age range	26 - 43 years old
smiling	97.4%
appears to be happy	99.9%
not wearing glasses	99.8%

Show more

Request

Response

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Celebrity recognition

Rekognition automatically recognizes celebrities in images and provides confidence scores (Your images aren't stored.)

Done with the demo?
Download SDKs

- Results
- Request
- Response

Choose a sample image


Use your own image

Upload or drag and drop

Use image URL Go

people.jpg sneadle.jpg Show All

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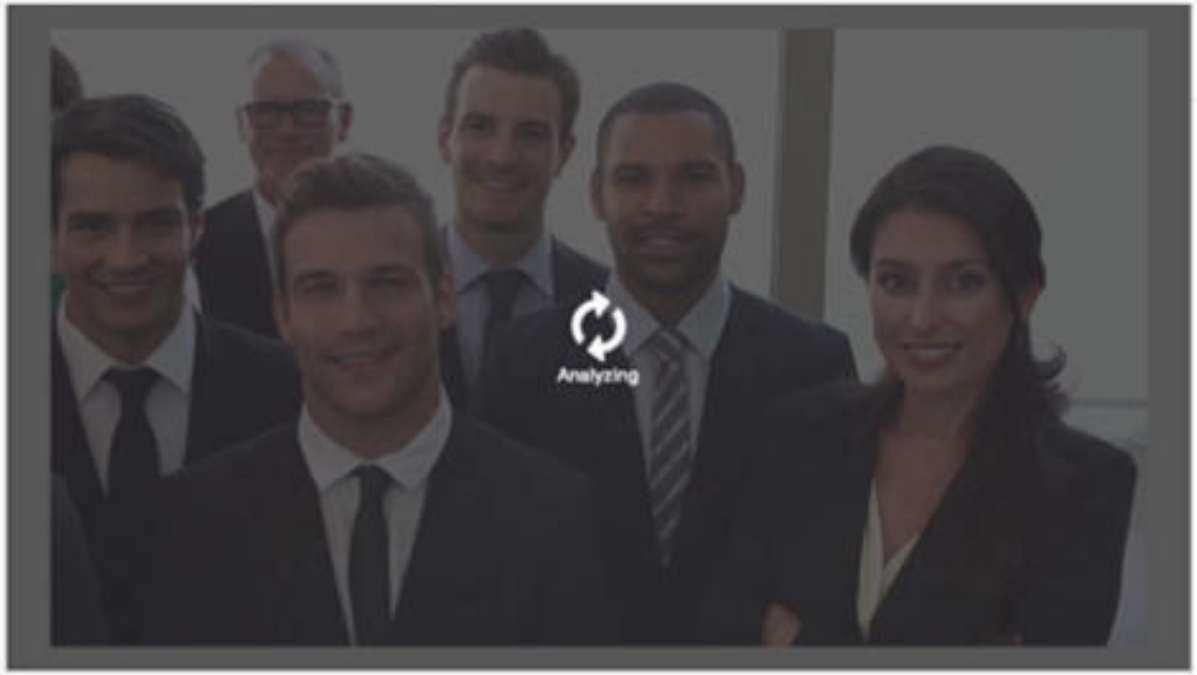
Celebrity recognition

Rekognition automatically recognizes celebrities in images and provides confidence scores (Your images aren't stored.)



Done with the demo?
Download SDKs

- Results
- Request
- Response

Choose a sample image


Use your own image

Upload or drag and drop

Use image URL Go

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Face comparison

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Celebrity recognition

Rekognition automatically recognizes celebrities in images and provides confidence scores (Your images aren't stored.)

Choose a sample image


Use your own image

Upload or drag and drop

Use image URL Go

Done with the demo?
Download SDKs

Results

No celebrity faces recognized

Request

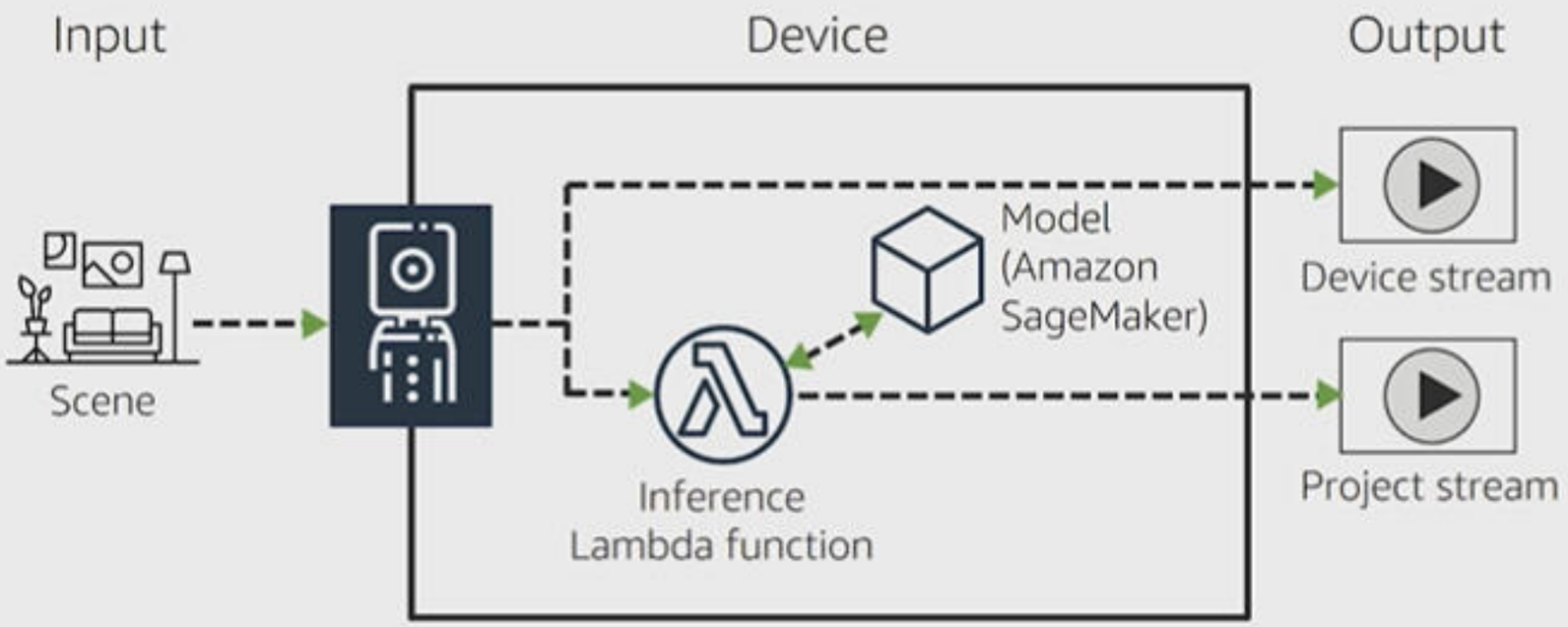
Response

Thanks for watching!

aws training and certification

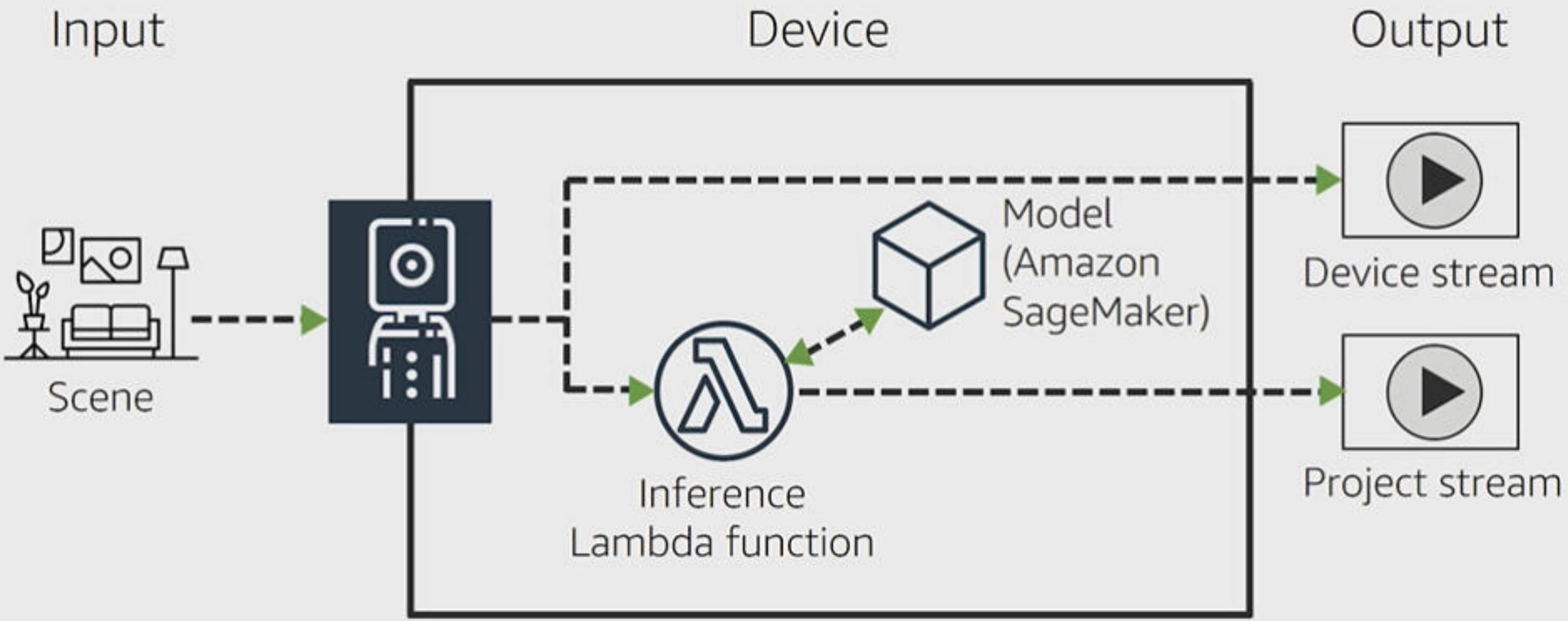
AWS DeepLens workflow

aws training and certification



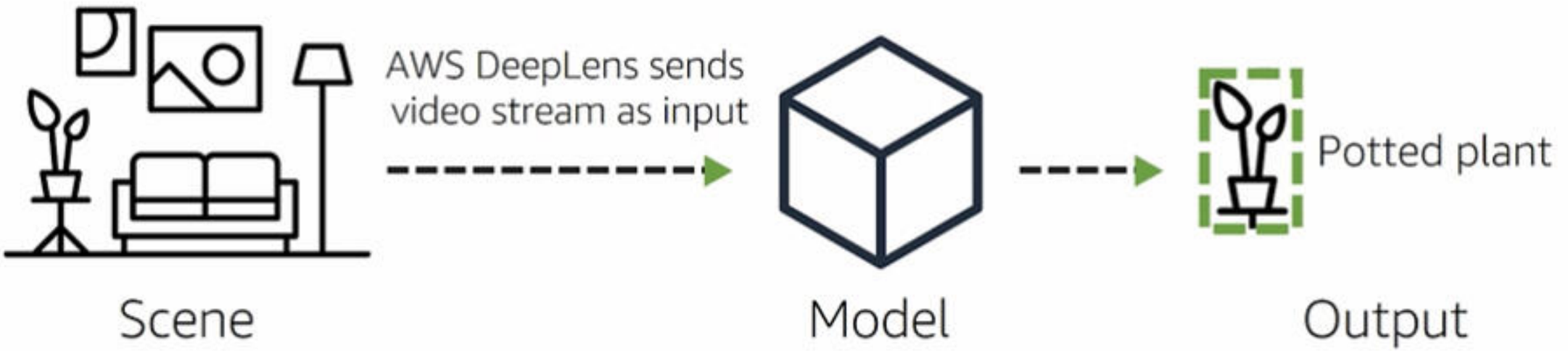
AWS DeepLens workflow

aws training and certification



Demo overview: Object Detection

aws training and certification



Demo overview: Object Detection

aws training and certification

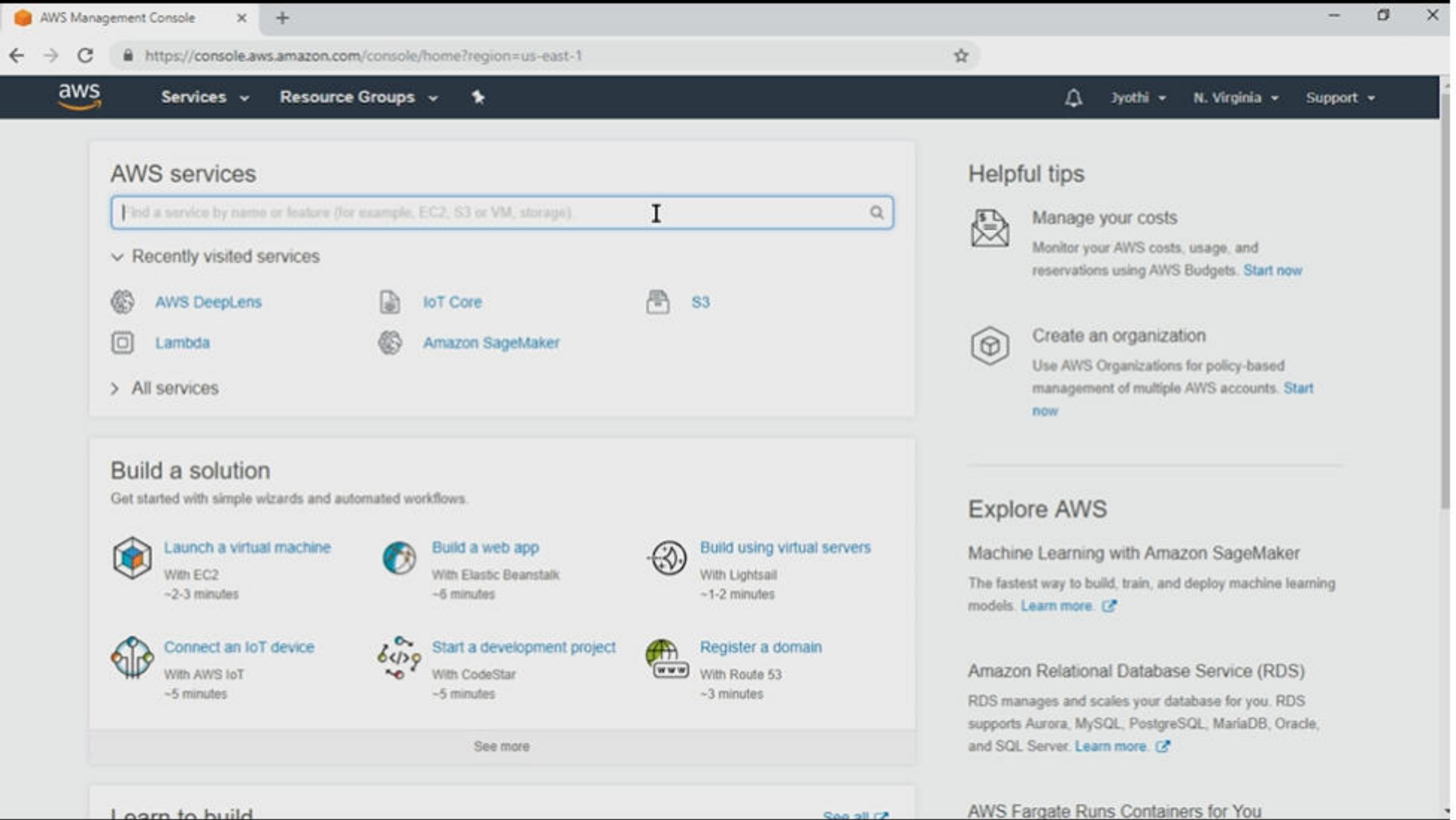
Scene

AWS DeepLens sends video stream as input

Model

Potted plant

Output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Find a service by name or feature (for example, EC2, S3 or VM, storage)
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~2-3 minutes
Build a web app
With Elastic Beanstalk
~6 minutes
Build using virtual servers
With Lightsail
~1-2 minutes
Connect an IoT device
With AWS IoT
~5 minutes
Start a development project
With CodeStar
~5 minutes
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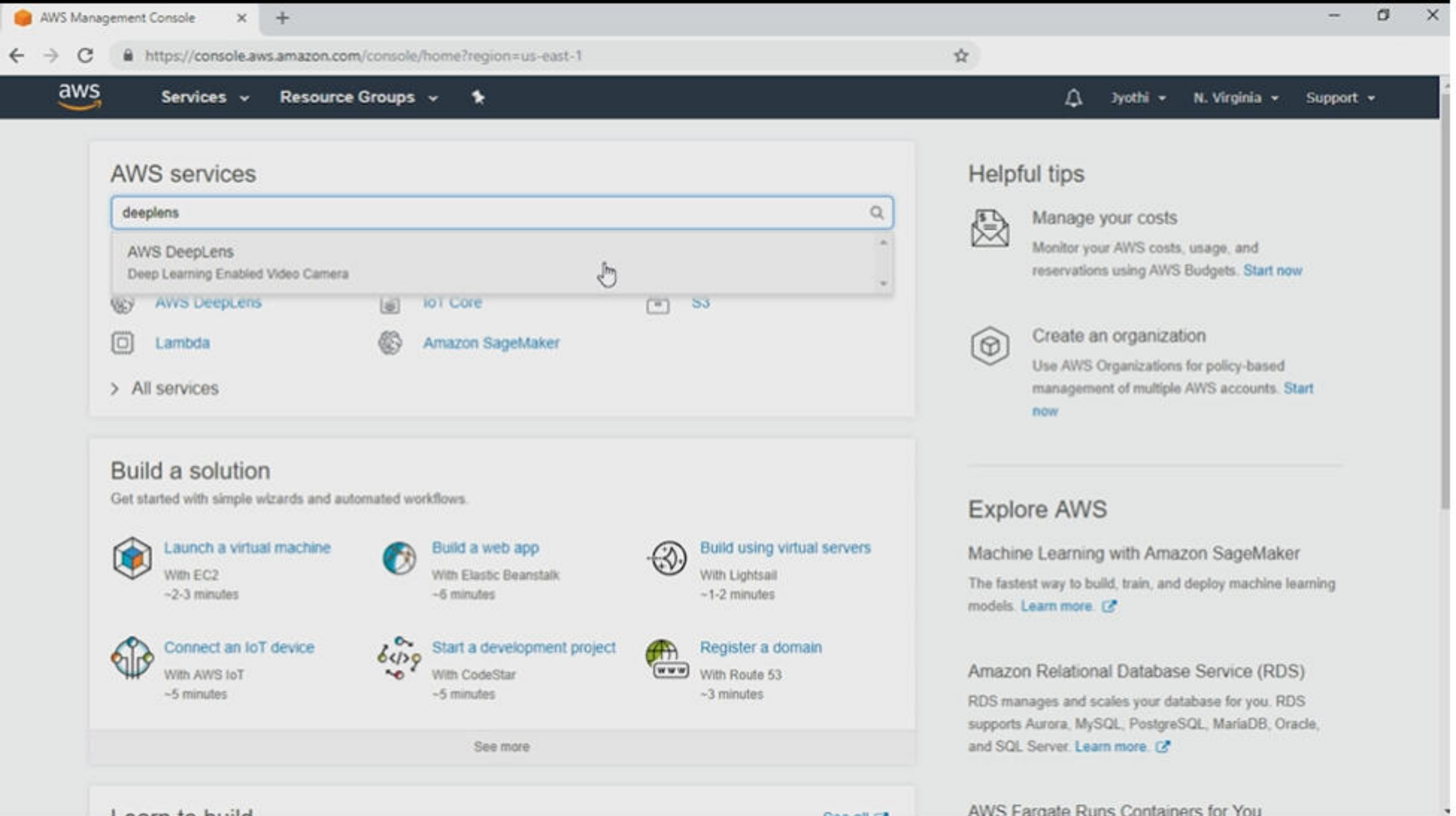
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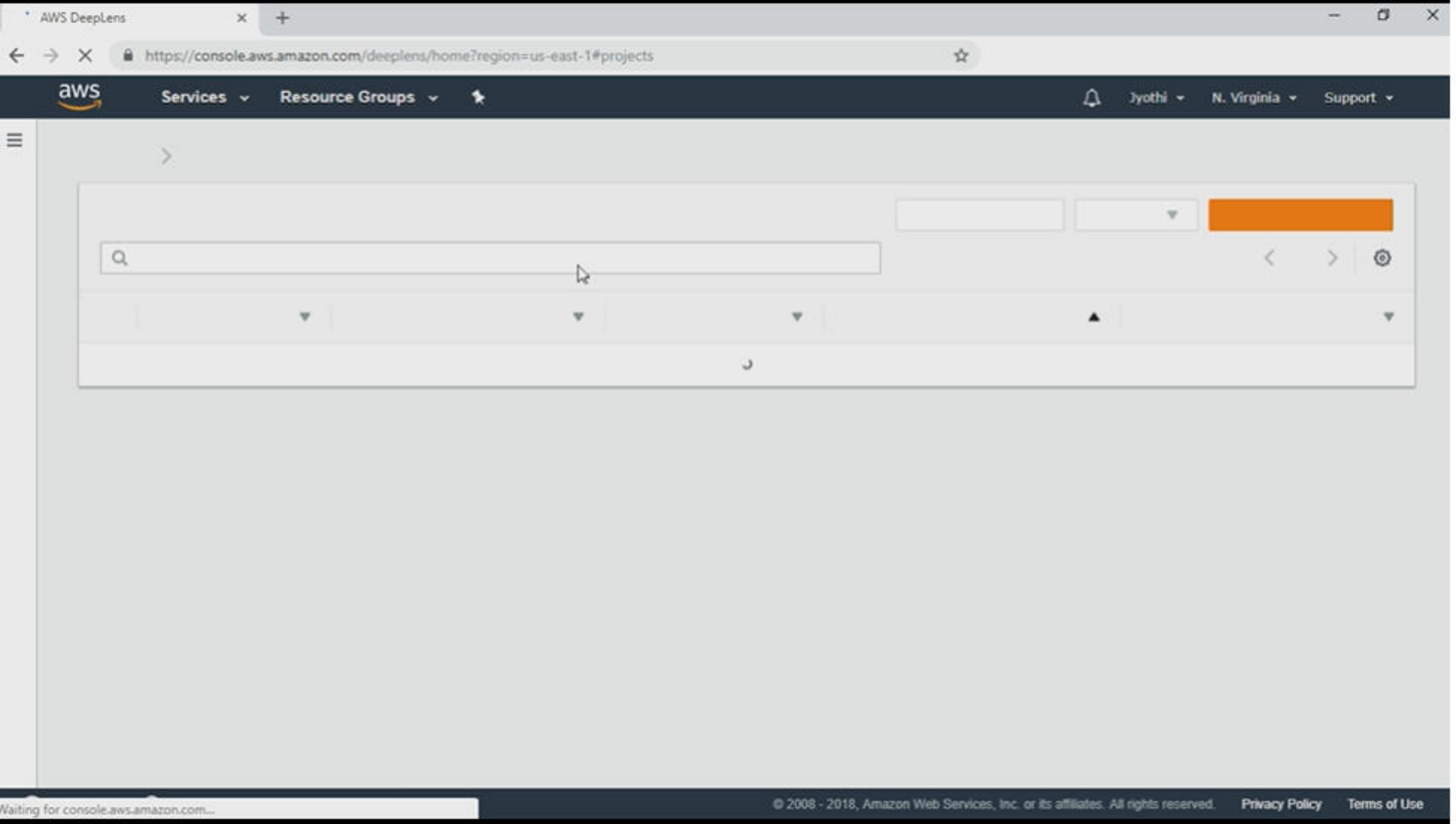
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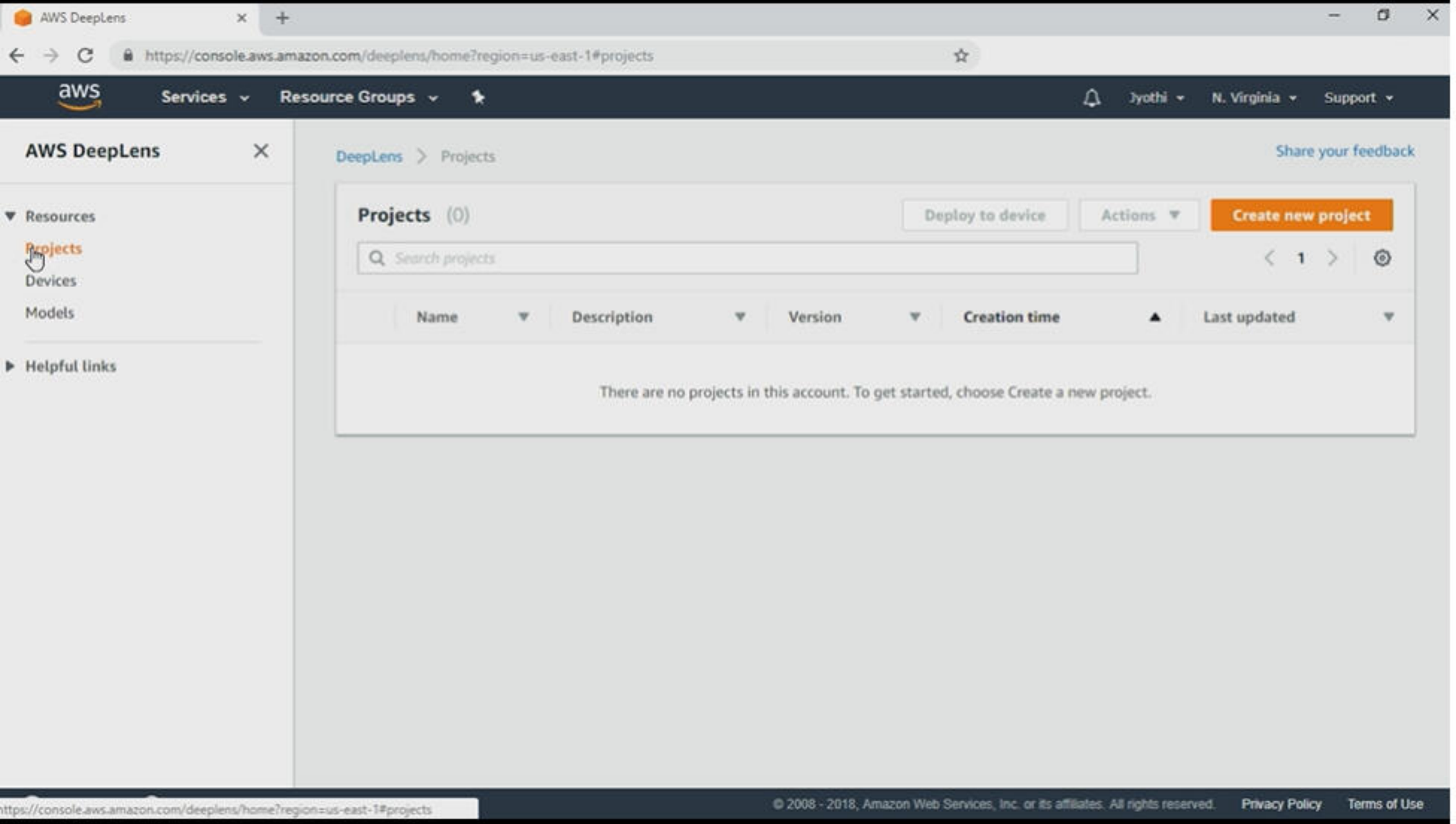
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Name
Description
Version
Creation time
Last updated
There are no projects in this account. To get started, choose Create a new project.
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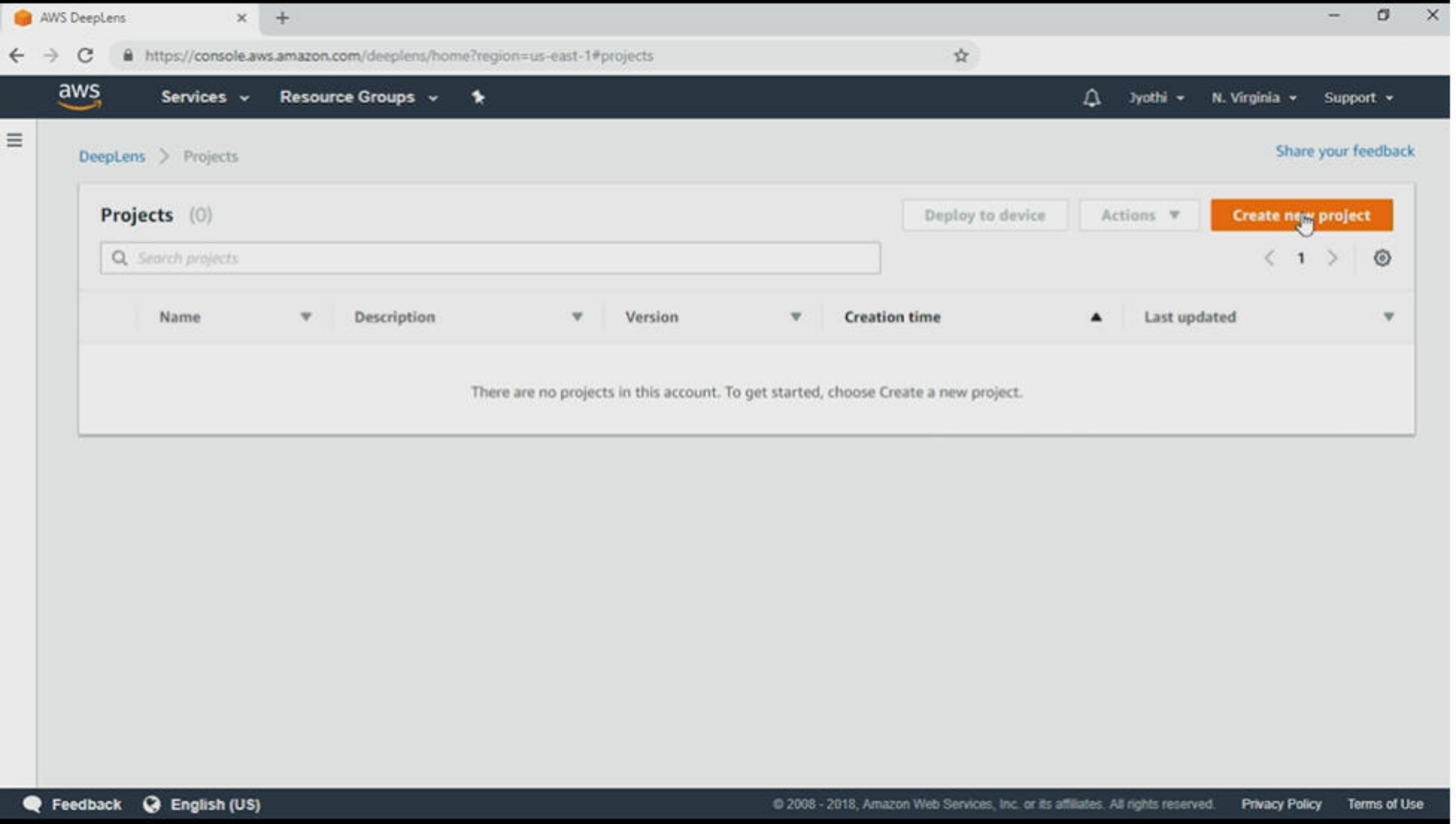
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https://console.aws.amazon.com/deeplens/home?region=us-east-1#projects/create

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DeepLens > Projects > Create project

Share your feedback

Step 1
Choose project type

Step 2
Specify project details

Choose project type

Project type

Choose an option

- **Use a project template**
  Test a preconfigured project to deploy a solution quickly, or customize the templates for your own use.
- **Create a new blank project**
  Choose models and functions or create new logic for a custom use case.

Project templates

AWS DeepLens

https://console.aws.amazon.com/deeplens/home?region=us-east-1#projects/create

aws Services Resource Groups Jyothi N. Virginia Support

Choose an option

Use a project template
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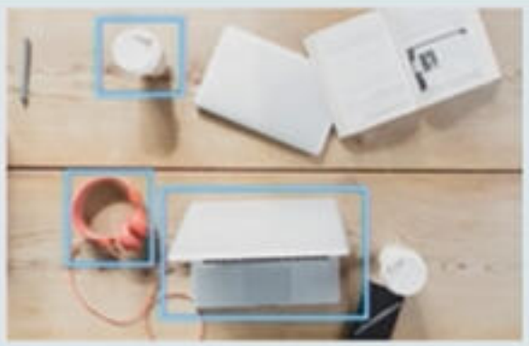
Create a new blank project
Choose models and functions or create new logic for a custom use case.

Project templates



Object detection
Detect 20 popular objects.

Artistic style transfer
Make your surroundings look like Van Gogh's paintings.

AWS DeepLens

https://console.aws.amazon.com/deeplens/home?region=us-east-1#projects/create

aws Services Resource Groups Jyothi N. Virginia Support

Cat and dog recognition

Locate and recognize your cat or dog.

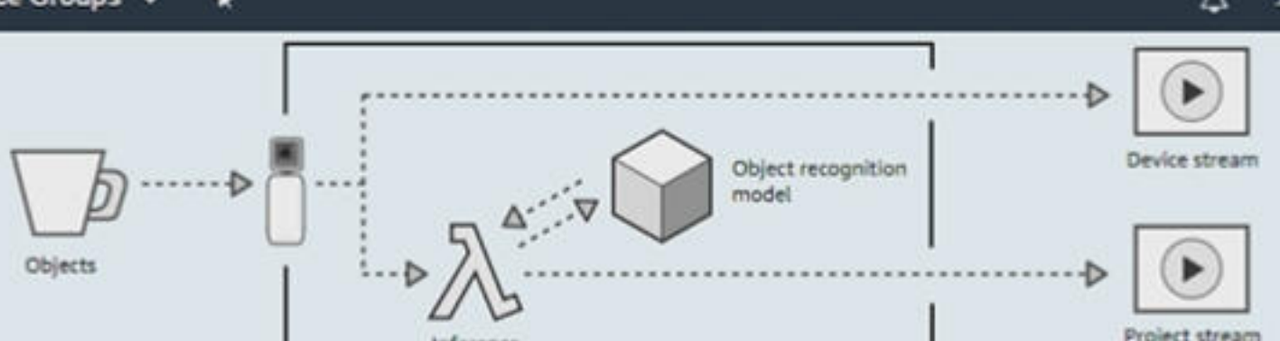
Action recognition

Recognize more than 30 kinds of actions.

Head Pose detection

Detect 9 different head pose angles

Cancel Next

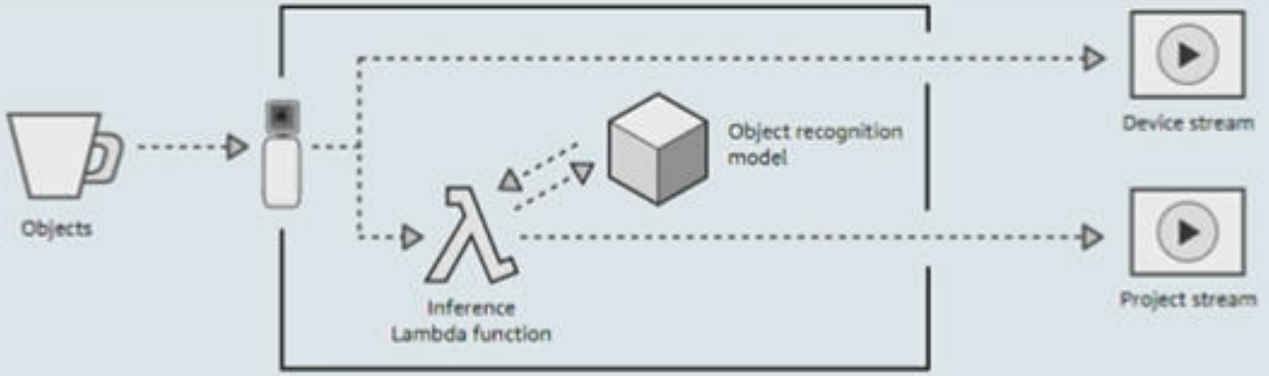


The sample project uses the Single Shot MultiBox detector (SSD) framework for object detection with pre-trained resnet_50 network. The network has been trained on the Pascal VOC dataset and is capable of recognizing 20 different kinds of objects. The model takes the video stream from your AWS DeepLens as input and labels it with identified objects. To get you started, we have prefilled this sample project with a pretrained optimized model ready to deploy to AWS DeepLens. After the model is deployed you can enjoy watching AWS DeepLens recognize objects around you.

Project content

We automatically associate a model and Lambda function with your project template. You can associate another model or function later.

Cancel Previous Create



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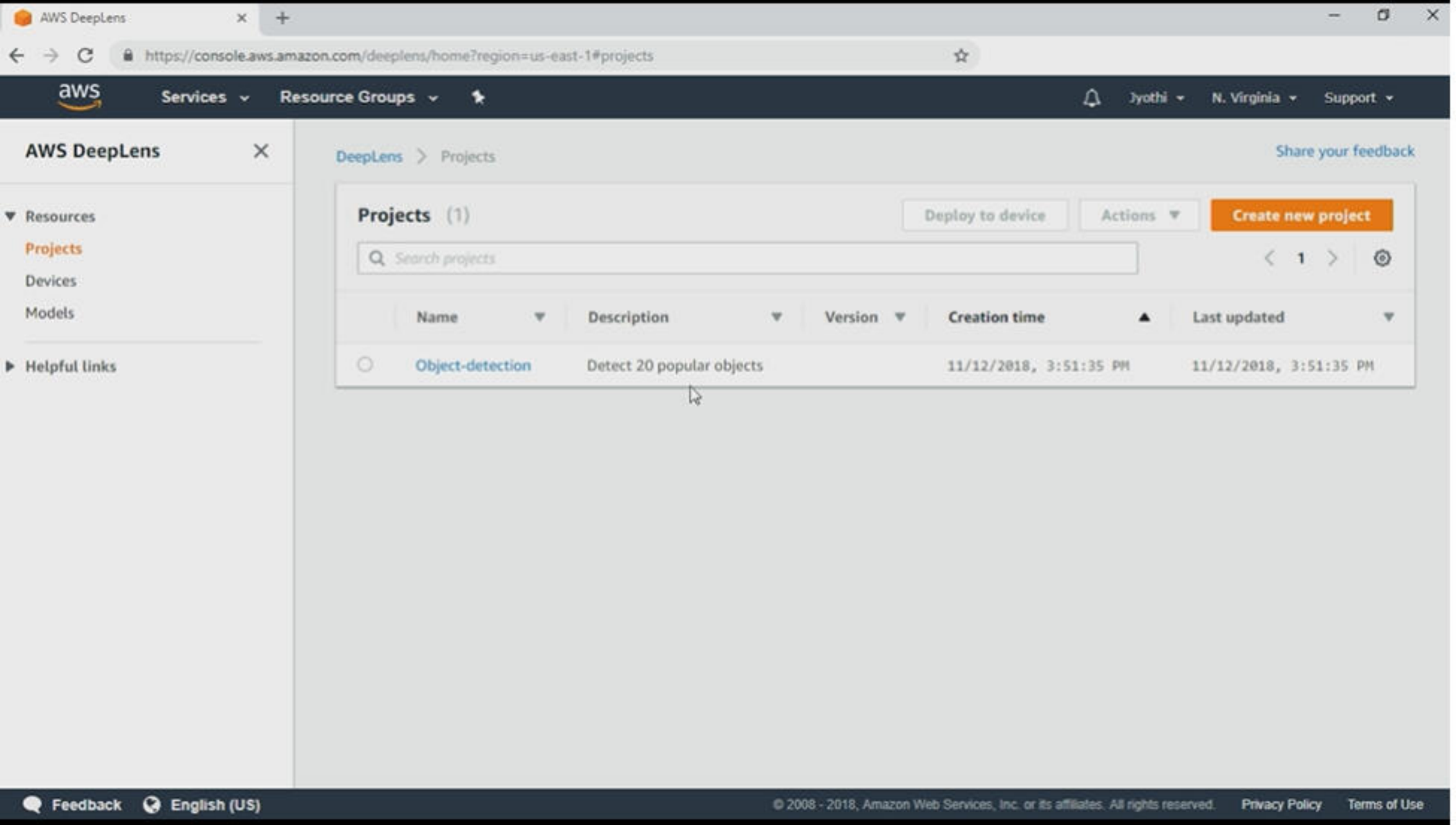
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Creation time
Last updated
Object-detection
Detect 20 popular objects
11/12/2018, 3:51:35 PM
11/12/2018, 3:51:35 PM
Feedback
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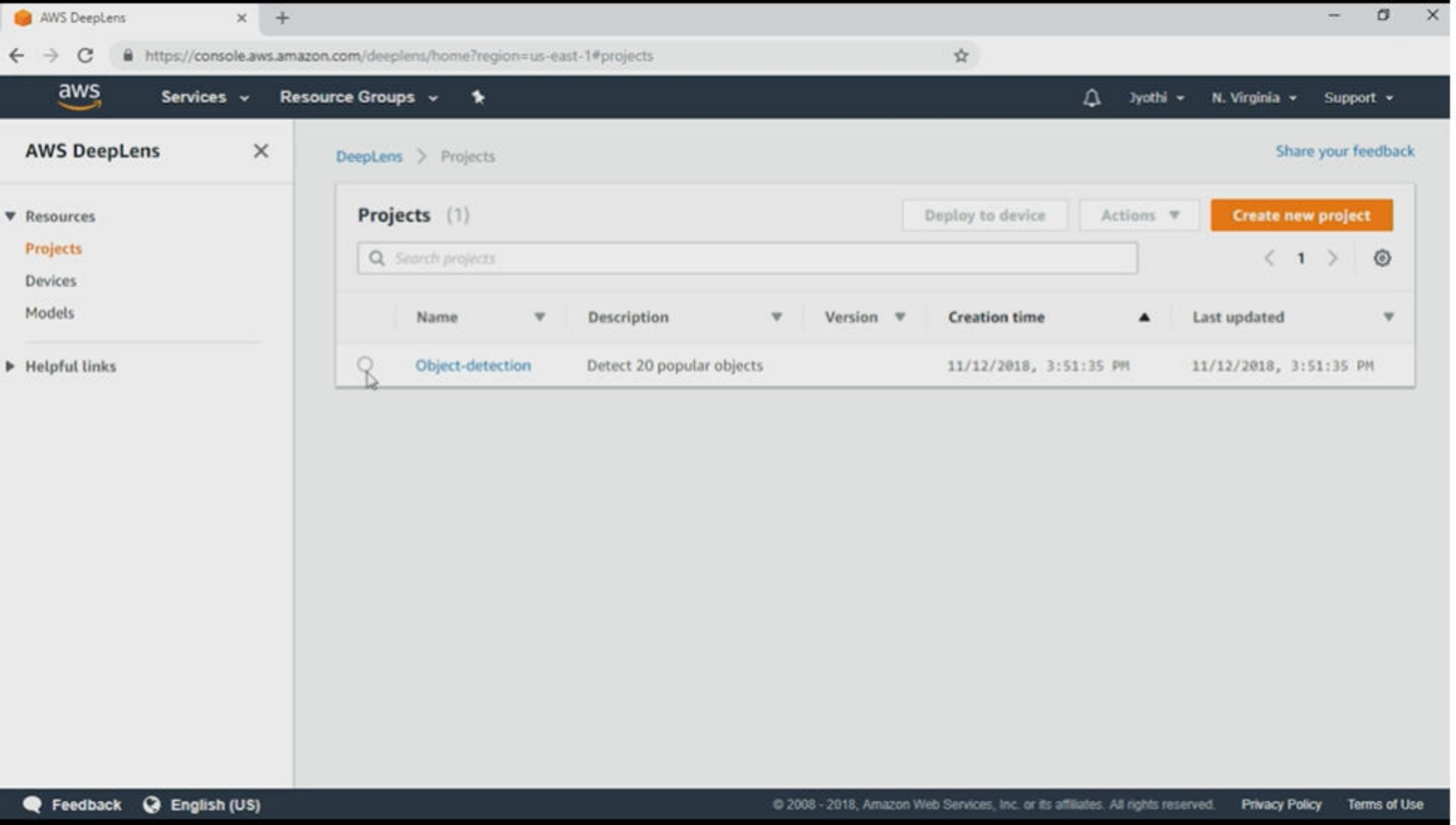
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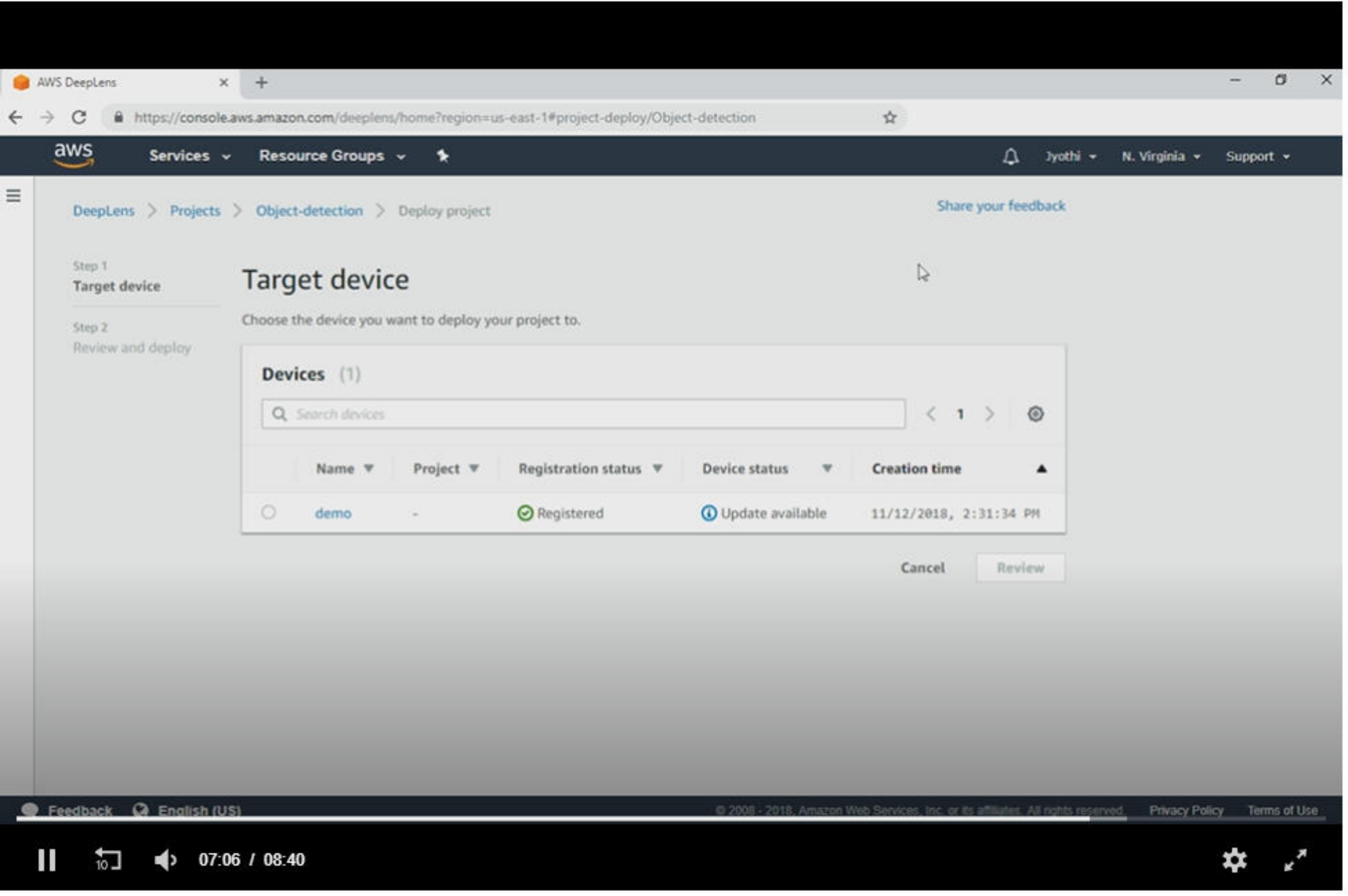
AWS DeepLens
https://console.aws.amazon.com/deeplens/home?region=us-east-1#project-deploy/Object-detection
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Support
DeepLens > Projects > Object-detection > Deploy project
Share your feedback
Step 1
Target device
Step 2
Review and deploy
Target device
Choose the device you want to deploy your project to.
Devices (1)
Search devices
1
Name
Project
Registration status
Device status
Creation time
demo
-
Registered
Update available
11/12/2018, 2:31:34 PM
Cancel
Review
Feedback
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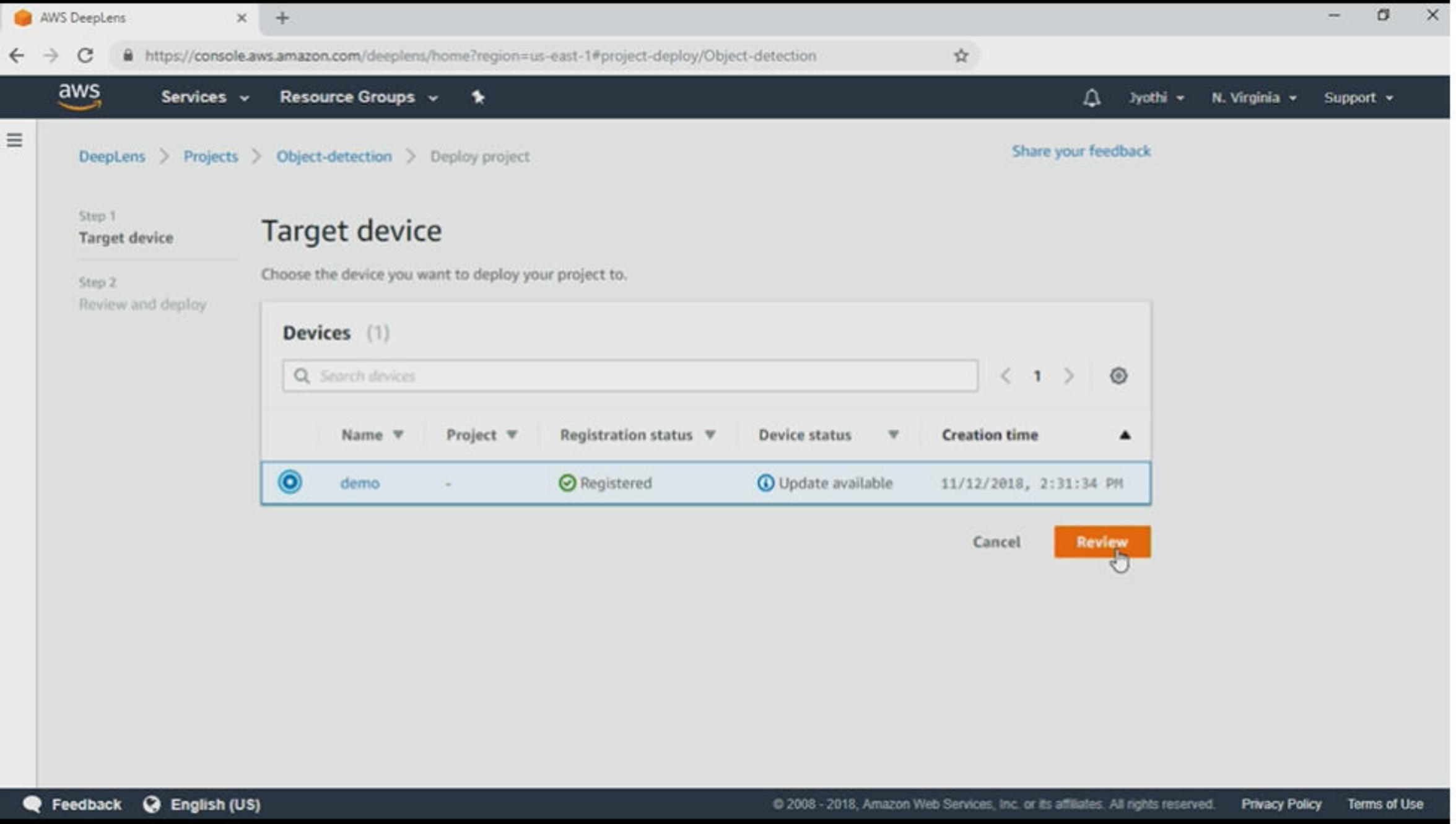
07:06 / 08:40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https://console.aws.amazon.com/deeplens/home?region=us-east-1#project-deploy/Object-detection
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Search devices
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Name
Project
Registration status
Device status
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demo
-
Registered
Update available
11/12/2018, 2:31:34 PM
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Review
Feedback
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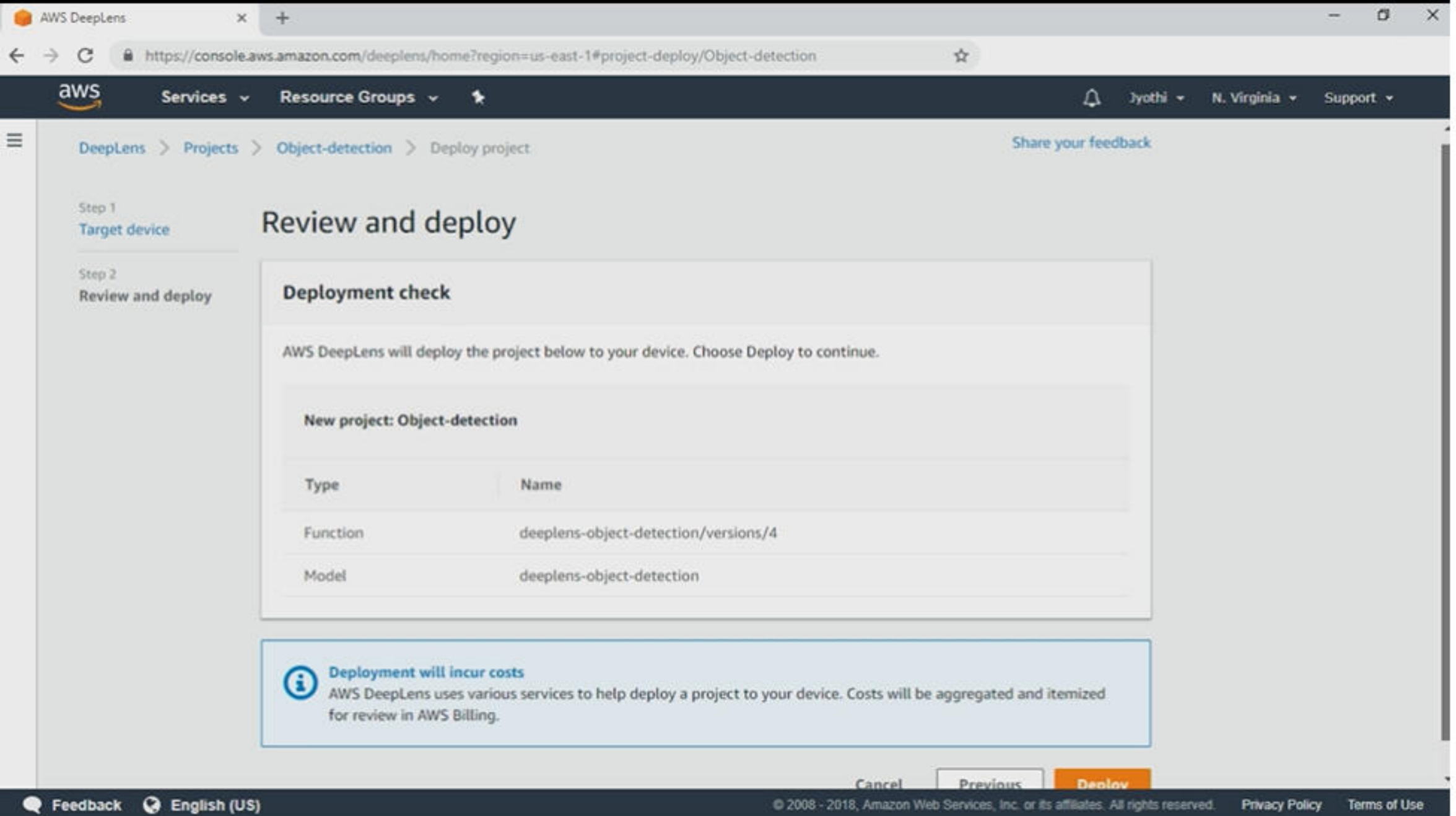
AWS DeepLens
https://console.aws.amazon.com/deeplens/home?region=us-east-1#project-deploy/Object-detection
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DeepLens > Projects > Object-detection > Deploy project
Share your feedback
Step 1
Target device
Step 2
Review and deploy
Review and deploy
Deployment check
AWS DeepLens will deploy the project below to your device. Choose Deploy to continue.
New project: Object-detection
Type
Name
Function
deeplens-object-detection/versions/4
Model
deeplens-object-detection
Deployment will incur costs
AWS DeepLens uses various services to help deploy a project to your device. Costs will be aggregated and itemized for review in AWS Billing.
Cancel
Previous
Deploy
Feedback
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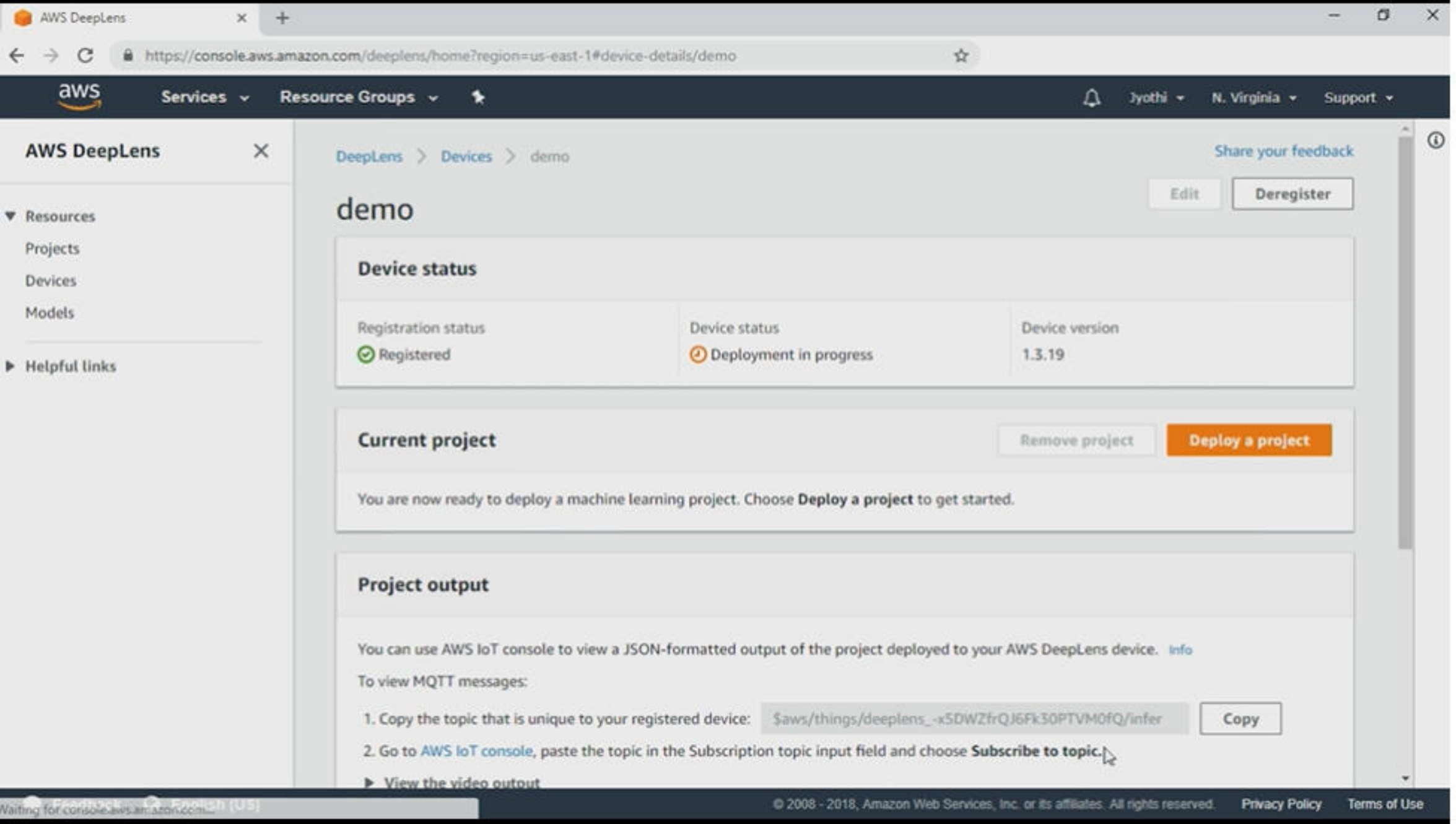
AWS DeepLens
https://console.aws.amazon.com/deeplens/home?region=us-east-1#device-details/demo
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DeepLens > Devices > demo
Share your feedback
Edit
Deregister
demo
Device status
Registration status
Registered
Device status
Deployment in progress
Device version
1.3.19
Current project
Remove project
Deploy a project
You are now ready to deploy a machine learning project. Choose Deploy a project to get started.
Project output
You can use AWS IoT console to view a JSON-formatted output of the project deployed to your AWS DeepLens device. Info
To view MQTT messages:
1. Copy the topic that is unique to your registered device: $aws/things/deeplens_-x5DWZfrQJ6Fk30PTVM0fQ/infer
Copy
2. Go to AWS IoT console, paste the topic in the Subscription topic input field and choose Subscribe to topic.
View the video output
Waiting for console.aws.amazon.com...
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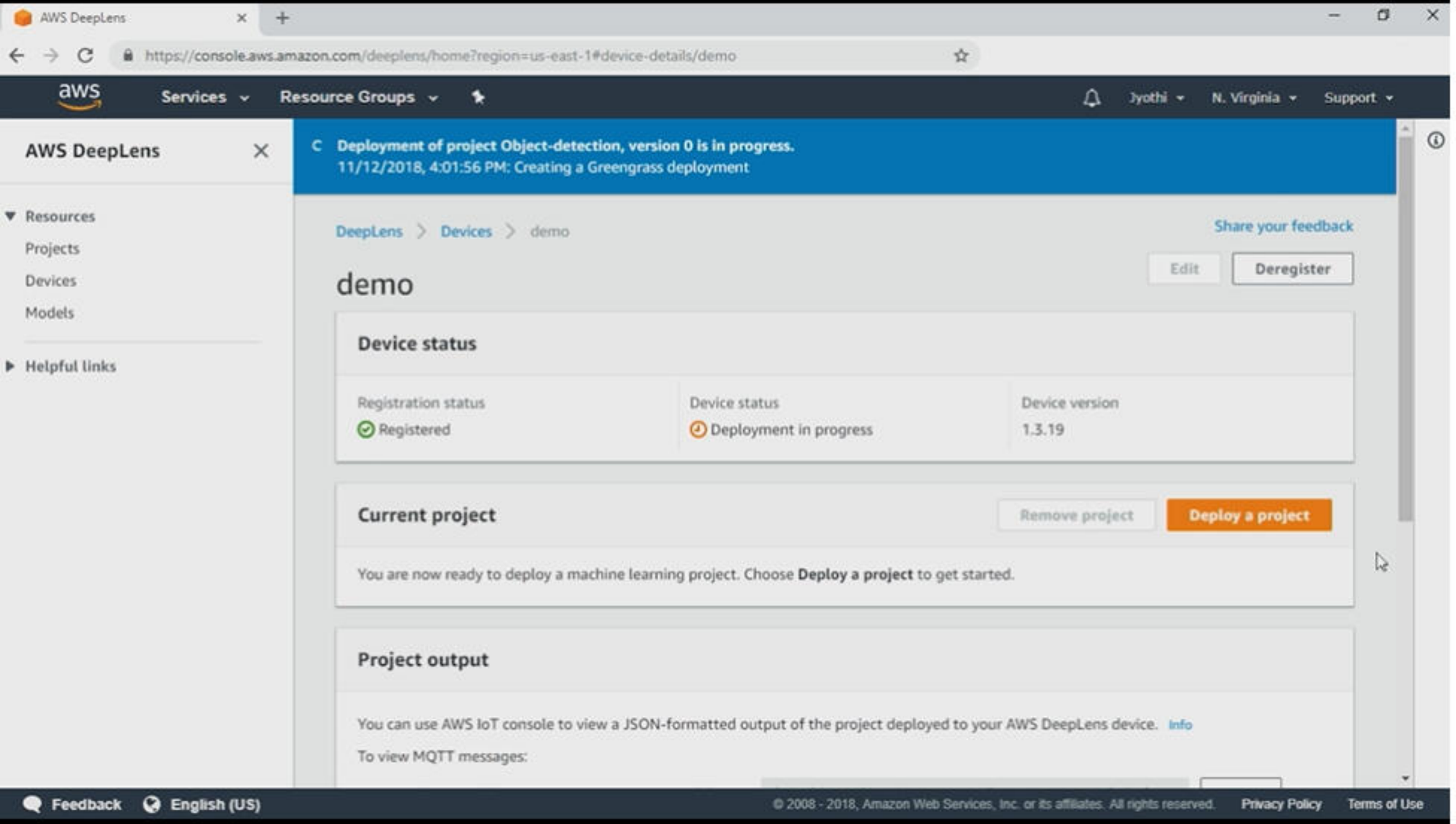
AWS DeepLens
https://console.aws.amazon.com/deeplens/home?region=us-east-1#device-details/demo
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Deployment of project Object-detection, version 0 is in progress.
11/12/2018, 4:01:56 PM: Creating a Greengrass deployment
DeepLens > Devices > demo
Share your feedback
Edit
Deregister
demo
Device status
Registration status
Registered
Device status
Deployment in progress
Device version
1.3.19
Current project
Remove project
Deploy a project
You are now ready to deploy a machine learning project. Choose Deploy a project to get started.
Project output
You can use AWS IoT console to view a JSON-formatted output of the project deployed to your AWS DeepLens device. Info
To view MQTT messages:
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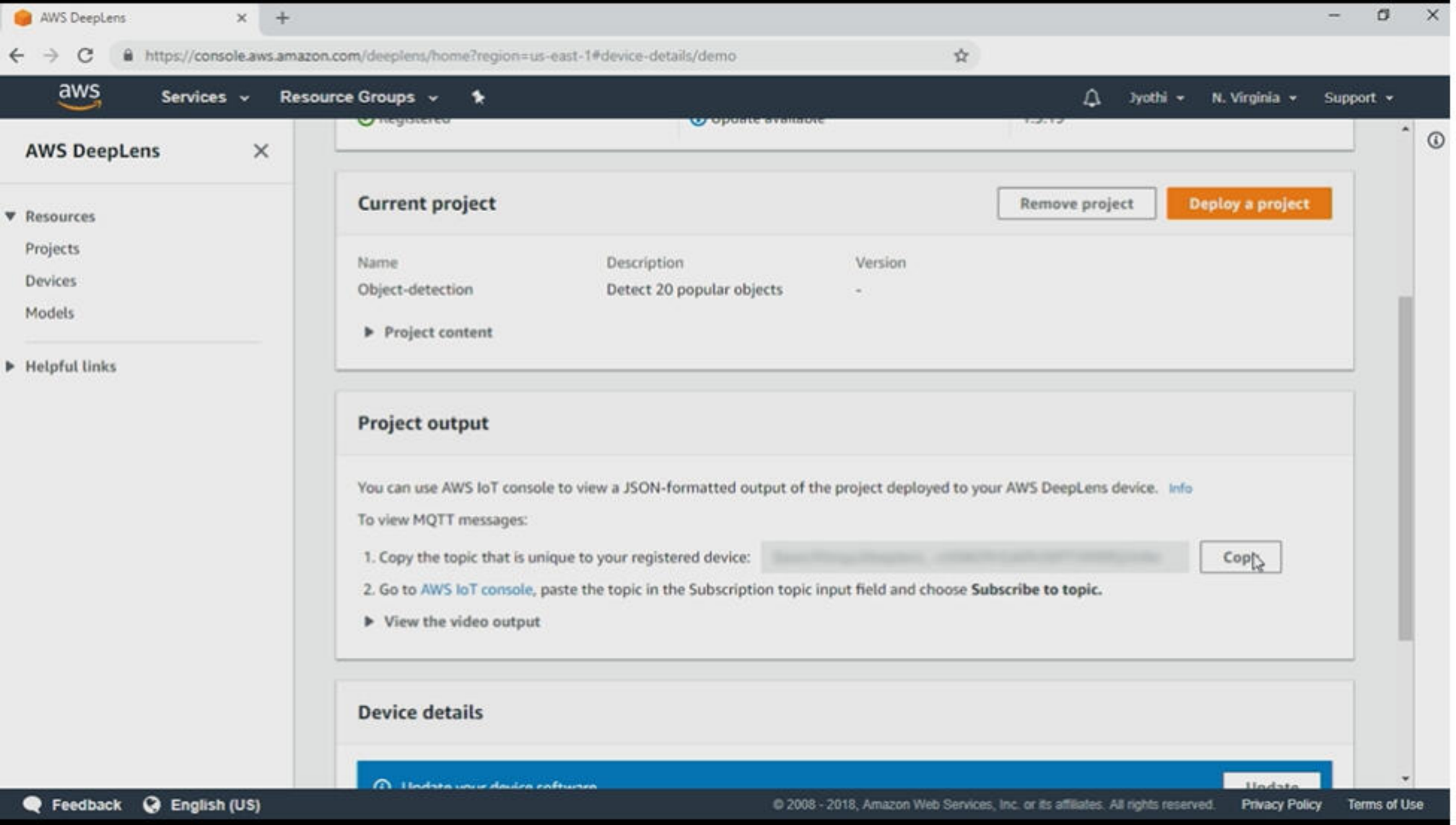
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https://console.aws.amazon.com/deeplens/home?region=us-east-1#device-details/demo
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Current project
Remove project
Deploy a project
Name
Object-detection
Description
Detect 20 popular objects
Version
-
Project content
Project output
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To view MQTT messages:
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Copy
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View the video output
Device details
Feedback
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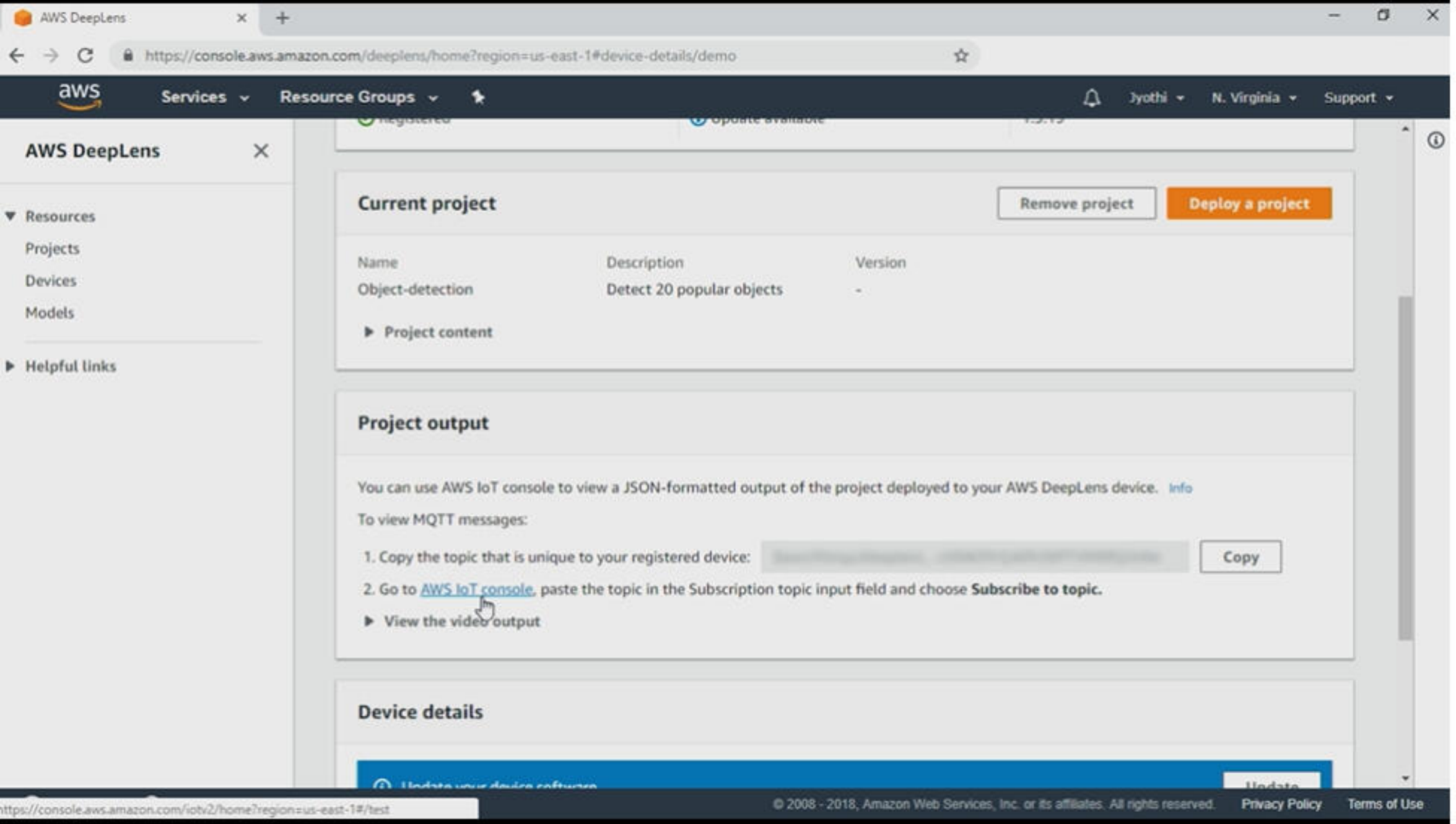
AWS DeepLens
https://console.aws.amazon.com/deeplens/home?region=us-east-1#device-details/demo
aws
Services
Resource Groups
Jyothi
N. Virginia
Support
AWS DeepLens
Resources
Projects
Devices
Models
Helpful links
Current project
Remove project
Deploy a project
Name
Description
Version
Object-detection
Detect 20 popular objects
-
Project content
Project output
You can use AWS IoT console to view a JSON-formatted output of the project deployed to your AWS DeepLens device. Info
To view MQTT messages:
1. Copy the topic that is unique to your registered device:
Copy
2. Go to AWS IoT console, paste the topic in the Subscription topic input field and choose Subscribe to topic.
View the video output
Device details
Update
https://console.aws.amazon.com/iotv2/home?region=us-east-1#/test
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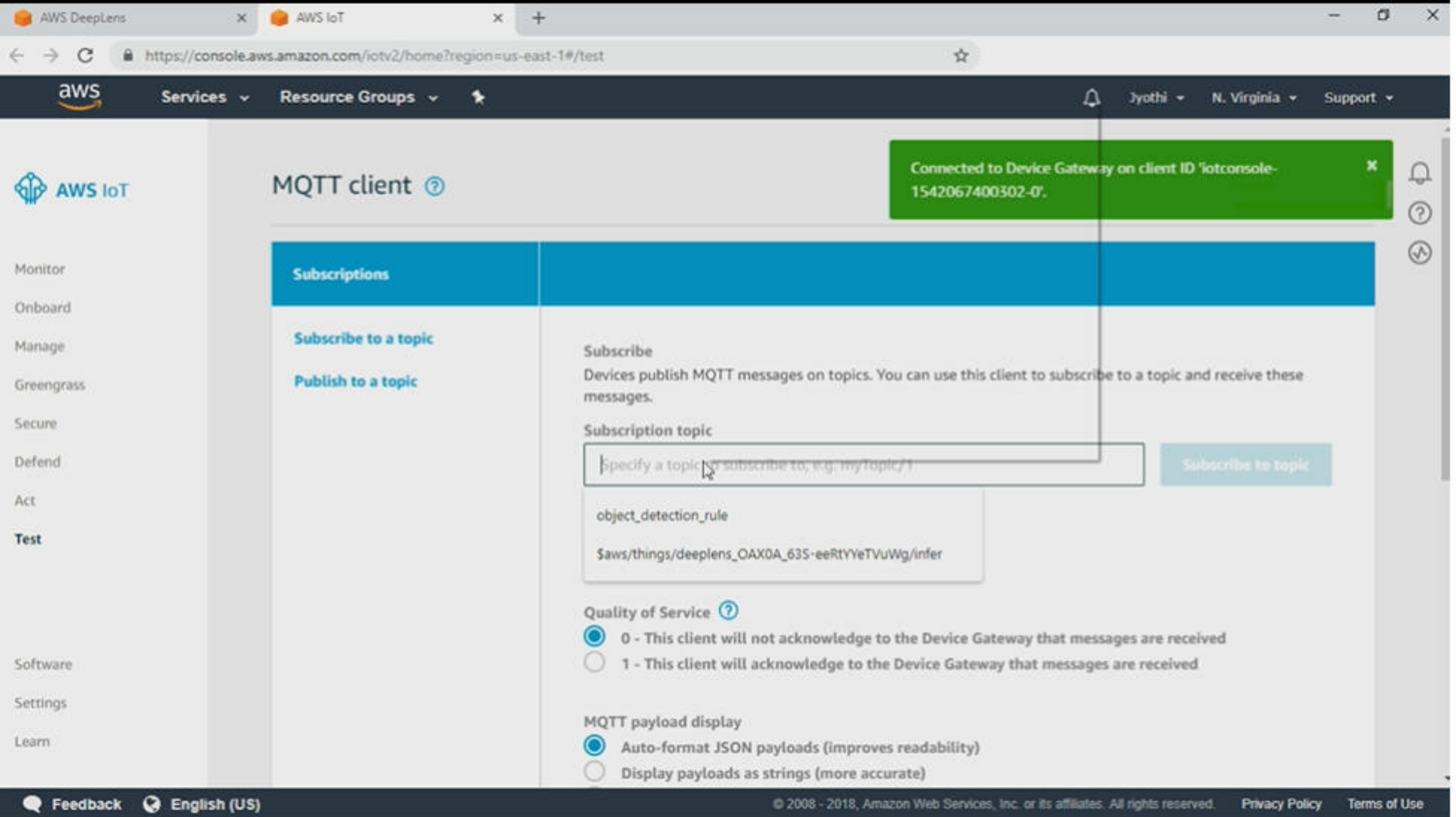
Terms of Use


AWS DeepLens
AWS IoT
https://console.aws.amazon.com/iotv2/home?region=us-east-1#/test
aws
Services
Resource Groups
Jyothi
N. Virginia
Support
AWS IoT
MQTT client
Connected to Device Gateway on client ID 'iotconsole-1542067400302-0'.
Monitor
Onboard
Manage
Greengrass
Secure
Defend
Act
Test
Software
Settings
Learn
Subscriptions
Subscribe to a topic
Publish to a topic
Subscribe
Devices publish MQTT messages on topics. You can use this client to subscribe to a topic and receive these messages.
Subscription topic
Specify a topic or subscribe to, e.g. my/topic/1
Subscribe to topic
object_detection_rule
$aws/things/deeplens_OAX0A_635-eeRtYYeTVuWg/infer
Quality of Service
0 - This client will not acknowledge to the Device Gateway that messages are received
1 - This client will acknowledge to the Device Gateway that messages are received
MQTT payload display
Auto-format JSON payloads (improves readability)
Display payloads as strings (more accurate)
Feedback
English (US)
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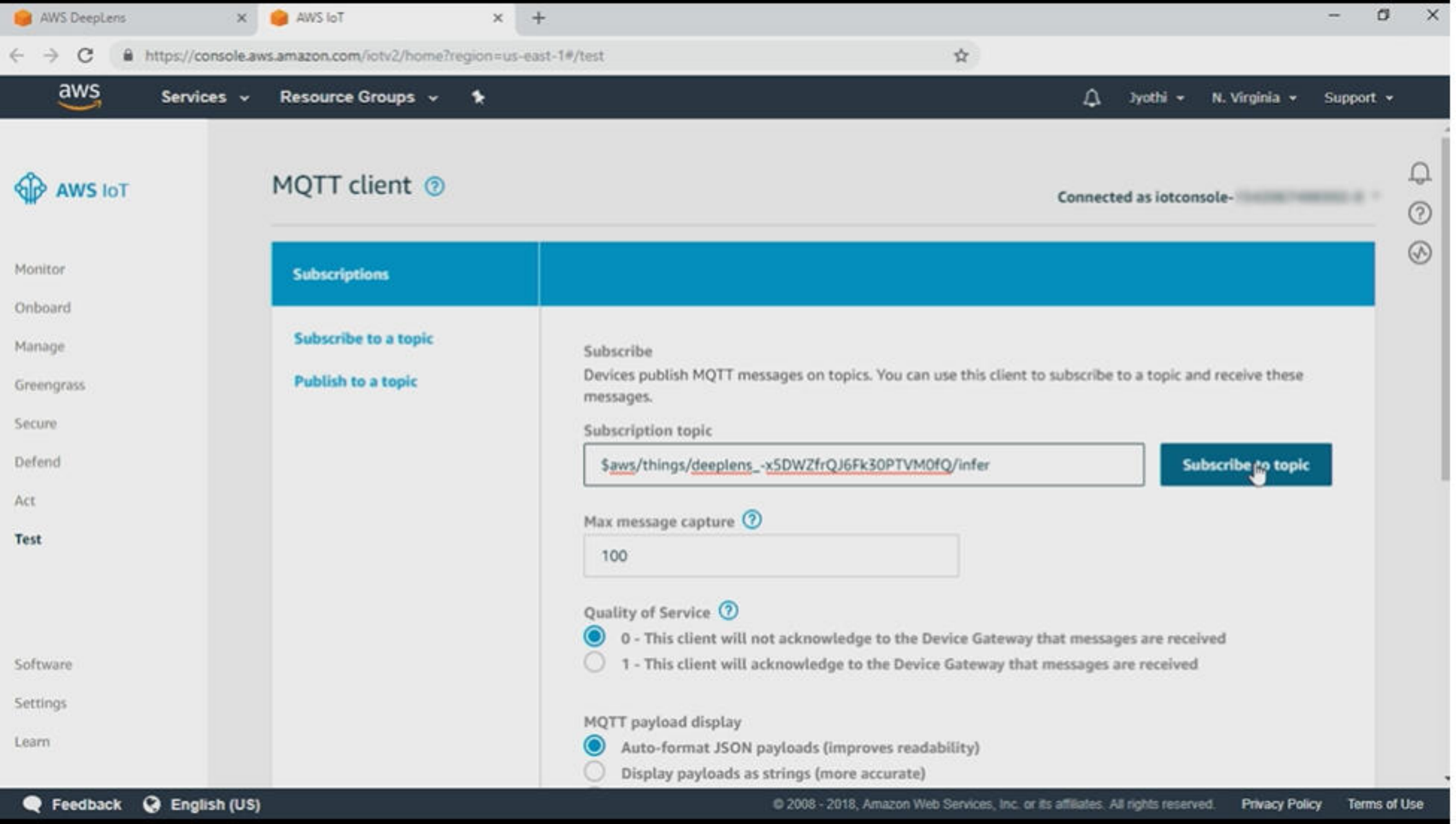
AWS DeepLens
AWS IoT
https://console.aws.amazon.com/iotv2/home?region=us-east-1#/test
aws
Services
Resource Groups
Jyothi
N. Virginia
Support
AWS IoT
Monitor
Onboard
Manage
Greengrass
Secure
Defend
Act
Test
Software
Settings
Learn
MQTT client
Connected as iotconsole-
Subscriptions
Subscribe to a topic
Publish to a topic
Subscribe
Devices publish MQTT messages on topics. You can use this client to subscribe to a topic and receive these messages.
Subscription topic
$aws/things/deeplens_-x5DWZfrQJ6Fk30PTVM0fQ/infer
Subscribe to topic
Max message capture
100
Quality of Service
0 - This client will not acknowledge to the Device Gateway that messages are received
1 - This client will acknowledge to the Device Gateway that messages are received
MQTT payload display
Auto-format JSON payloads (improves readability)
Display payloads as strings (more accurate)
Feedback
English (US)
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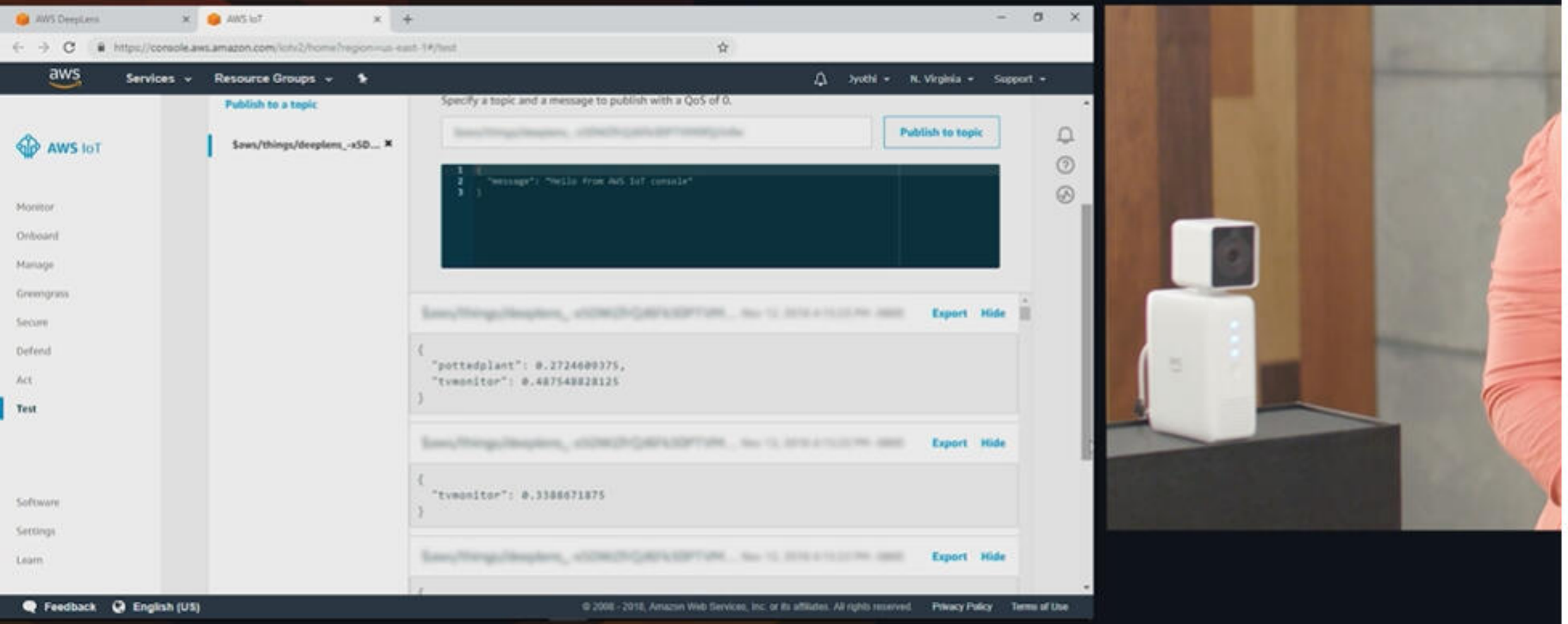
AWS DeepLens
AWS IoT
https://console.aws.amazon.com/iotv2/home?region=us-east-1#/test
aws
Services
Resource Groups
Jyothi
N. Virginia
Support
AWS IoT
Monitor
Onboard
Manage
Greengrass
Secure
Defend
Act
Test
Software
Settings
Learn
Publish to a topic
$aws/things/deeplens_-xSD...
Specify a topic and a message to publish with a QoS of 0.
Publish to topic
{
"message": "Hello from AWS IoT console"
}
Export
Hide
{
"pottedplant": 0.2724609375,
"tvmonitor": 0.487548828125
}
Export
Hide
{
"tvmonitor": 0.3388671875
}
Export
Hide
Feedback
English (US)
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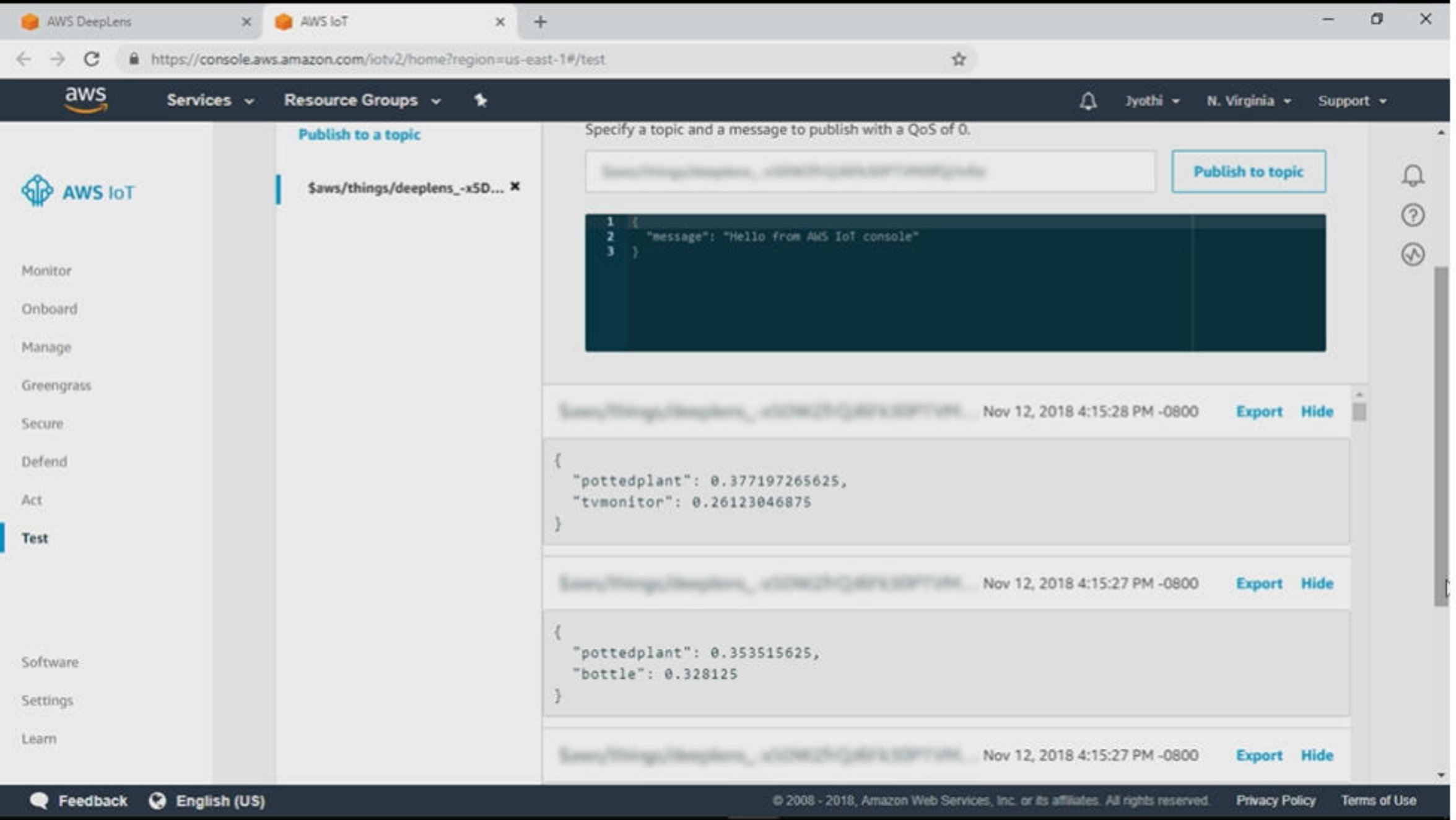
Terms of Use


AWS DeepLens
AWS IoT
https://console.aws.amazon.com/iotv2/home?region=us-east-1#/test
aws
Services
Resource Groups
Jyothi
N. Virginia
Support
AWS IoT
Monitor
Onboard
Manage
Greengrass
Secure
Defend
Act
Test
Software
Settings
Learn
Publish to a topic
$aws/things/deeplens_-x5D...
Specify a topic and a message to publish with a QoS of 0.
Publish to topic
{
"message": "Hello from AWS IoT console"
}
Nov 12, 2018 4:15:28 PM -0800
Export
Hide
{
"pottedplant": 0.377197265625,
"tvmonitor": 0.26123046875
}
Nov 12, 2018 4:15:27 PM -0800
Export
Hide
{
"pottedplant": 0.353515625,
"bottle": 0.328125
}
Nov 12, 2018 4:15:27 PM -0800
Export
Hide
Feedback
English (US)
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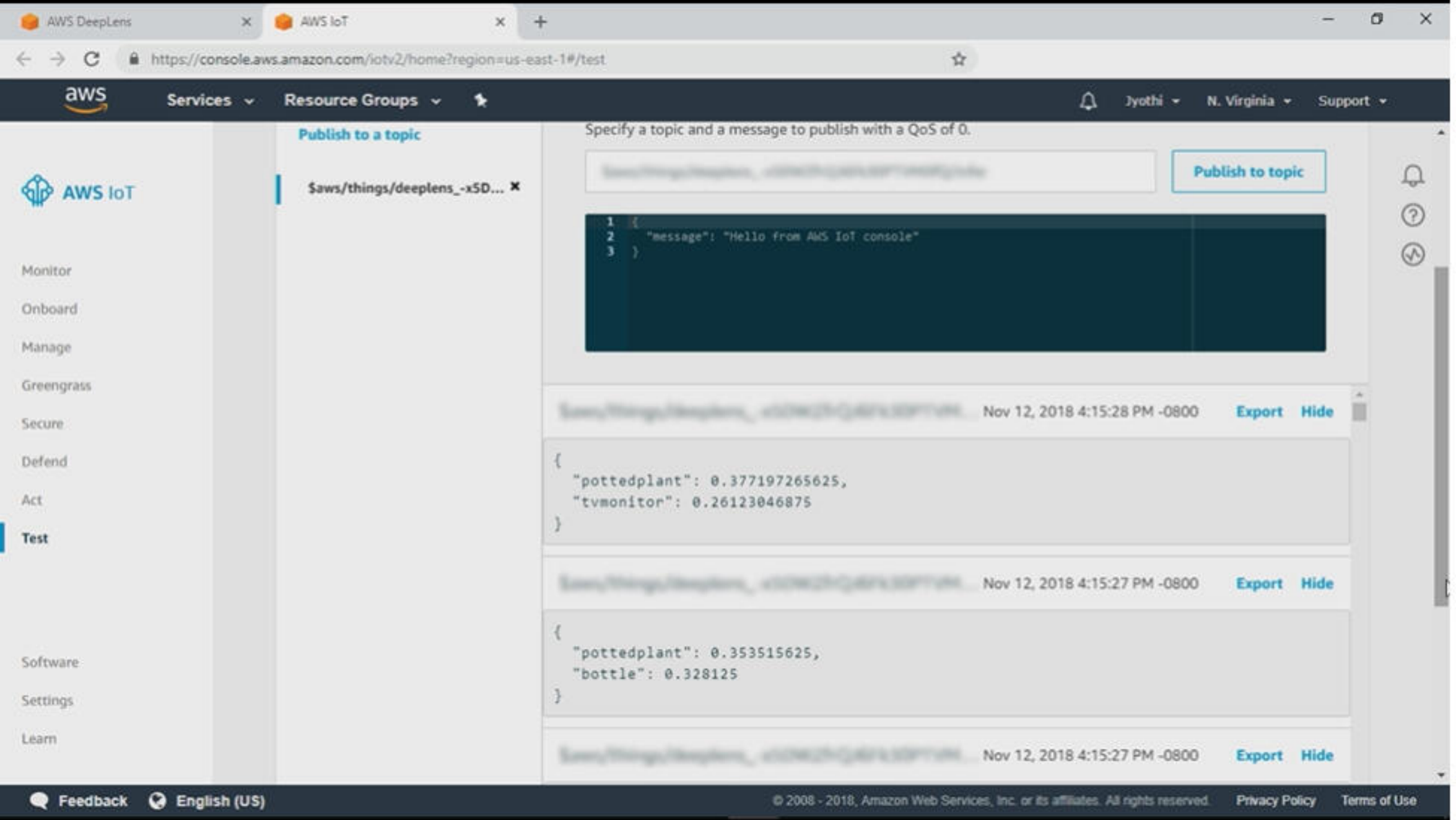
AWS DeepLens
AWS IoT
https://console.aws.amazon.com/iotv2/home?region=us-east-1#/test
aws
Services
Resource Groups
Jyothi
N. Virginia
Support
AWS IoT
Monitor
Onboard
Manage
Greengrass
Secure
Defend
Act
Test
Software
Settings
Learn
Publish to a topic
$aws/things/deeplens_-x5D...
Specify a topic and a message to publish with a QoS of 0.
Publish to topic
{
"message": "Hello from AWS IoT console"
}
Nov 12, 2018 4:15:28 PM -0800
Export
Hide
{
"pottedplant": 0.377197265625,
"tvmonitor": 0.26123046875
}
Nov 12, 2018 4:15:27 PM -0800
Export
Hide
{
"pottedplant": 0.353515625,
"bottle": 0.328125
}
Nov 12, 2018 4:15:27 PM -0800
Export
Hide
Feedback
English (US)
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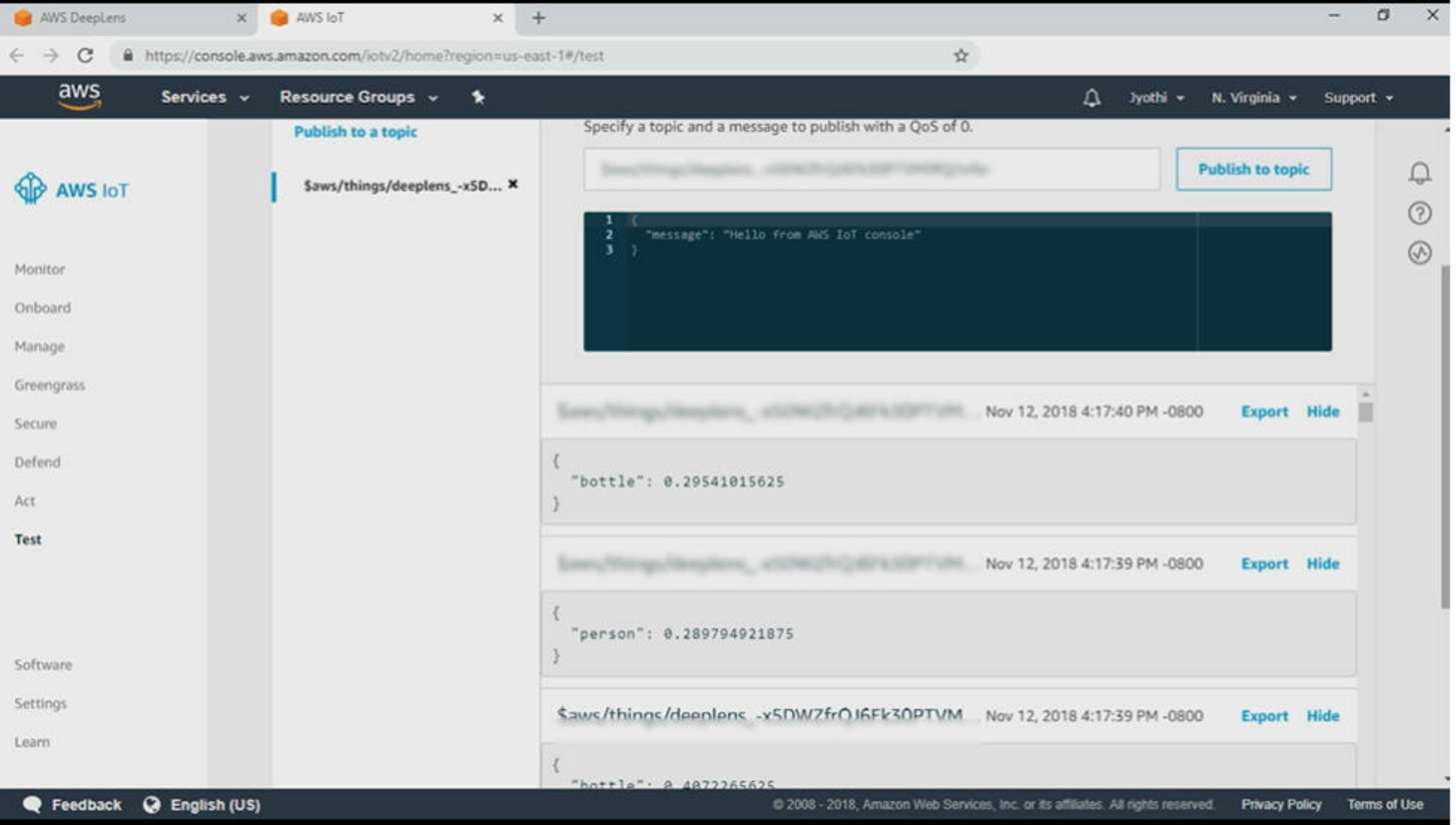
AWS DeepLens
AWS IoT
https://console.aws.amazon.com/iotv2/home?region=us-east-1#/test
aws
Services
Resource Groups
Jyothi
N. Virginia
Support
AWS IoT
Monitor
Onboard
Manage
Greengrass
Secure
Defend
Act
Test
Software
Settings
Learn
Publish to a topic
$aws/things/deeplens_-x5D...
Specify a topic and a message to publish with a QoS of 0.
Publish to topic
{
"message": "Hello from AWS IoT console"
}
Nov 12, 2018 4:17:40 PM -0800
Export
Hide
{
"bottle": 0.29541015625
}
Nov 12, 2018 4:17:39 PM -0800
Export
Hide
{
"person": 0.289794921875
}
Nov 12, 2018 4:17:39 PM -0800
Export
Hide
Feedback
English (US)
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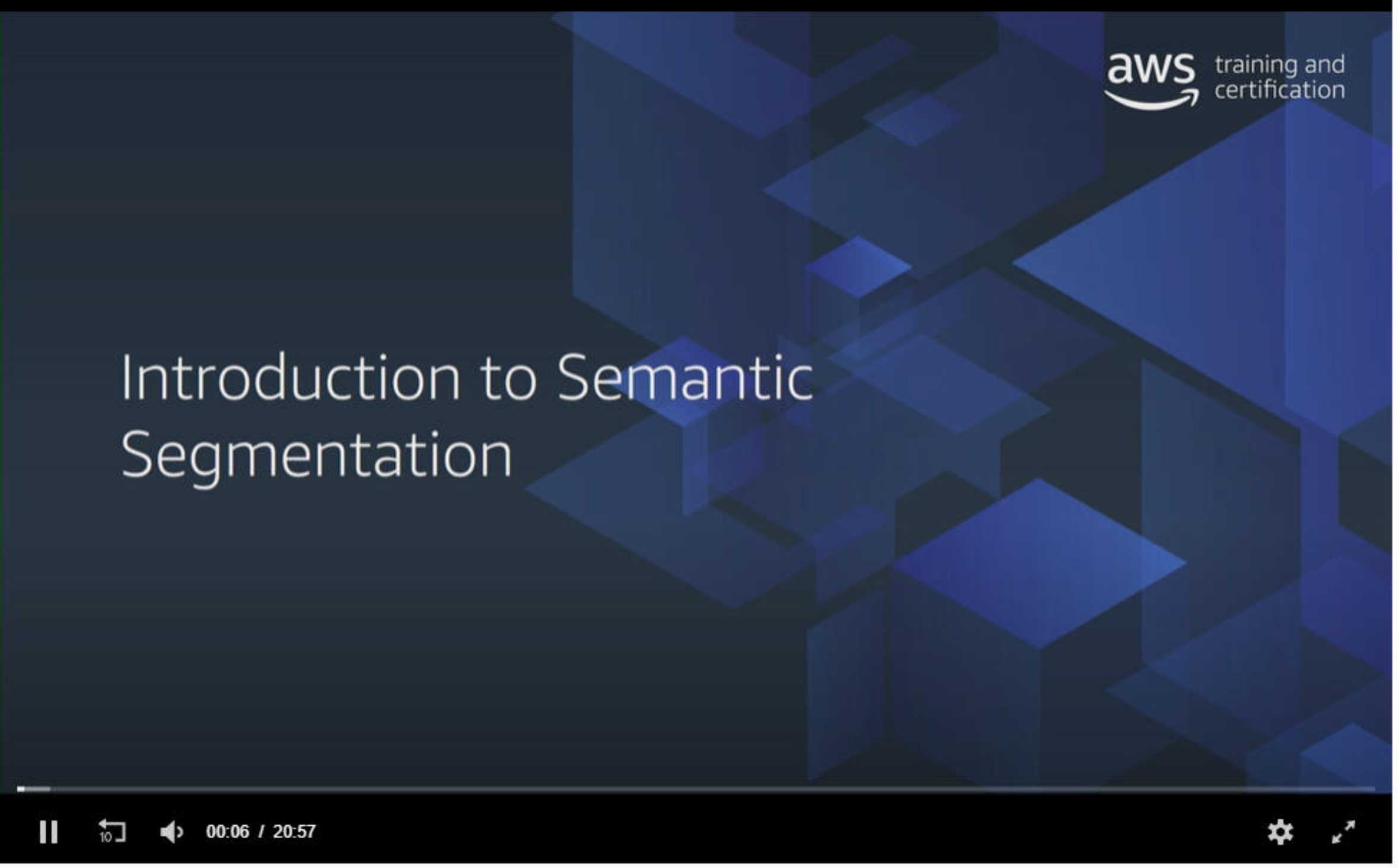
Thank You


aws training and certification
Introduction to Semantic Segmentation
00:06 / 20:57

aws training and certification

Introduction to Semantic Segmentation

In This Course

aws training and certification

- Computer Vision & Localization
- Semantic Segmentation
  - Deep Learning Problem
  - Architecture
  - Practical Application


Amazon AI

Things to Know

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- Image processing
- Computer Vision Basics
- Deep Learning Fundamentals
- Convolutional Neural Networks

Computer Vision

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“Acquiring, processing, analyzing and understanding digital images”

Computer Vision Contd.

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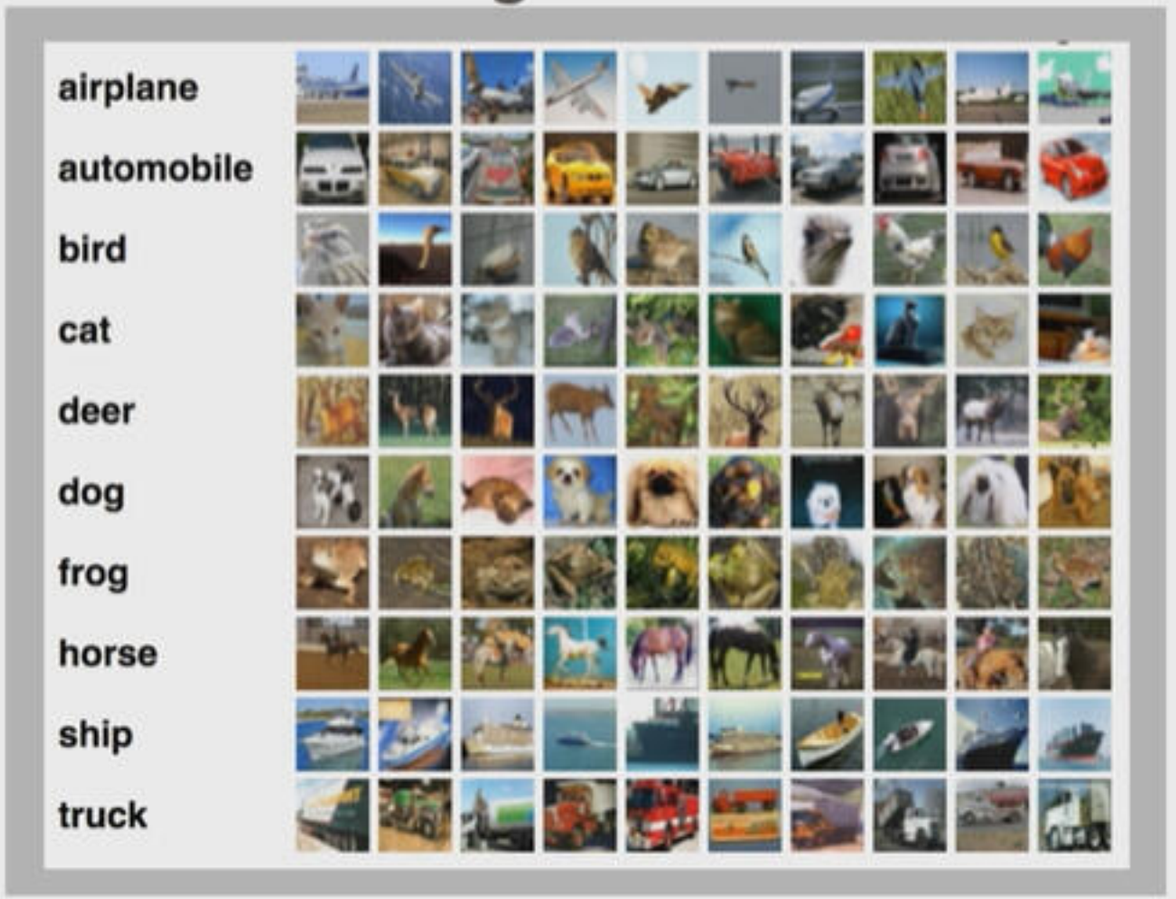
Global Image Classification



Computer Vision Contd.

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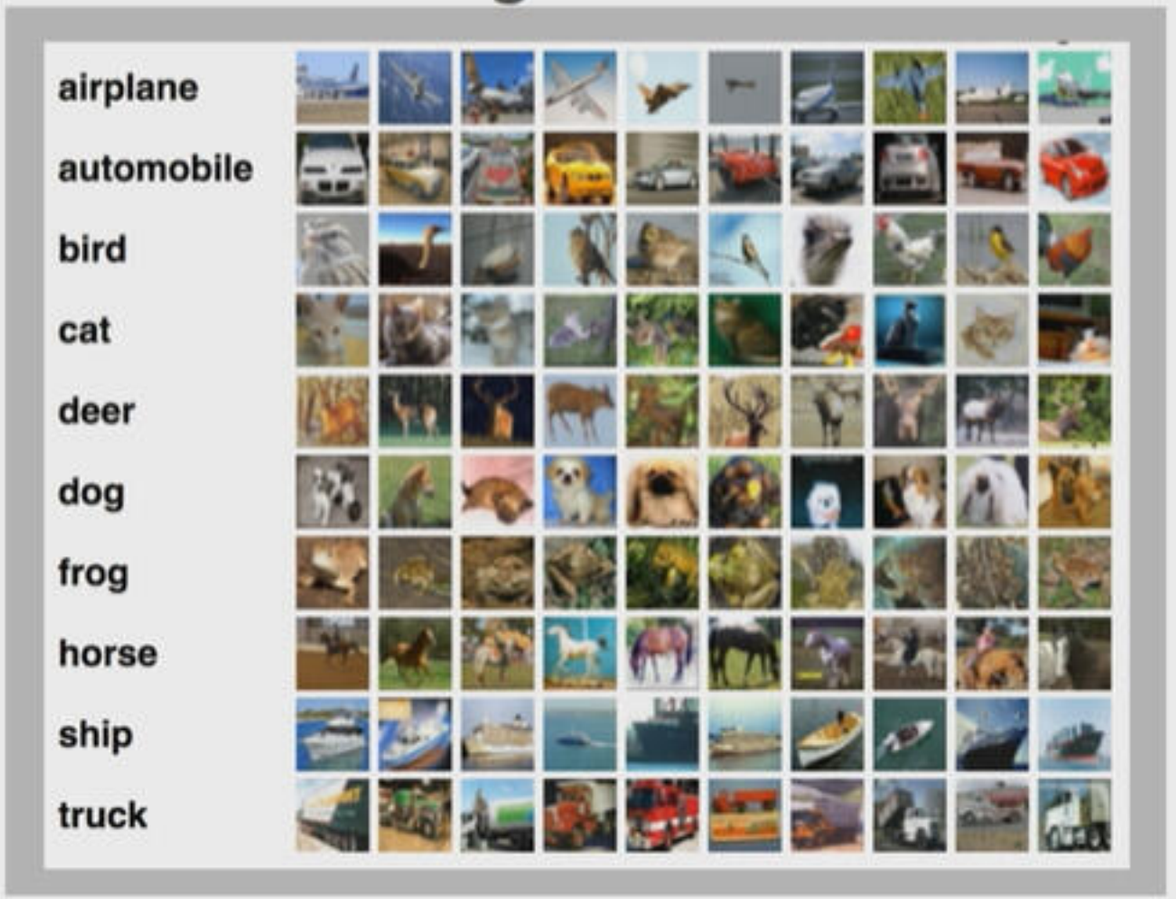
Global Image Classification



Computer Vision Contd.

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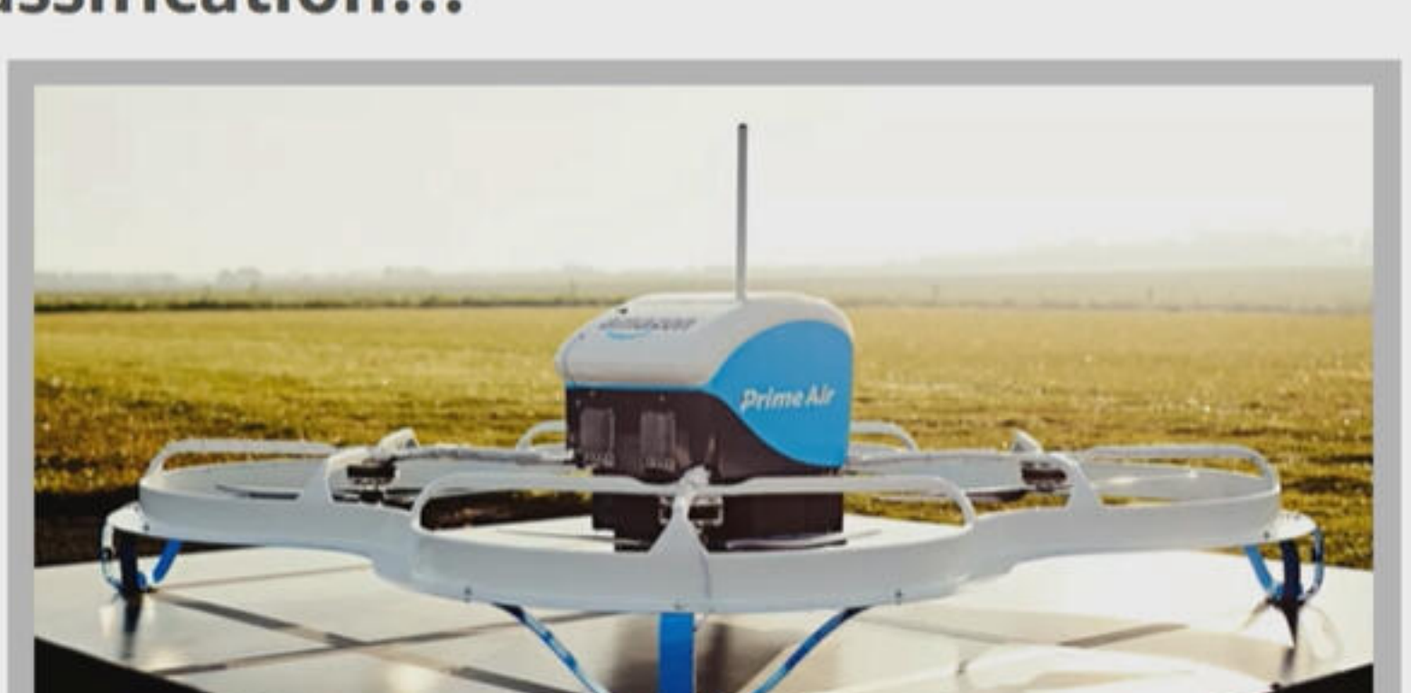
Image classification...



...usually not enough

Computer Vision Contd.

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Image classification...

...usually not enough

Computer Vision Contd.

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Image classification...

...usually not enough

Localization Techniques

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Tells us local information about an image:

- What?
- Where?
- How many?

Course Localization

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Object Detection

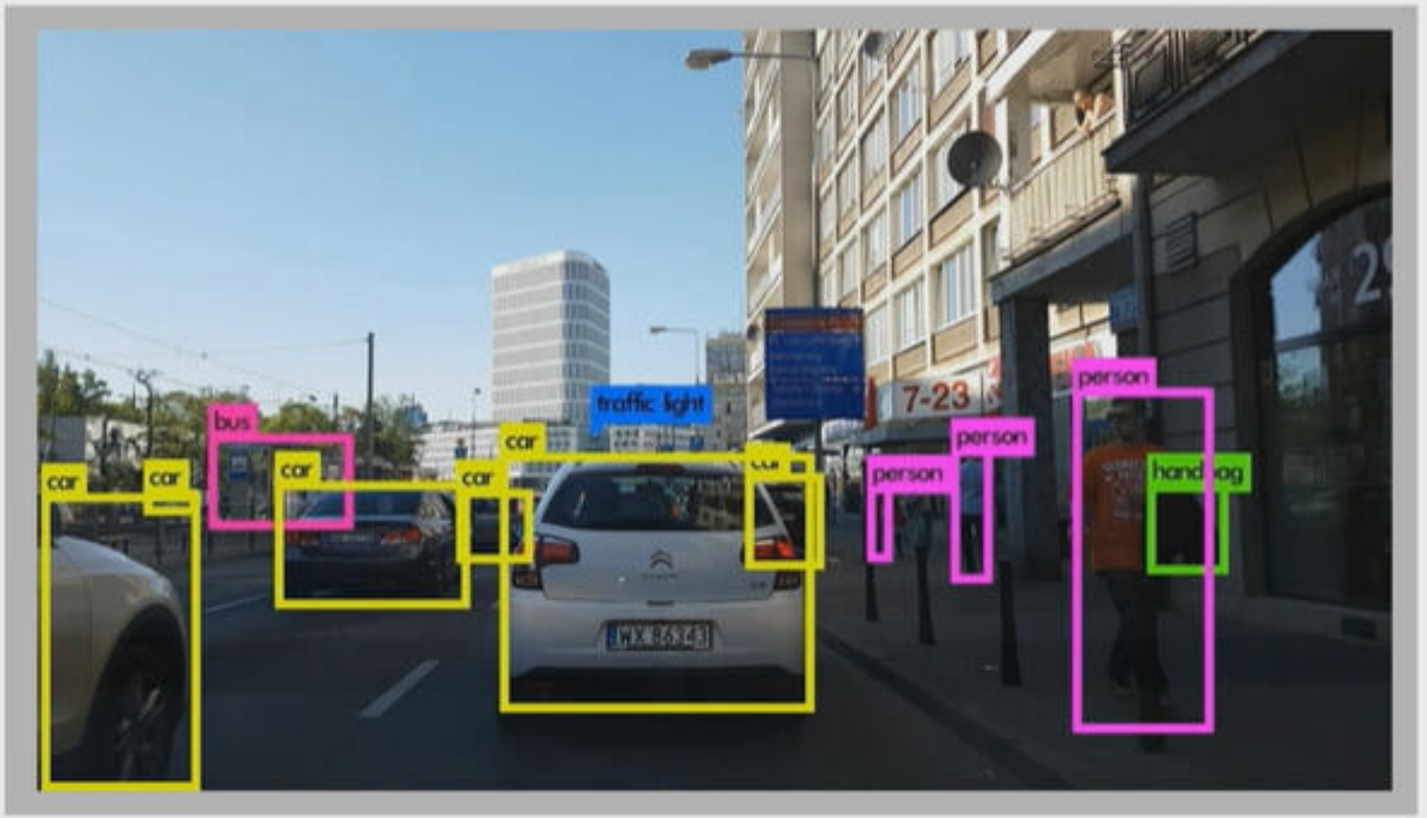

Image from Yolo object Detector Series

Fine Localization

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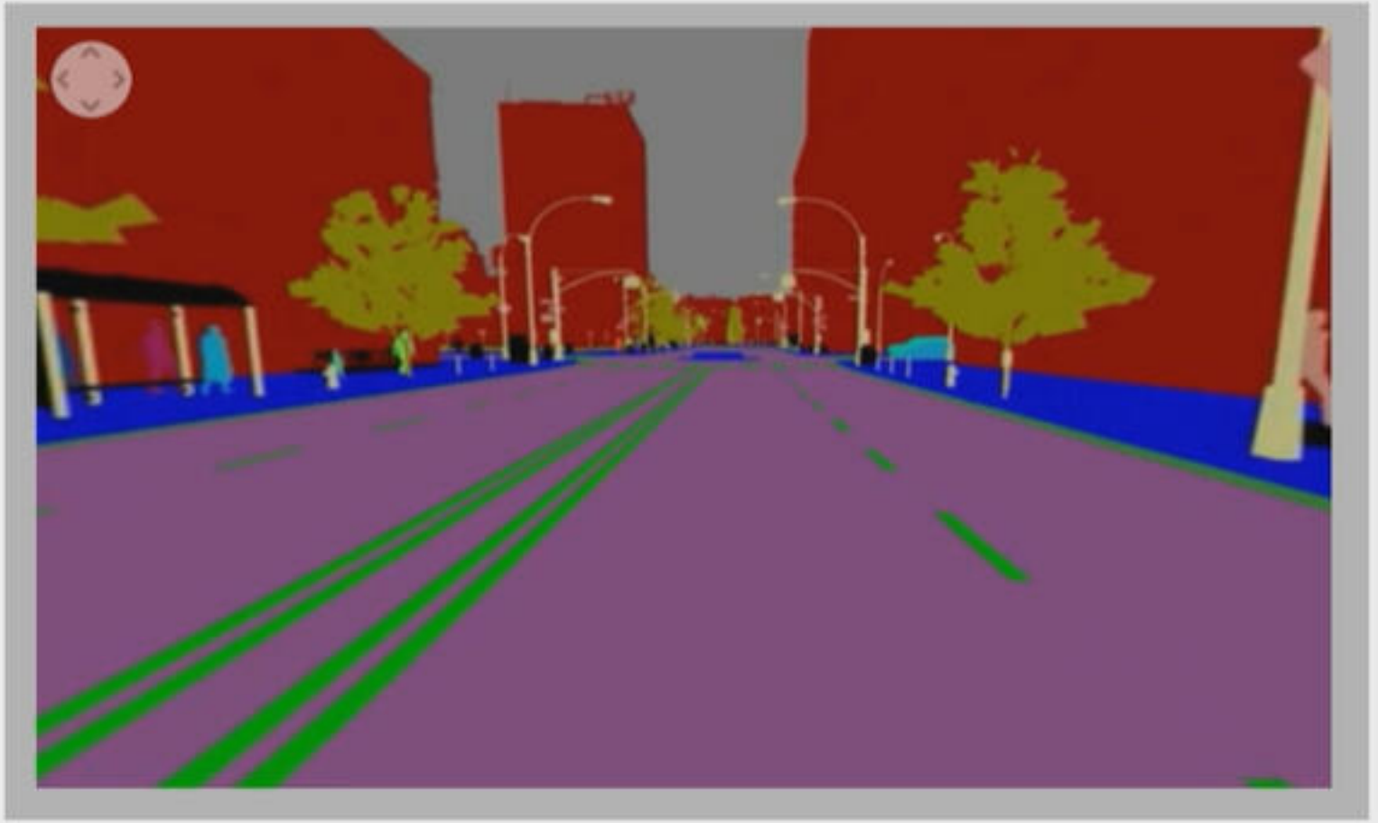
Semantic Segmentation



Synthia Dataset Semantic Segmentation Ground Truth

Localization Techniques

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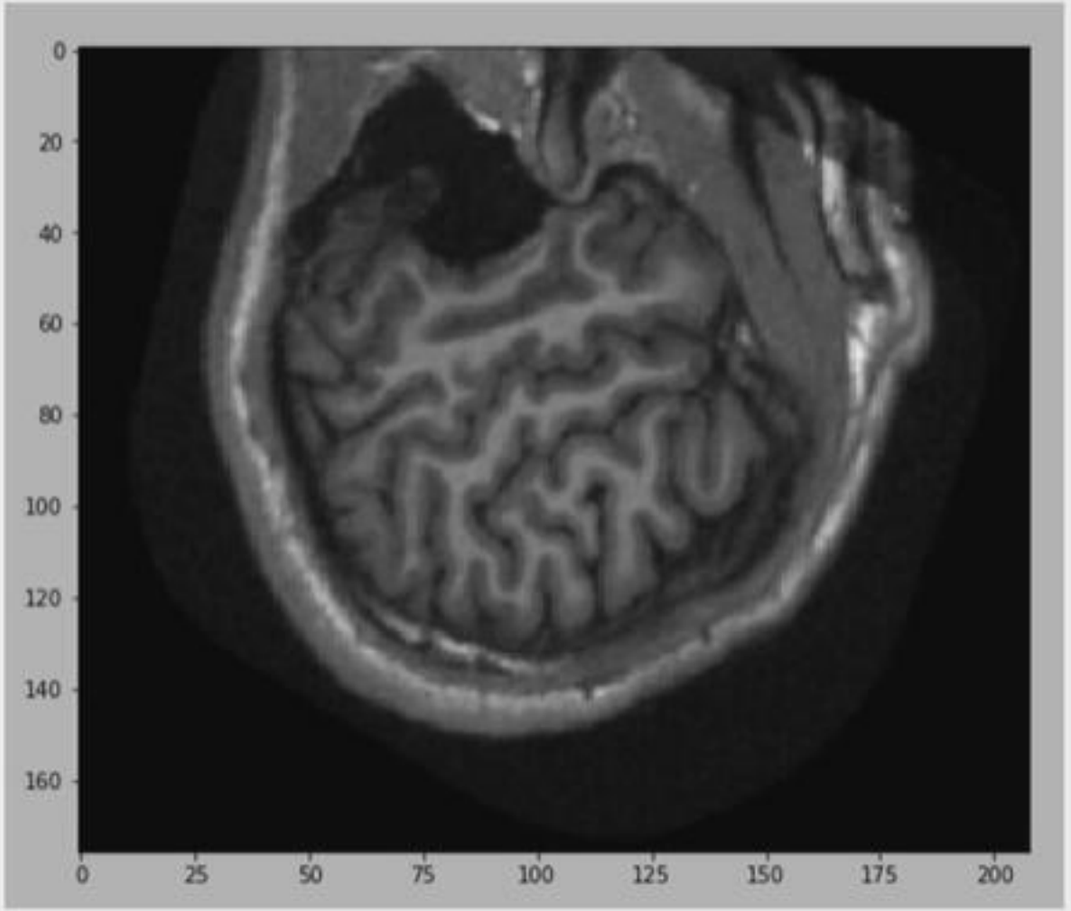

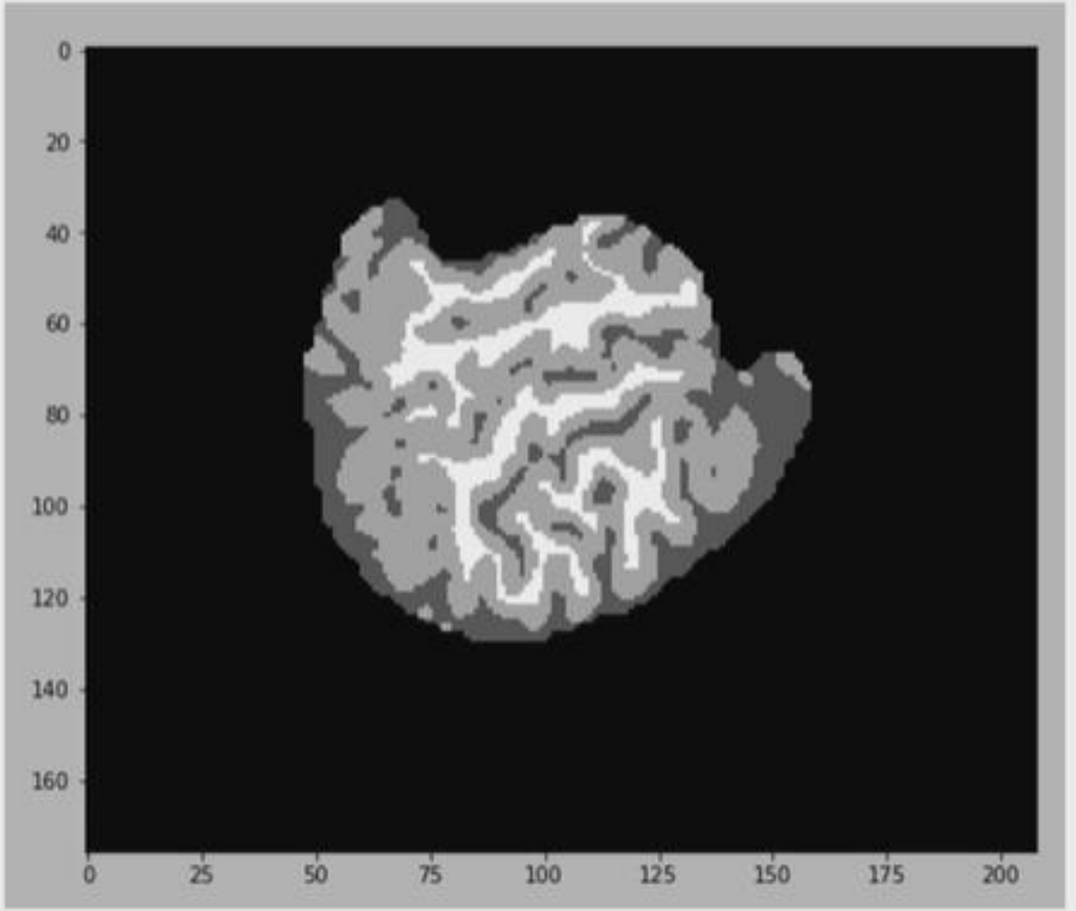

Image from Yolo object Detector Series

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Semantic Segmentation and Deep Learning

Semantic Segmentation

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Anatomy of a Deep Learning Task:

- Task
- Data
- Architecture
- Loss

Per-pixel Classification

Feature Selection and Learning for Semantic Segmentation
https://vision.in.tum.de/_media/spezial/bib/hazirbas2014msc.pdf

Convolutional Neural Networks

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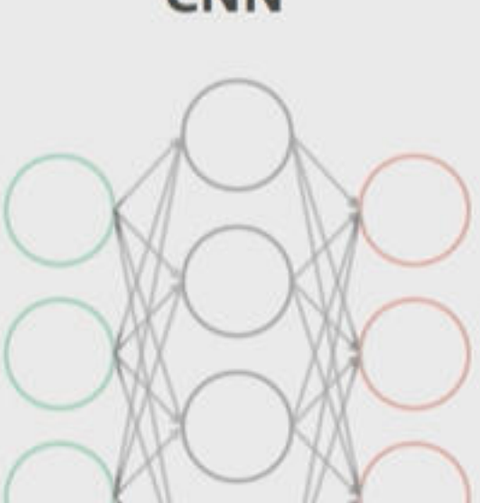
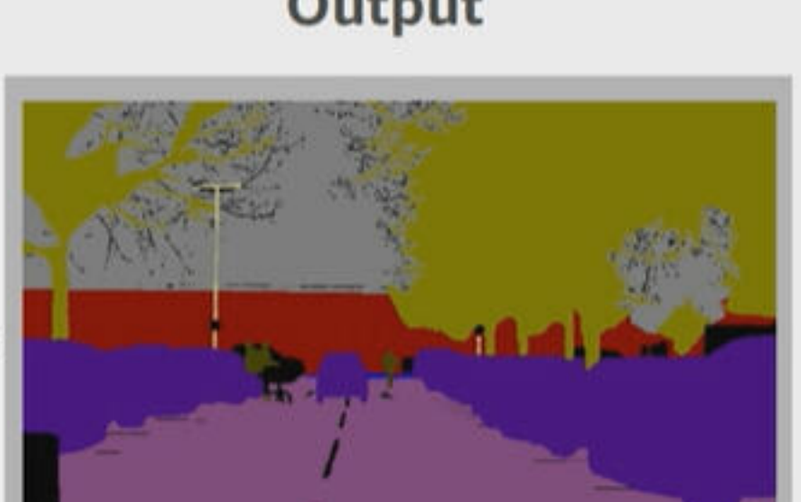
Input **CNN** **Output**

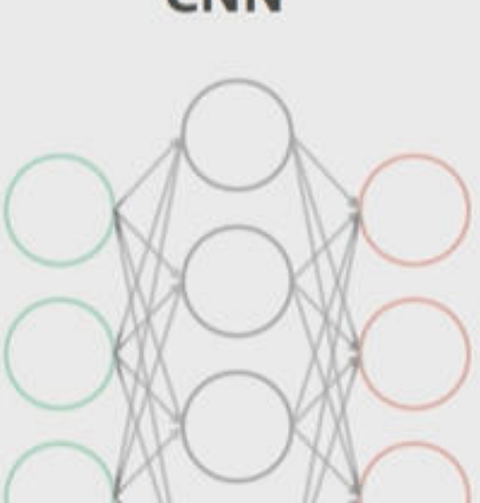


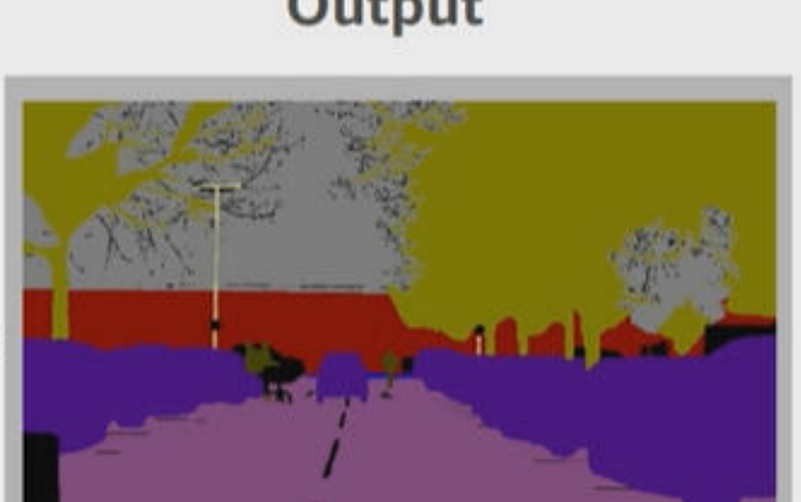


Convolutional Neural Networks

aws training and certification

Input **CNN** **Output**





Semantic vs. Instance Segmentation

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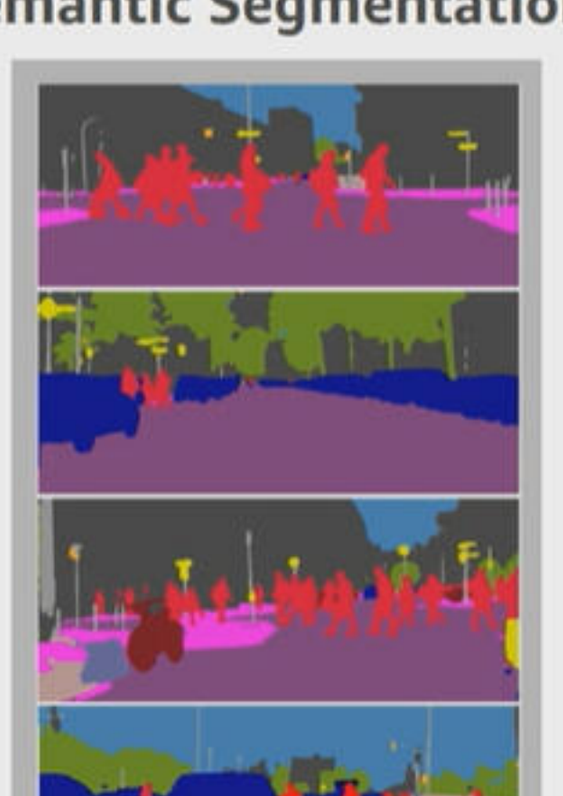
Image

Semantic Segmentation



Instance Segmentation

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Semantic Segmentation: Data

Data

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Input: Image

Data Contd.

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Input: Image array

- Shape: (H x W x C)
- C = 1 for greyscale, 3 for RGB
- Unsigned integer (0-255)

```
array([[[122,  97,  93],
        [121,  97,  93],
        [120,  99,  96],
        ...,
        [232, 233, 237],
        [226, 227, 231],
        [220, 224, 227]],

       [[120,  95,  91],
        [118,  94,  90],
        [117,  96,  93],
        ...,
        [232, 233, 237],
        [226, 227, 231],
        [220, 224, 227]],

       [[116,  91,  87],
        [114,  90,  86],
        [113,  89,  85],
        ...,
        [232, 233, 237],
        [226, 227, 231],
        [220, 224, 227]],

       ...,
```

Data Contd.

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Output?

For classification,
class labels are integers
or "one-hot encodings",
represented as vectors.

Label-integer mapping:
{Car:0, Street:1, Tree:2}

Label
1
0
0
2

One-hot →

Car	Street	Tree
0	1	0
1	0	0
1	0	0
0	0	1

```
array([[0, 1, 0],
       [1, 0, 0],
       [1, 0, 0],
       [0, 0, 1]])
```

Data Contd.

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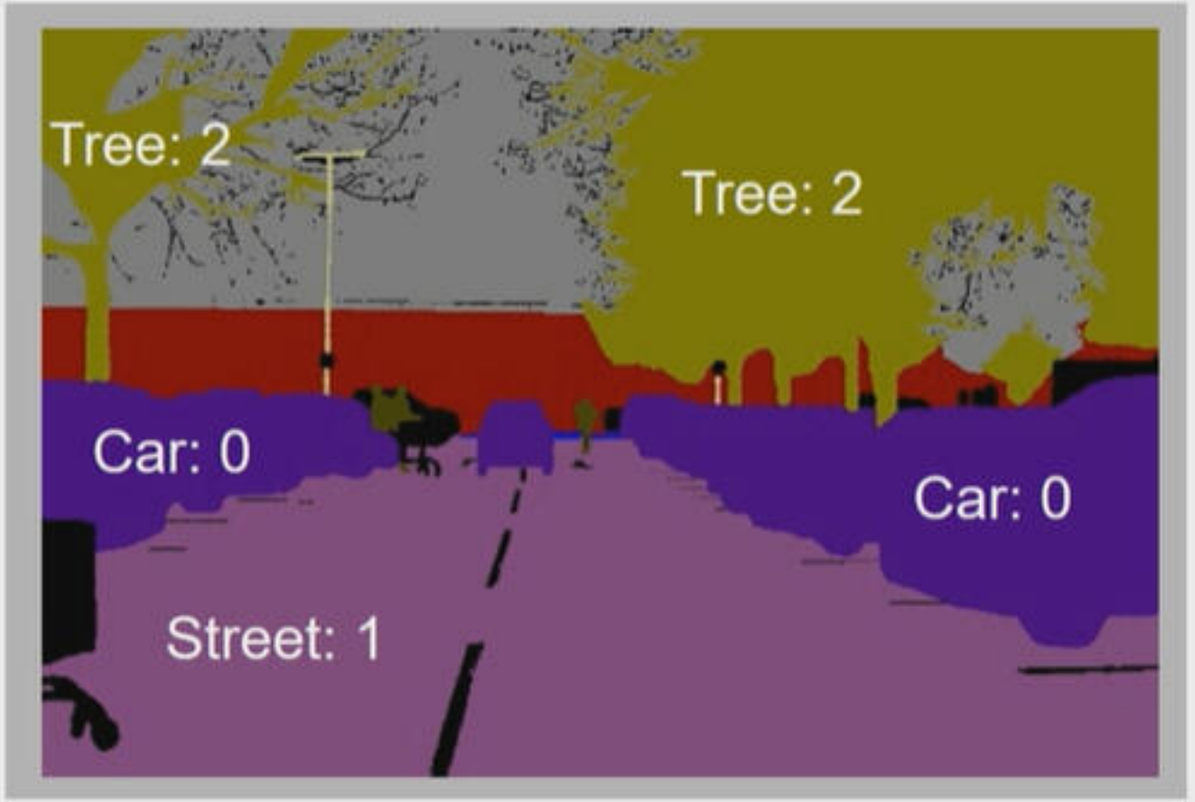
Output: Mask array

- Same spatial resolution (HxW)
- Integer values for pixel class
- Can also be one-hot encoded:
  - (HxWxN), N = # of classes

Note: Each color in this example is a unique class integer.



Data Contd.

aws training and certification

Output: Mask array

- Same spatial resolution (HxW)
- Integer values for pixel class
- Can also be one-hot encoded:
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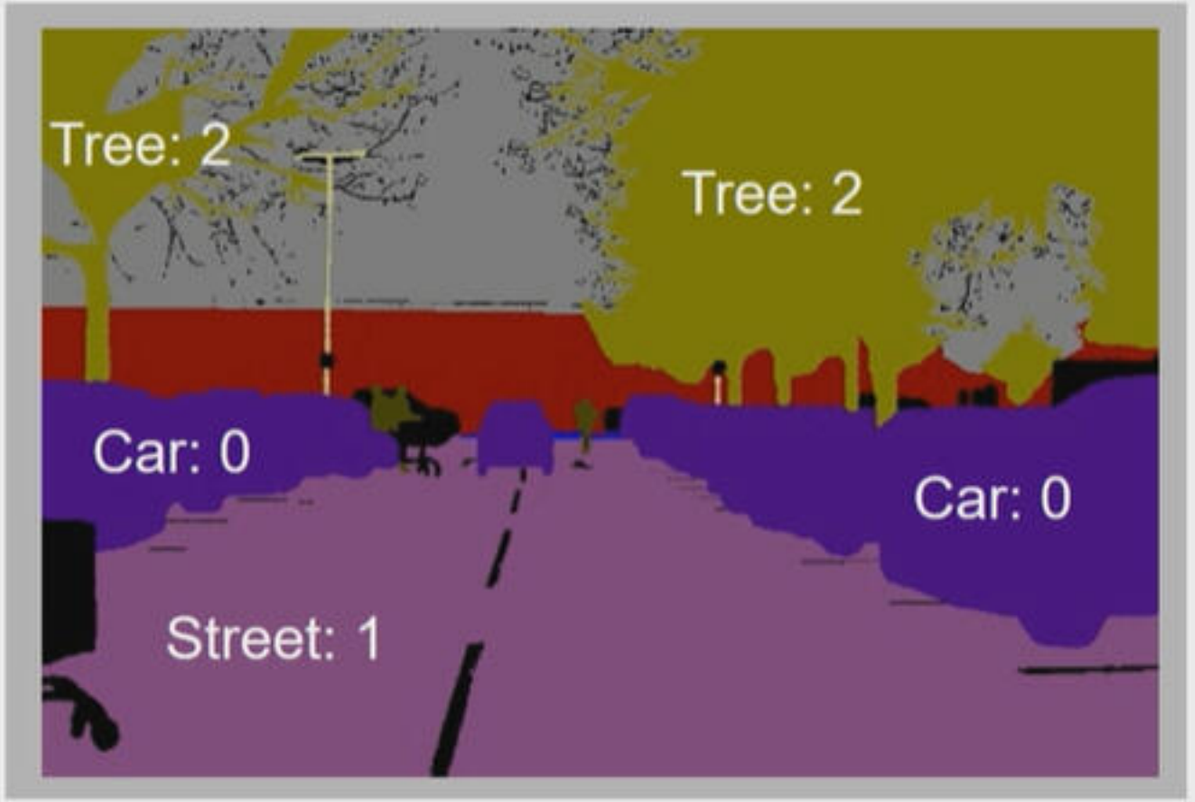
Note: Each color in this example is a unique class integer.



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Semantic Segmentation: Architecture

Semantic Segmentation: Architecture

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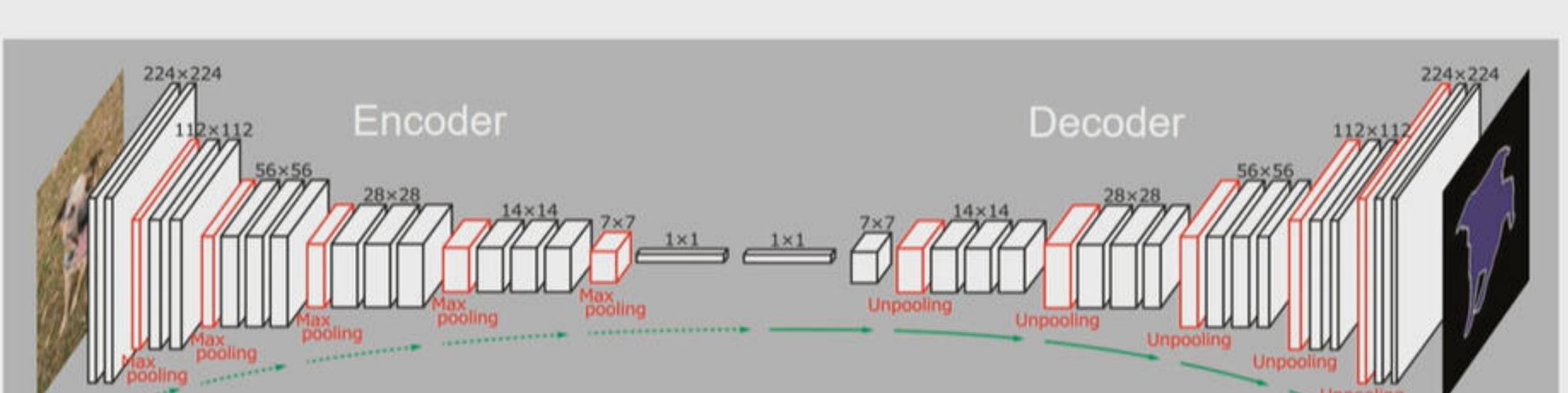

Image Segmentation
https://leonardoaraujosantos.gitbooks.io/artificial-inteligence /content/image_segmentation.html

U-Net

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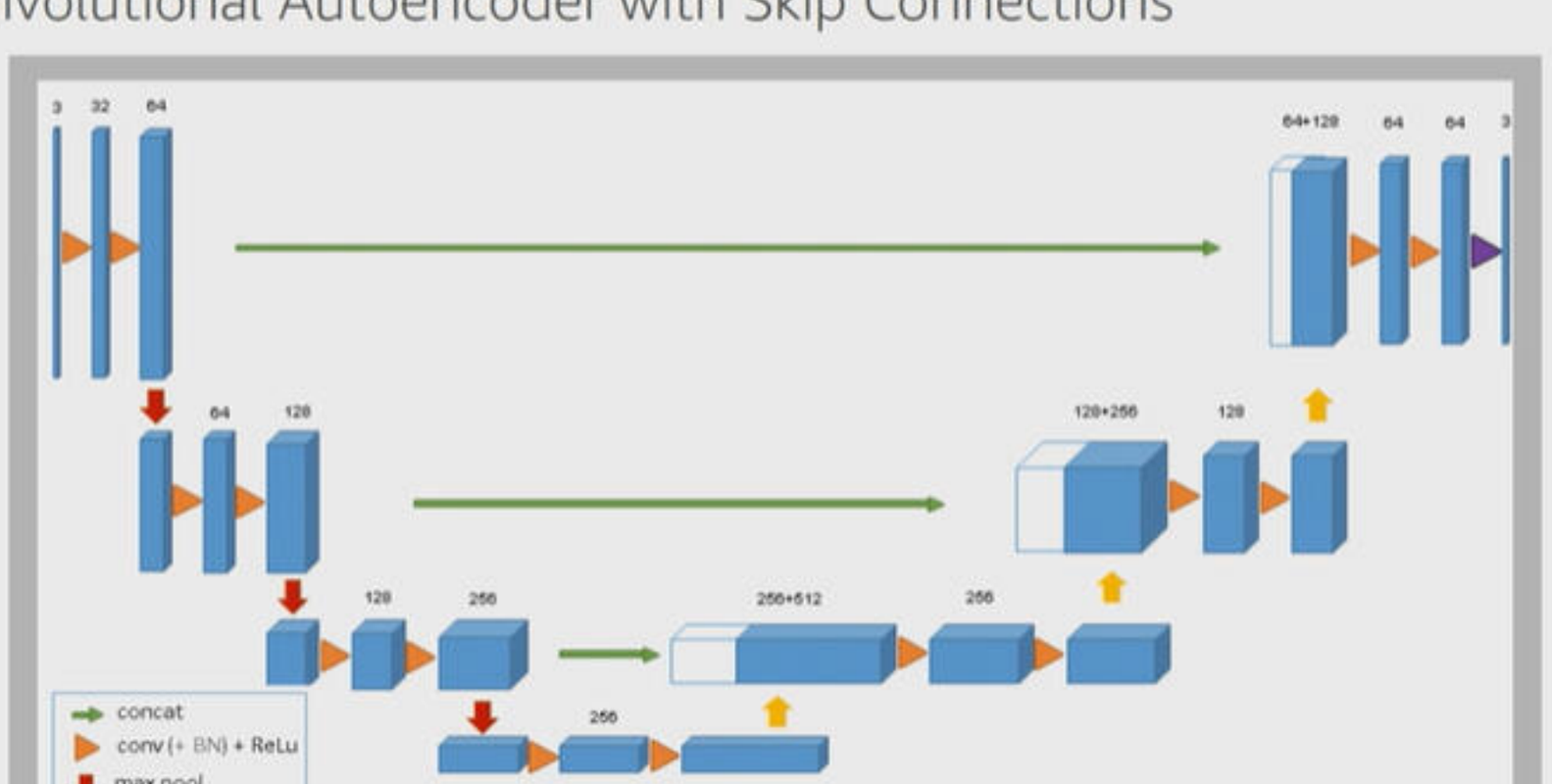
A Fully Convolutional Autoencoder with Skip Connections



Udactiy Students on Cutting-edge Autonomous Vehicle Tools https://medium.com/self-driving-cars/udacity-students-on-cutting-edge-autonomous-vehicle-tools-3c540eb7397f

Skip Connections

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Why Skip Connections?

- Easier training
  - "Vanishing gradient"
- Intuition
  - Coarse features fill in gaps

Loss

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Classification: Categorical Cross-entropy

Semantic Segmentation: Average Categorical Cross-entropy

$$CE = -\sum_{x} p(x) \log q(x)$$

Loss Contd.

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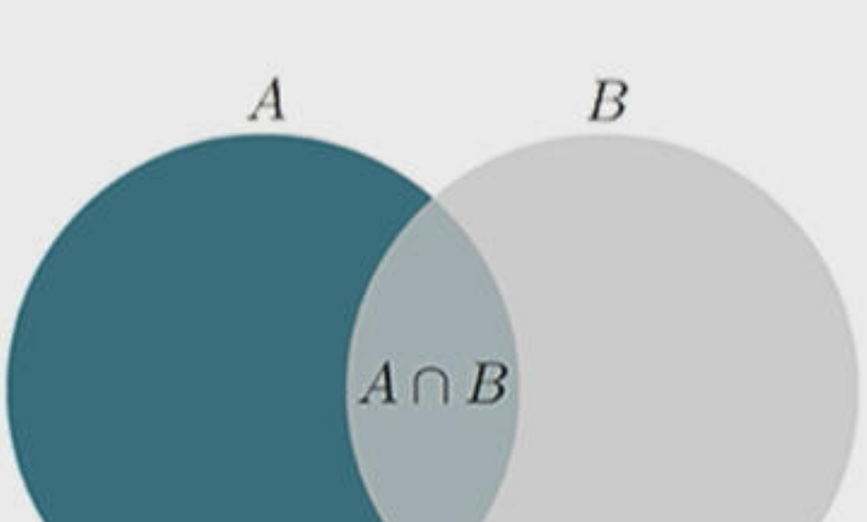
Negative dice-coefficient



Dice-Coefficient:

$$\frac{2 * |A \cap B|}{|A| + |B|}$$

- 0 if no overlap
- 1 if total overlap
- Maximize overlap by minimizing the negative
- Typically written as 1-Dice-coef
- Averaged over classes

Resizing Your Input

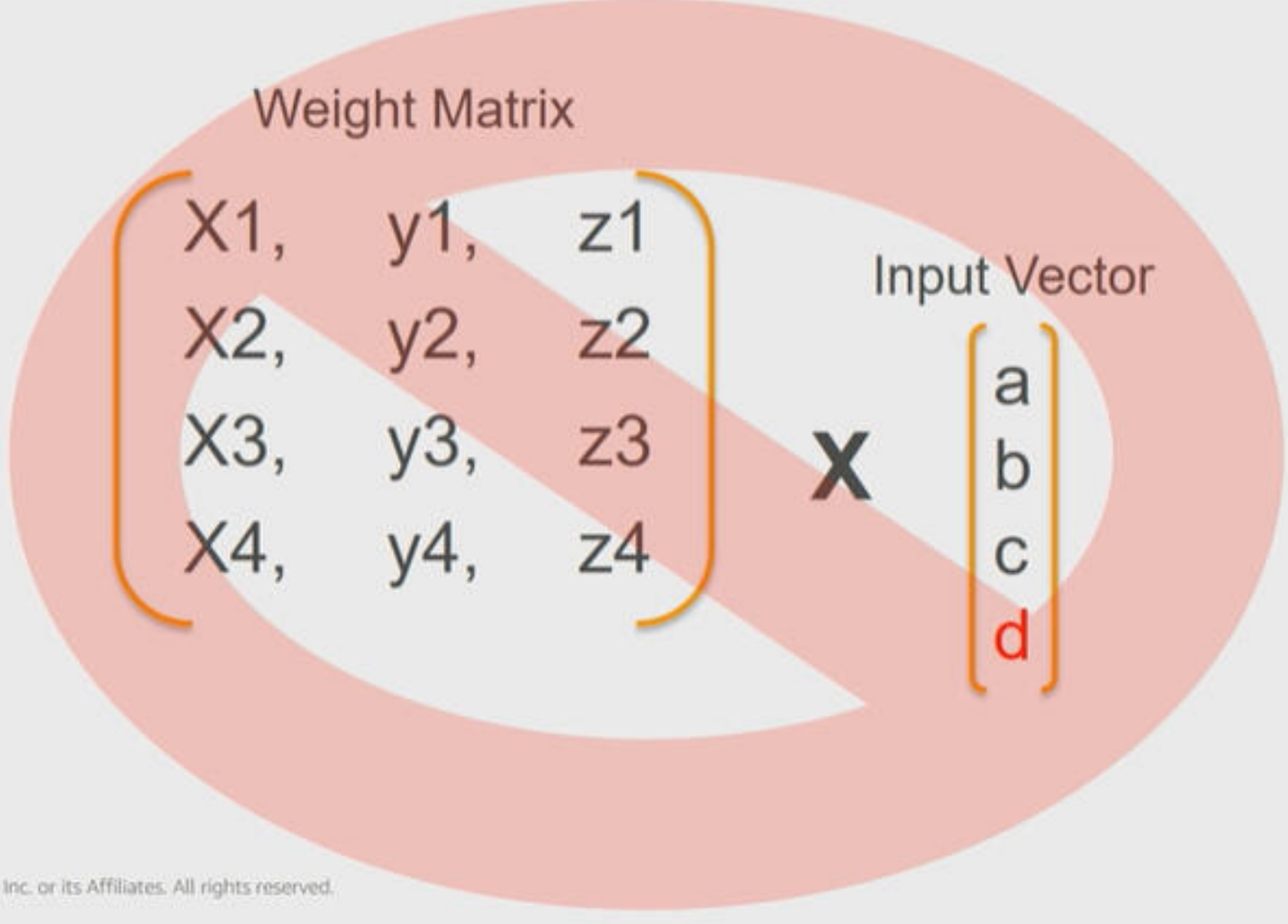
aws training and certification

Weight Matrix

$$\begin{pmatrix} X1, & y1, & z1 \\ X2, & y2, & z2 \\ X3, & y3, & z3 \\ X4, & y4, & z4 \end{pmatrix} \mathbf{X} \begin{pmatrix} a \\ b \\ c \end{pmatrix}$$

Input Vector

Resizing Your Input Contd.



Cropping

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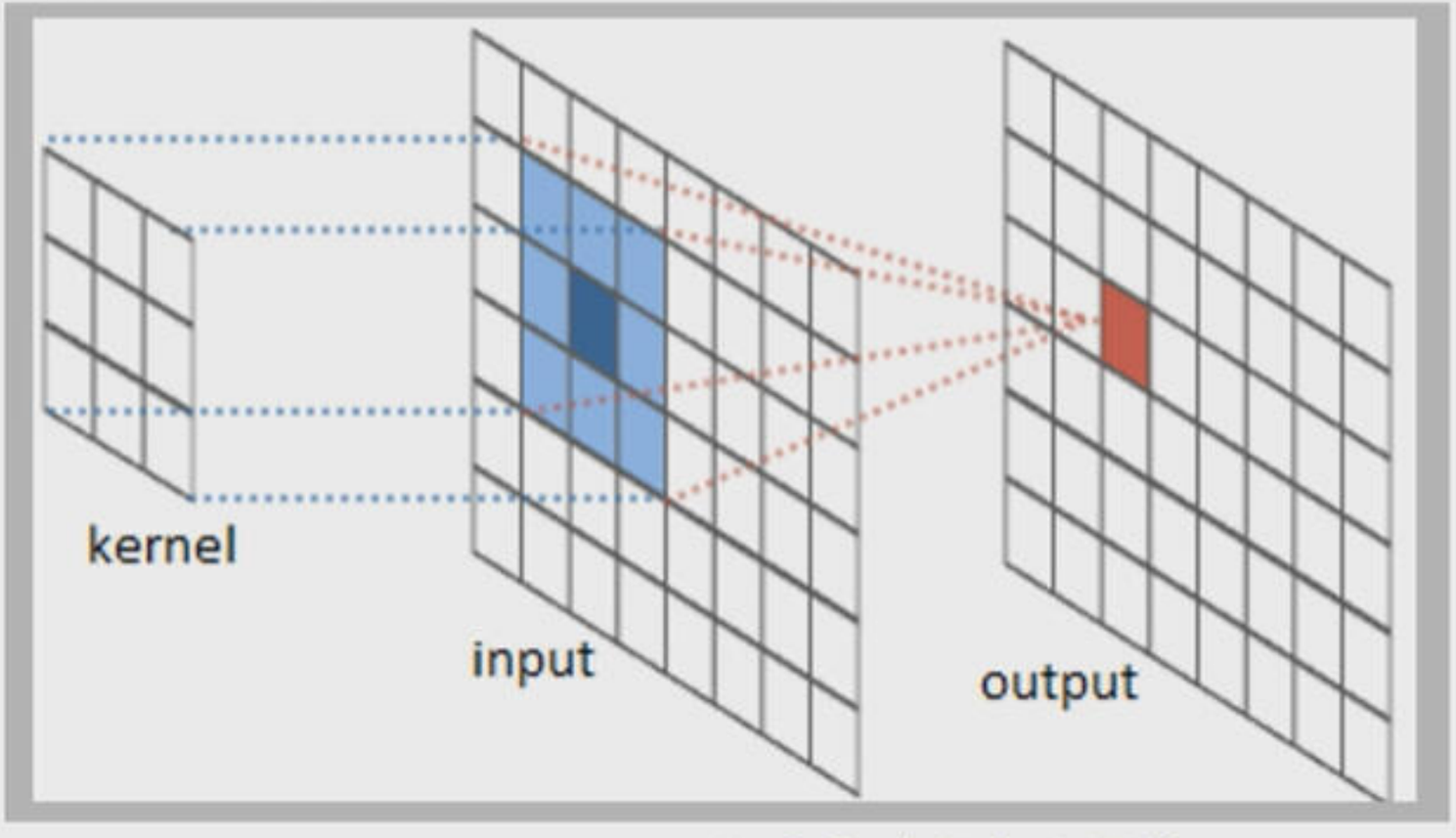
FCN's: Cropped input, same output



How Do Convolution Matrices Work?
https://stackoverflow.com/questions/15356153/how-do-convolution-matrices-work

Class Imbalance

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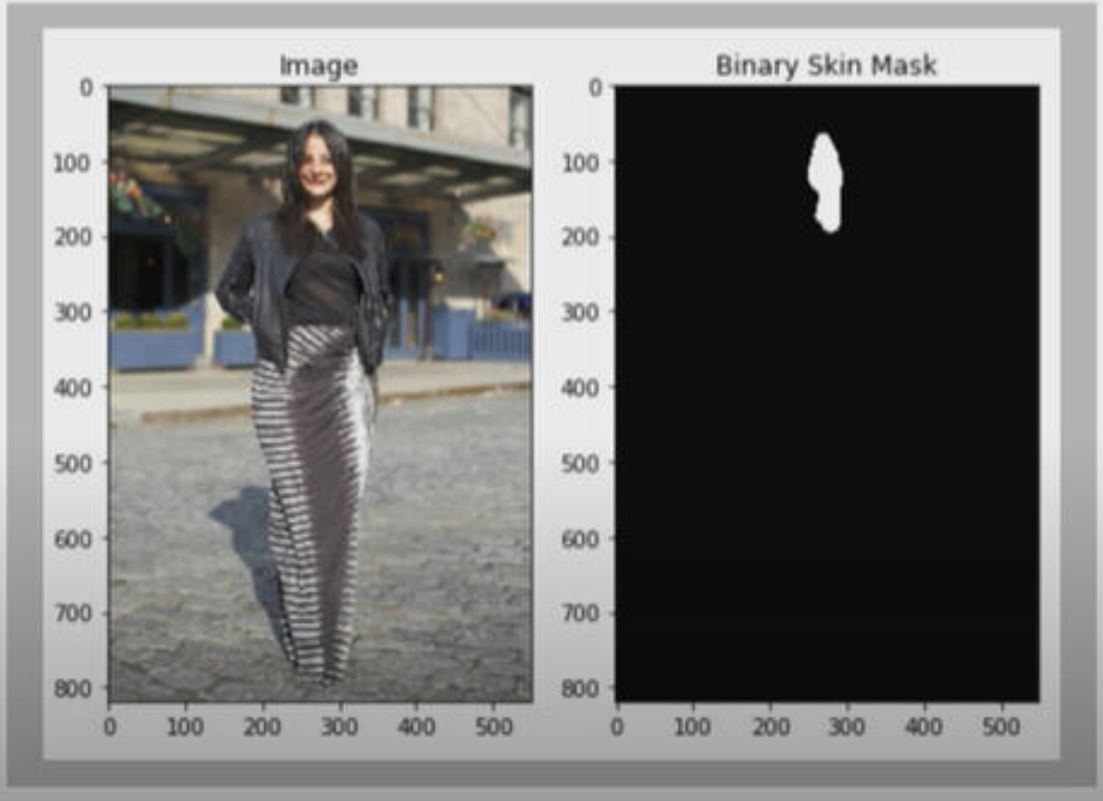
- Weighting loss function helps imbalance in general
- Segmentation also has spatial imbalance



Class Imbalance Contd.

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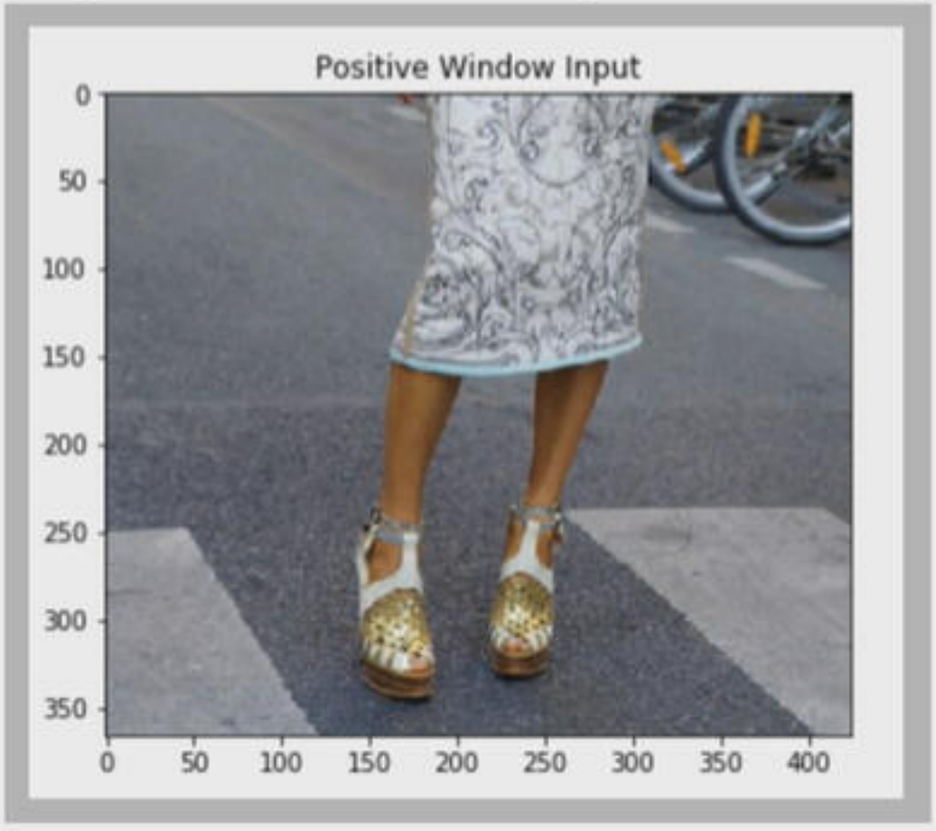
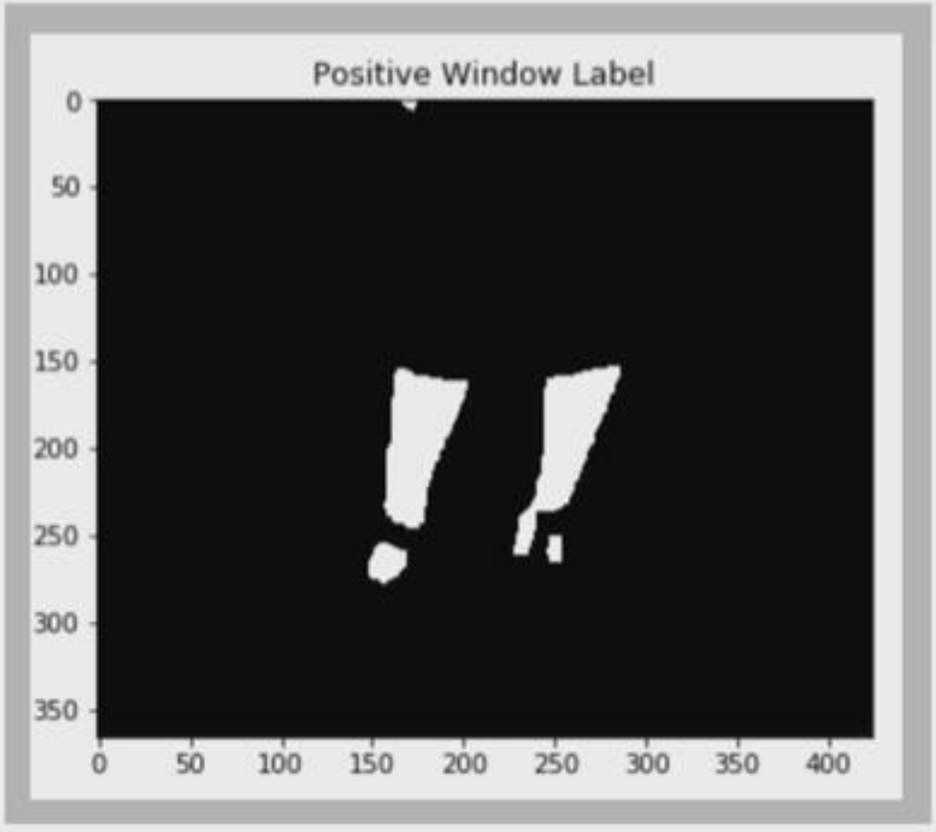
- Solution: Crop from positive windows.
- Every window has a full positive sample.





Next Steps: Hands on!!!

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github.com/aws-samples

Attributes returned by DetectFaces()

```
{
  "FaceDetails": [ {
    "AgeRange": {"High"..."Low"...},
    "Beard": {...},
    "BoundingBox": {"Height".."Left".."Top".."Width"..},
    "Eyeglasses": {...},
    "EyesOpen": {...},
    "Gender": {...},
    "MouthOpen": {...},
    "Mustache": {...},
    "Smile": {...},
    "Sunglasses": {...}
] }
```


aws

Attributes returned by DetectFaces()

```
{
  "FaceDetails": [ {
    "AgeRange": {"High"..."Low"...},
    "Beard": {...},
    "BoundingBox": {"Height".."Left".."Top".."Width"..},
    "Eyeglasses": {...},
    "EyesOpen": {...},
    "Gender": {...},
    "MouthOpen": {...},
    "Mustache": {...},
    "Smile": {...},
    "Sunglasses": {...}
] }
```

Loop: Capture an image & draw rectangles

```
while(True):

  # Capture frame
  frame = capture.read()...

  # Resize image for faster rekognition
  image = capture.resize(frame, 0.15, ...)

# Detect faces in image
faces = rekognition.detect_faces(Image={'Bytes':image}, ...)

# Draw rectangle around faces
for face in faces['FaceDetails']:
  is_smiling = face['Smile']['Value']
  draw_rectangle(image, face['BoundingBox'], is_smiling)
```


aws

Loop: Capture an image & draw rectangles

```
while(True):

  # Capture frame
  frame = capture.read()...

  # Resize image for faster rekognition
  image = capture.resize(frame, 0.15, ...)

  # Detect faces in image
  faces = rekognition.detect_faces(Image={'Bytes':image}, ...)

  # Draw rectangle around faces
  for face in faces['FaceDetails']:
    is_smiling = face['Smile']['Value']
    draw_rectangle(image, face['BoundingBox'], is_smiling)
```

aws

Loop: Capture an image & draw rectangles

```
while(True):

  # Capture frame
  frame = capture.read()...

  # Resize image for faster rekognition
  image = capture.resize(frame, 0.15, ...)

# Detect faces in image
faces = rekognition.detect_faces(Image={'Bytes':image}, ...)

# Draw rectangle around faces
for face in faces['FaceDetails']:
  is_smiling = face['Smile']['Value']
  draw_rectangle(image, face['BoundingBox'], is_smiling)
```


aws

Attributes returned by DetectFaces()


```
{
  "FaceDetails": [ {
    "AgeRange": {"High"..."Low"...},
    "Beard": {...},
    "BoundingBox": {"Height".."Left".."Top".."Width"..},
    "Eyeglasses": {...},
    "EyesOpen": {...},
    "Gender": {...},
    "MouthOpen": {...},
    "Mustache": {...},
    "Smile": {...},
    "Sunglasses": {...}
] }
```


aws

Loop: Find face in collection

```
while(True):

# Detect faces in image
   faces = rekognition.search_faces_by_image(
               CollectionId='...', Image={'Bytes':image}, ...)

   # Show name and confidence
   for matches in faces['FaceMatches']:

      if 'ExternalImageId' in matches['Face'].keys():
         name = matches['Face']['ExternalImageId']
         confidence = matches['Face']['Confidence']

         cv2.putText(...)
```


aws

Loop: Find face in collection

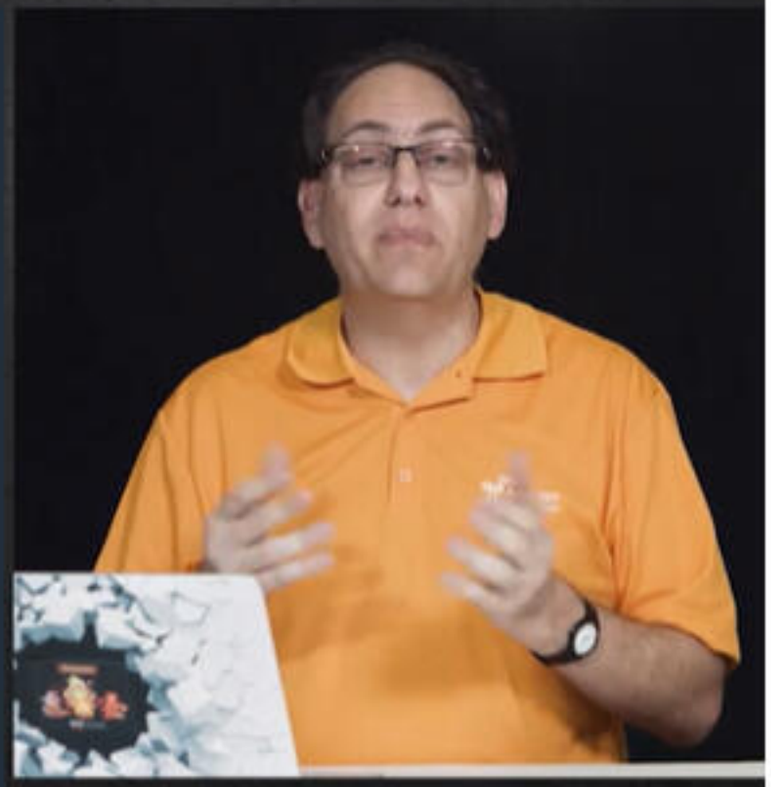
```
while(True):

# Detect faces in image
   faces = rekognition.search_faces_by_image(
               CollectionId='...', Image={'Bytes':image}, ...)

   # Show name and confidence
   for matches in faces['FaceMatches']:

      if 'ExternalImageId' in matches['Face'].keys():
         name = matches['Face']['ExternalImageId']
         confidence = matches['Face']['Confidence']

         cv2.putText(...)
```



aws

Loop: Find face in collection

```
while(True):

# Detect faces in image
   faces = rekognition.search_faces_by_image(
               CollectionId='...', Image={'Bytes':image}, ...)

   # Show name and confidence
   for matches in faces['FaceMatches']:

      if 'ExternalImageId' in matches['Face'].keys():
         name = matches['Face']['ExternalImageId']
         confidence = matches['Face']['Confidence']

         cv2.putText(...)
```

aws

Attributes returned by search_faces_by_image()

```
{'SearchedFaceBoundingBox': {...},
 'SearchedFaceConfidence': 99.9997787475586,
 'FaceMatches': [
   {'Face': {'BoundingBox': {...},
             'ExternalImageId': 'John',
             'Confidence': 99.99739837646484
            }
         }
    ]
}
```


aws

Attributes returned by detect_text()

```
{u'TextDetections': [
        {'Geometry': {'BoundingBox': ...},
         'Confidence': 99.93452453613281,
         'DetectedText': 'THANKS',
         'Type': 'LINE'
        },
        ...
```

Also: `'Type': 'WORD'`

aws

Functions for still images

CompareFaces	Match face between images
DetectFaces	Find up to 100 faces in an image
DetectLabels	Find real-world entities in an image
DetectModerationLabels	Detect adult content
DetectText	Find machine-readable text
IndexFaces	Add 100 faces in an image to a collection
RegognizeCelebrities	Identify up to 100 celebrities in an image
SearchFaces	Find a face ID in a face collection
SearchFacesByImage	Find largest face in a face collection

aws

Part 2: Hands-On Rekognition Video

Let's get Hands-On!

Using Amazon Rekognition on Video Files

Find a person, make a video of just them

aws

Create a Collection & Load Faces

```
$ aws rekognition create-collection
--collection-id trainers

$ aws rekognition index-faces
--collection-id trainers
--image "S3Object={Bucket=hands-on-rekognition,Name=John.jpg}"
--external-image-id John
```

aws

Create a Collection & Load Faces

```
$ aws rekognition create-collection
--collection-id trainers

$ aws rekognition index-faces
--collection-id trainers
--image "S3Object={Bucket=hands-on-rekognition,Name=John.jpg}"
--external-image-id John
```

aws

Search for faces

```
$ aws rekognition start-face-search
--video "S3Object={Bucket=...,Name=trainers.mp4}"
--collection-id trainers
```

```
$ aws rekognition get-face-search --job-id...
```


aws

Search for faces

```
$ aws rekognition start-face-search
--video "S3Object={Bucket=...,Name=trainers.mp4}"
--collection-id trainers
```

```
$ aws rekognition get-face-search --job-id...
```


aws

Create a Collection & Load Faces

```
$ aws rekognition create-collection
--collection-id trainers

$ aws rekognition index-faces
--collection-id trainers
--image "S3Object={Bucket=hands-on-rekognition,Name=John.jpg}"
--external-image-id John
```

aws

jorote — ec2-user@ip-10-0-0-213:~ — ssh • -bash — 83×24

~ — ec2-user@ip-10-0-0-213:~ — ssh • -bash

```
[ec2-user@ip-10-0-0-213 ~]$ aws rekognition create-collection --collection-id Train
ers
{
    "CollectionArn": "aws:rekognition:us-west-2:416159072693:collection/Trainers",
    "FaceModelVersion": "3.0",
    "StatusCode": 200
}
[ec2-user@ip-10-0-0-213 ~]$
```

jorote — ec2-user@ip-10-0-0-213:~ — ssh • -bash — 83×24

~ — ec2-user@ip-10-0-0-213:~ — ssh • -bash

```
[ec2-user@ip-10-0-0-213 ~]$ aws rekognition index-faces \
> --collection-id Trainers \
> --image "S3Object={Bucket=us-west-2-aws-training,Name=awsu-spl/spl-202/faces/John
.jpg}" \
> --external-image-id Johnaws rekognition index-faces \
> --collection-id Trainers \
> --image "S3Object={Bucket=us-west-2-aws-training,Name=awsu-spl/spl-202/faces/John
.jpg}" \
> --external-image-id John
```

jorote — ec2-user@ip-10-0-0-213:~ — ssh • -bash — 83×24

~ — ec2-user@ip-10-0-0-213:~ — ssh • -bash


```
            },
            "Quality": {
                "Sharpness": 99.9305191040039,
                "Brightness": 39.646568298339844
            },
            "Confidence": 99.9974365234375
        },
        "Face": {
            "BoundingBox": {
                "Width": 0.2666666805744171,
                "Top": 0.1465798020362854,
                "Left": 0.5464788675308228,
                "Height": 0.46254071593284607
            },
            "FaceId": "487682b1-6c49-4697-b6d6-19487af206be",
            "ExternalImageId": "John",
            "Confidence": 99.9974365234375,
            "ImageId": "cc027b0d-5863-58b3-8e0a-7400fdf6f32c"
        }
    }
    ],
    "FaceModelVersion": "3.0"
}
```

jorote — ec2-user@ip-10-0-0-213:~ — ssh • -bash — 83×24

~ — ec2-user@ip-10-0-0-213:~ — ssh • -bash

```
> --external-image-id John
{
    "FaceRecords": [
        {
            "FaceDetail": {
                "BoundingBox": {
                    "Width": 0.2666666805744171,
                    "Top": 0.1465798020362854,
                    "Left": 0.5464788675308228,
                    "Height": 0.46254071593284607
                },
                "Landmarks": [
                    {
                        "Y": 0.3537498116493225,
                        "X": 0.6374950408935547,
                        "Type": "eyeLeft"
                    },
                    {
                        "Y": 0.3529587686061859,
                        "X": 0.720091700553894,
                        "Type": "eyeRight"
                    },
                    {
```

jorote — ec2-user@ip-10-0-0-213:~ — ssh • -bash — 83×24

~ — ec2-user@ip-10-0-0-213:~ — ssh • -bash


```
                "X": 0.7185091376304626,
                "Type": "mouthRight"
            }
        ],
        "Pose": {
            "Yaw": 0.4098865389823913 6,
            "Roll": -0.7546926140785217,
            "Pitch": -1.0719298124313354
        },
        "Quality": {
            "Sharpness": 99.9305191040039,
            "Brightness": 39.646568298339844
        },
        "Confidence": 99.9974365234375
    },
    "Face": {
        "BoundingBox": {
            "Width": 0.2666666805744171,
            "Top": 0.1465798020362854,
            "Left": 0.5464788675308228,
            "Height": 0.46254071593284607
        },
        "FaceId": "487682b1-6c49-4697-b6d6-19487af206be",
```

Search for faces

```
$ aws rekognition start-face-search
--video "S3Object={Bucket=...,Name=trainers.mp4}"
--collection-id trainers
```

```
$ aws rekognition get-face-search --job-id...
```


aws

jorote — ec2-user@ip-10-0-0-213:~ — ssh • -bash — 83×24

~ — ec2-user@ip-10-0-0-213:~ — ssh • -bash

```
[ec2-user@ip-10-0-0-213 ~]$ JOB=`aws rekognition start-face-search \
> --video "S3Object={Bucket=aws-tc-largeobjects,Name=SPLs/202/technical-trainers.mp
4}" \
> --collection-id Trainers \
> --query JobId \
> --output text`
[ec2-user@ip-10-0-0-213 ~]$
[ec2-user@ip-10-0-0-213 ~]$ echo $JOB
f1ef0d93e690fdc15ce4a3eb2b6276d9ed4a30b8ad672d06f9c136d893b526dd
[ec2-user@ip-10-0-0-213 ~]$
```

jorote — ec2-user@ip-10-0-0-179:~ — ssh • -bash — 83×24

~ — ec2-user@ip-10-0-0-179:~ — ssh • -bash

```
[ec2-user@ip-10-0-0-179 ~]$ aws rekognition get-face-search --job-id $JOB
```

```
                "Type": "mouthRight"
            }
        ],
        "Pose": {
            "Yaw": -13.82411003112793,
            "Roll": -12.427720069885254,
            "Pitch": 5.478622913360596
        },
        "Quality": {
            "Sharpness": 99.68138885498047,
            "Brightness": 43.79252243041992
                },
                "Confidence": 99.99217987060547
            }
        }
    },
    {
        "Timestamp": 38440,
        "Person": {
            "BoundingBox": {
                "Width": 0.5765625238418579,
                "Top": 0.06388889253139496,
                "Left": 0.3765625059604645,
```

jorote — ec2-user@ip-10-0-0-179:~ — ssh • -bash — 83×24

~ — ec2-user@ip-10-0-0-179:~ — ssh • -bash


```
            "Person": {
                "BoundingBox": {
                    "Width": 0.61328125,
                    "Top": 0.10277777910232544,
                    "Left": 0.14140625298023224,
                    "Height": 0.894444465637207
                },
                "Index": 6
            }
        }
    ],
    "NextToken": "+2DWHimFsAma4Xnu0PaYorzO2jgUUCz+O40yThh3AF/8+cCTN1yWtZtPaDUq3wC2q
jQ9GHpOnN7f",
    "JobStatus": "SUCCEEDED",
    "VideoMetadata": {
        "Format": "QuickTime / MOV",
        "FrameRate": 25.0,
        "Codec": "h264",
        "DurationMillis": 197080,
        "FrameHeight": 720,
        "FrameWidth": 1280
    }
}
```

```
                "Height": 0.8958333134651184
            },
            "Index": 6
        }
    },
    {
        "Timestamp": 56560,
        "FaceMatches": [
            {
                "Face": {
                    "BoundingBox": {
                        "Width": 0.311111031604767,
                        "Top": 0.11671099811792374,
                        "Left": 0.134443998336792,
                        "Height": 0.4299870133399634
                    },
                    "FaceId": "f6def7fd-3ab1-4e81-a0ae-6b5eb49a7228",
                    "ExternalImageId": "Edward",
                    "Confidence": 100.0,
                    "ImageId": "f867286b-c780-5aa9-b44c-aff7ff5170d4"
                },
                "Similarity": 99.4621810913086
            }
```

```
                "Height": 0.8958333134651184
            },
            "Index": 6
        }
    },
    {
        "Timestamp": 56560,
        "FaceMatches": [
            {
                "Face": {
                    "BoundingBox": {
                        "Width": 0.311111031604767,
                        "Top": 0.11671099811792374,
                        "Left": 0.134443998336792,
                        "Height": 0.4299870133399634
                    },
                    "FaceId": "f6def7fd-3ab1-4e81-a0ae-6b5eb49a7228",
                    "ExternalImageId": "Edward",
                    "Confidence": 100.0,
                    "ImageId": "f867286b-c780-5aa9-b44c-aff7ff5170d4"
                },
                "Similarity": 99.4621810913086
            }
```

FaceSearch() returns Timestamps and Faces


```
{ "Persons": [
   {
     "Timestamp": 7360,
     "FaceMatches": [
       {
         "Face": {
           "ExternalImageId": "John",
           "Confidence": 99.99750518798828 ...}
       }
   ],
},
{
   "Timestamp": 7560,
   ...
```


aws

Clip Stitching with Amazon Elastic Transcoder

```
Timestamps:
[99800, 99840, 100000, 100040, ...]

Convert into individual scene start/end times:
[(99800, 101480), (127520, 131760), ...]

Convert into clips for Amazon Elastic Transcoder:
[
  {'Key': 'trainers.mp4',
   'TimeSpan': {'StartTime': '99.8', 'Duration': '1.68'}},
  {'Key': 'trainers.mp4',
   'TimeSpan': {StartTime': '127.52', 'Duration': '4.24'}},
  ...
]
```


aws

Result:

AWS Machine Learning Blog

Automated video editing with YOU as the star!

by John Rotenstein | on 10 APR 2018 | in Amazon Rekognition Video | Permalink | Comments | Share

Have you ever wanted to find a specific person among hours of video footage?

Perhaps you're preparing a video for a 21st birthday celebration, wanting to find happy memories of your birthday child. Maybe you are scouring video footage, looking to see what a specific employee did on their last day at work. Or it may be that you want to produce a highlight reel of your own efforts at the Nathan's Hot Dog Eating Contest.

In this blog post, you will learn how to combine the capabilities of Amazon Rekognition Video and Amazon Elastic Transcoder to automatically convert a long video into a highlight video showing all footage of a given person.

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Result:

AWS Machine Learning Blog

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In this blog post, you will learn how to combine the capabilities of Amazon Rekognition Video and Amazon Elastic Transcoder to automatically convert a long video into a highlight video showing all footage of a given person.

Functions for stored videos

`StartCelebrityRecognition`	Recognize celebrities in a stored video
`StartContentModeration`	Detect adult content in a stored video
`StartFaceDetection`	Detect faces in a stored video
`StartFaceSearch`	Search for faces in a collection that match faces of persons detected in a stored video
`StartLabelDetection`	Detect real-world entities in a video
`StartPersonTracking`	Track persons in a stored video

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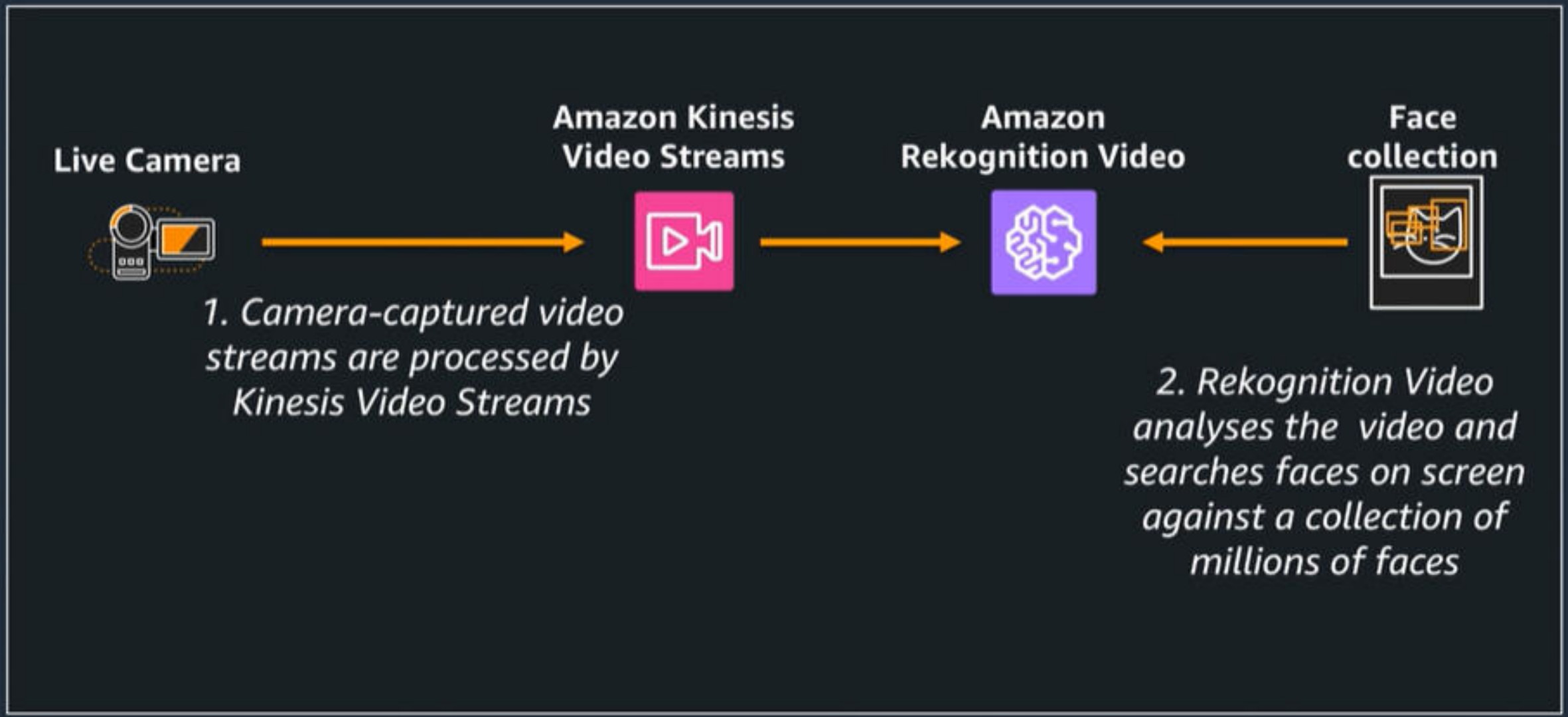
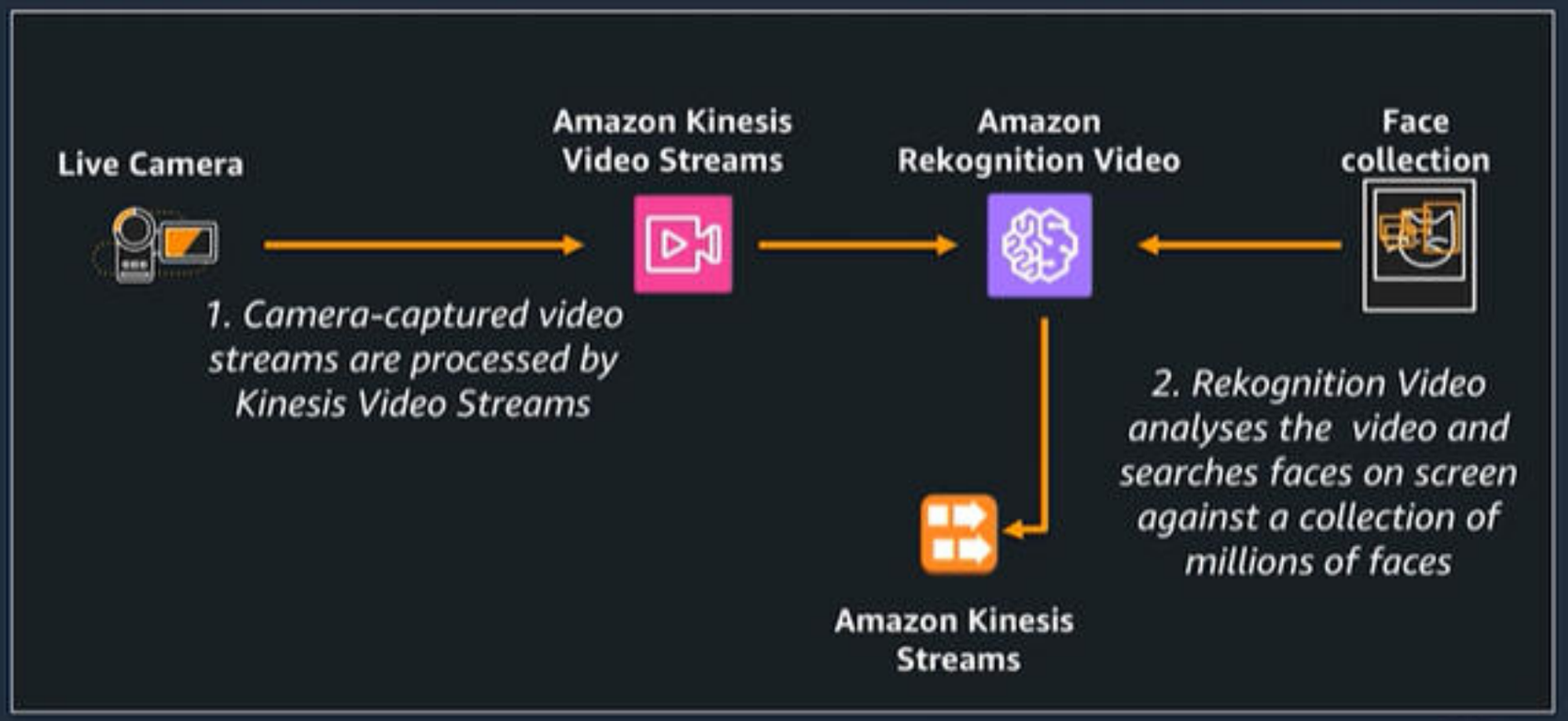
Part 3: Rekognition Streaming Video

Face Detection on streaming video

Architecture diagram



Architecture diagram



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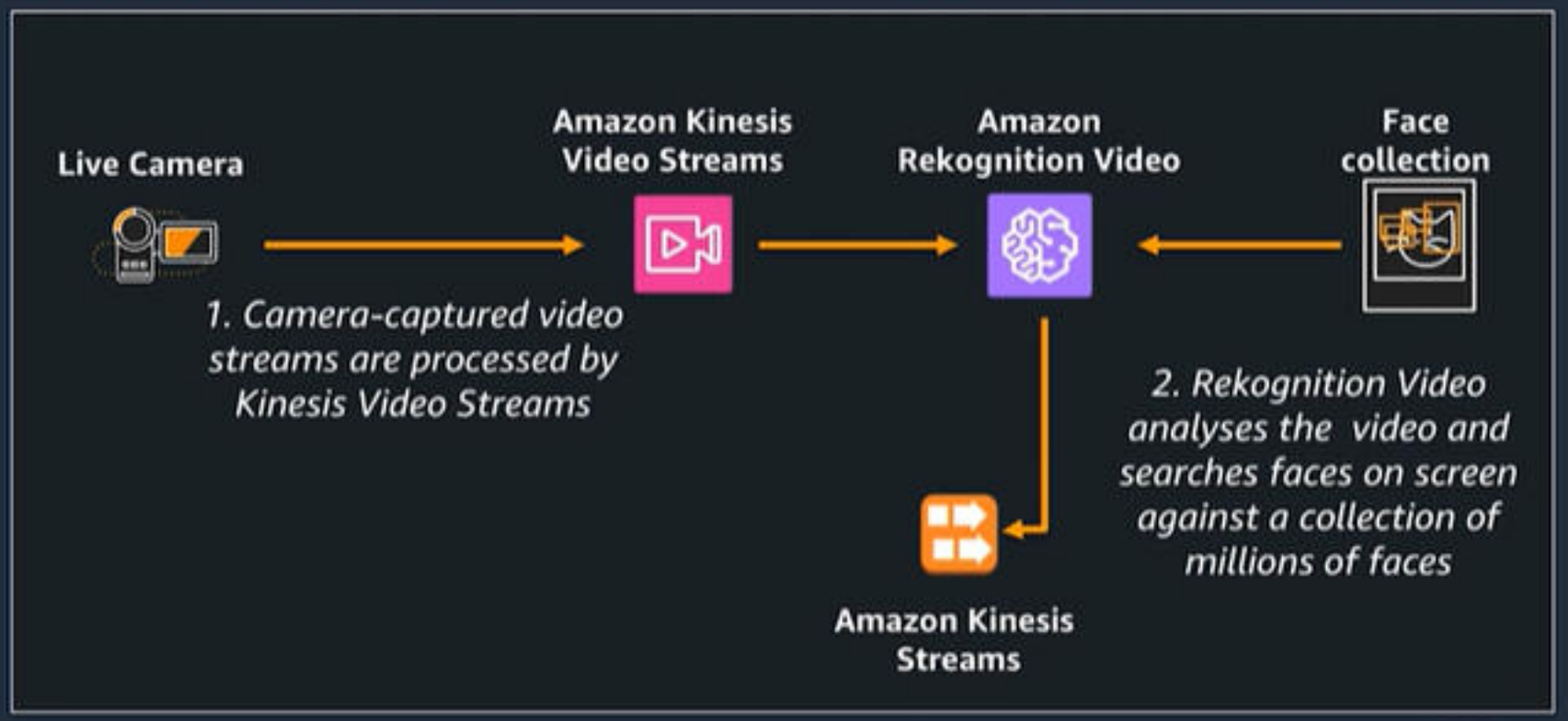
Architecture diagram



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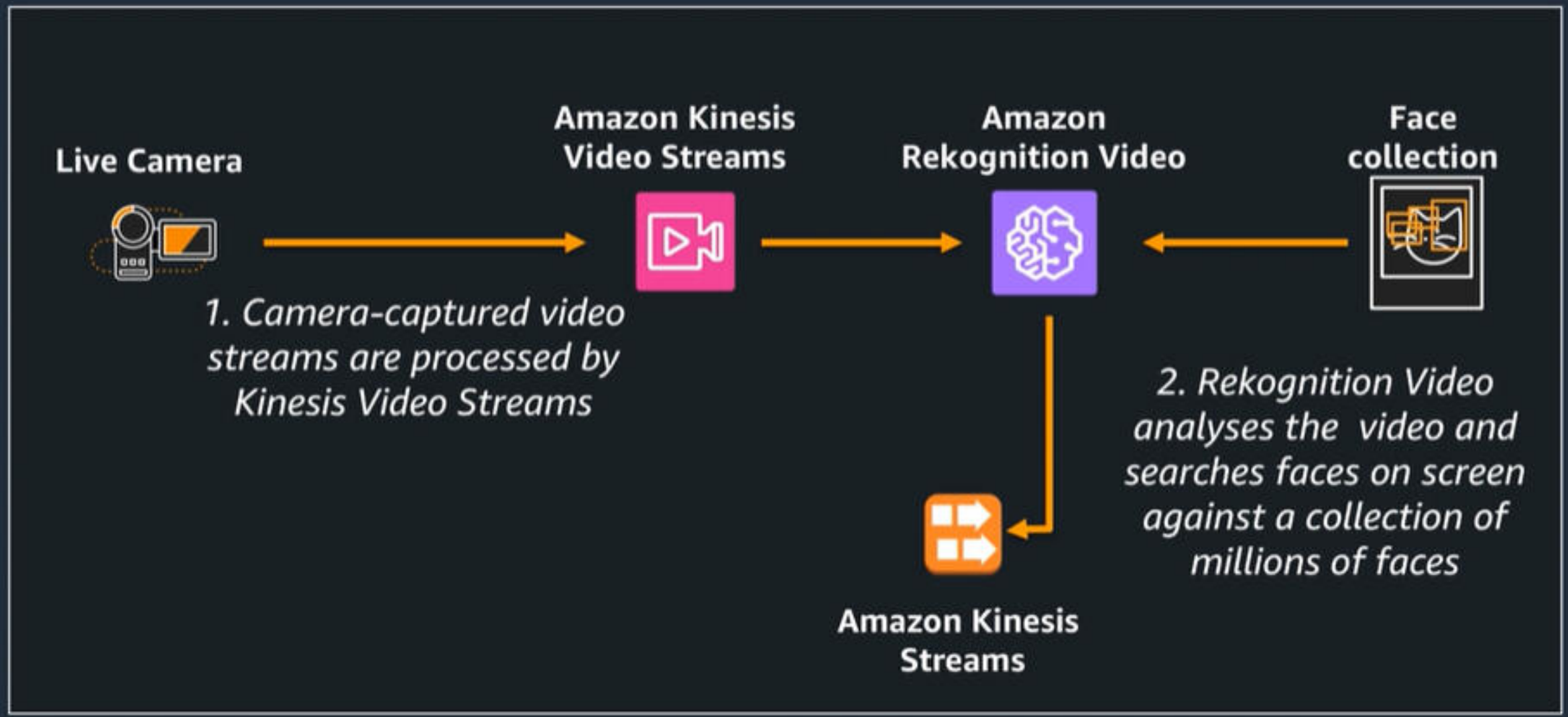
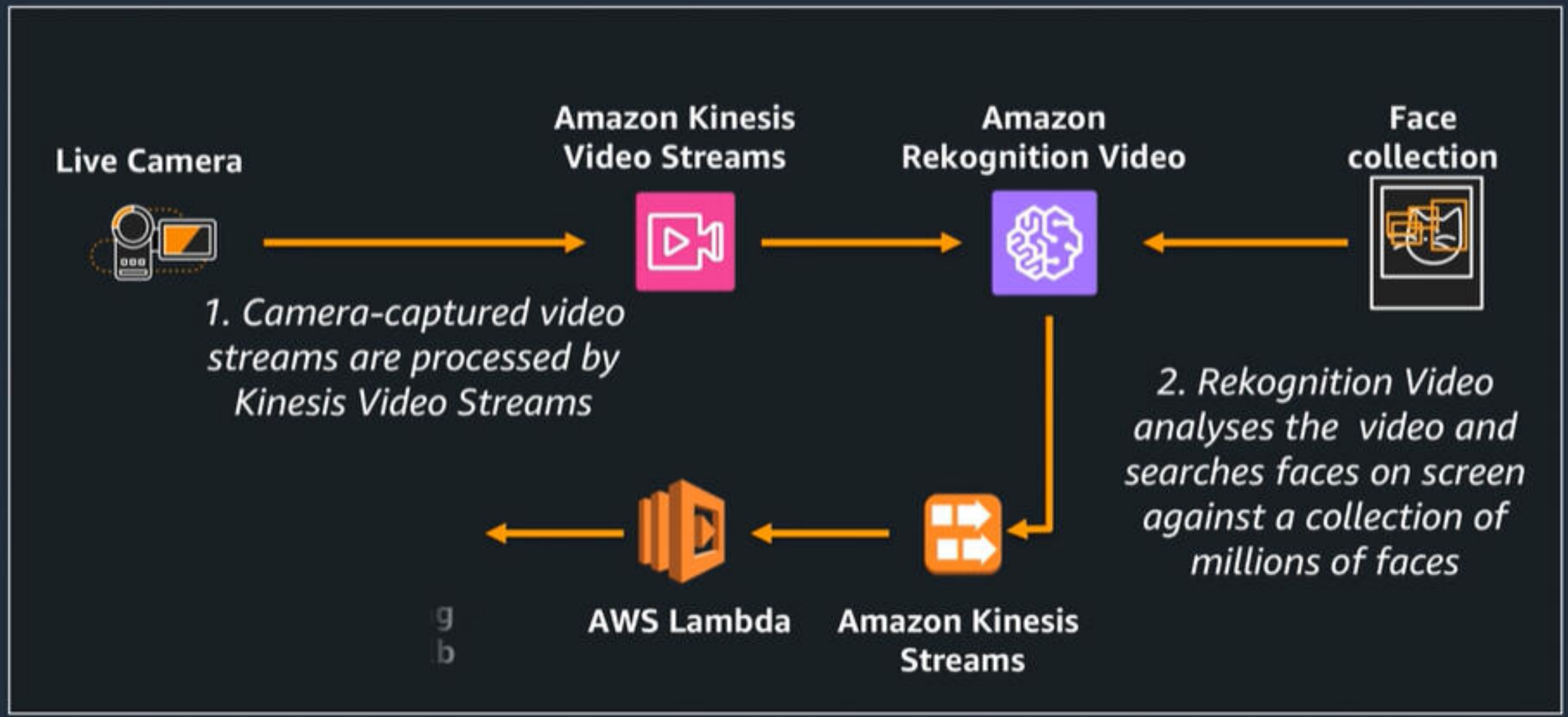
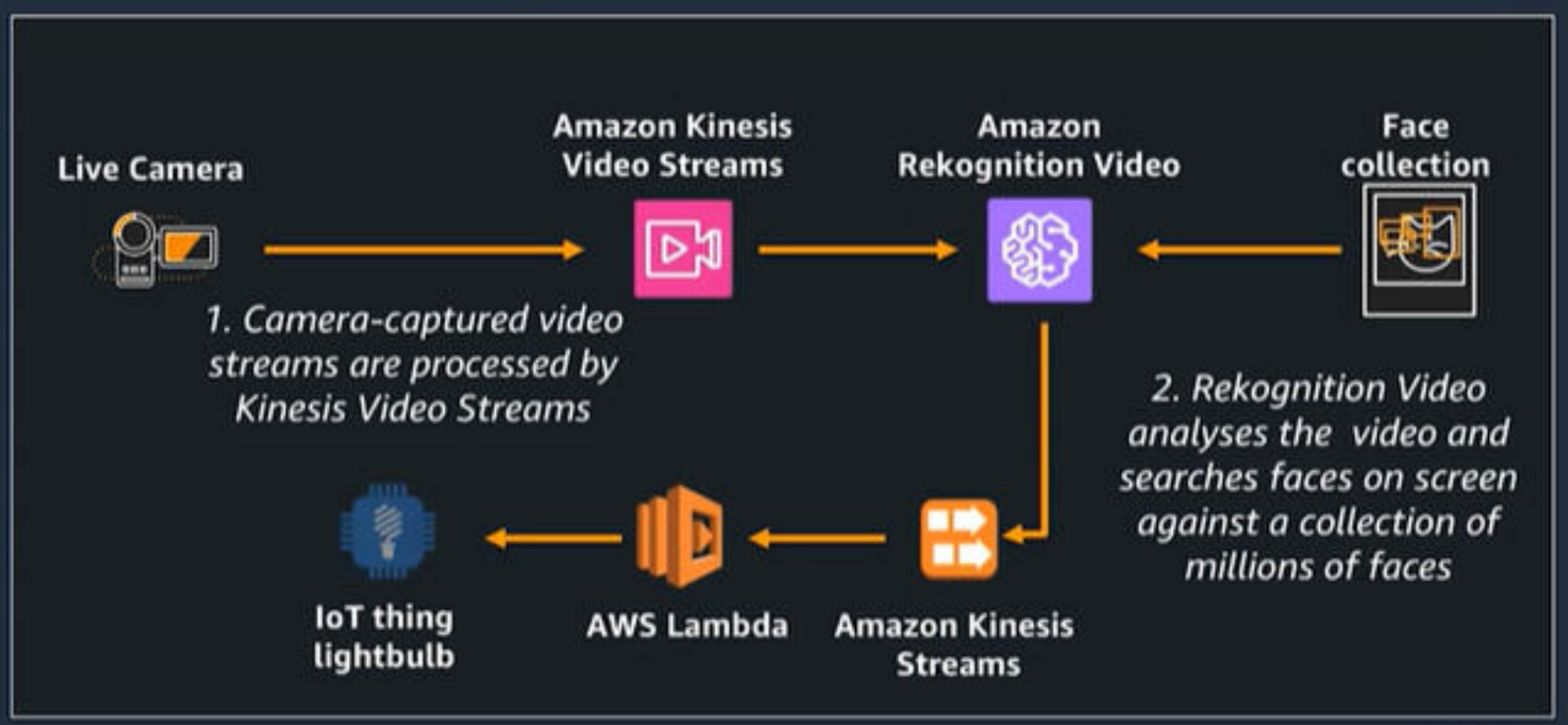
Architecture diagram



Architecture diagram

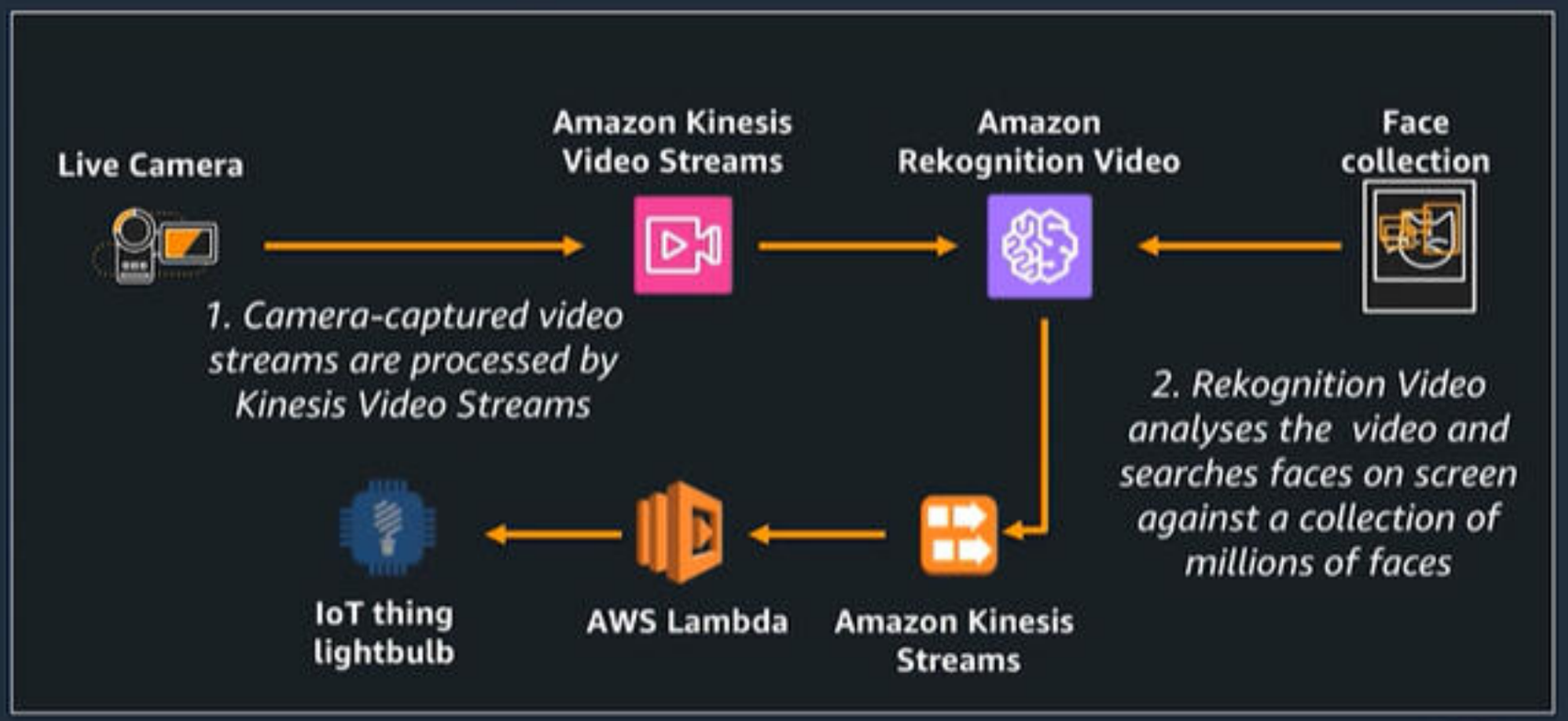


Architecture diagram



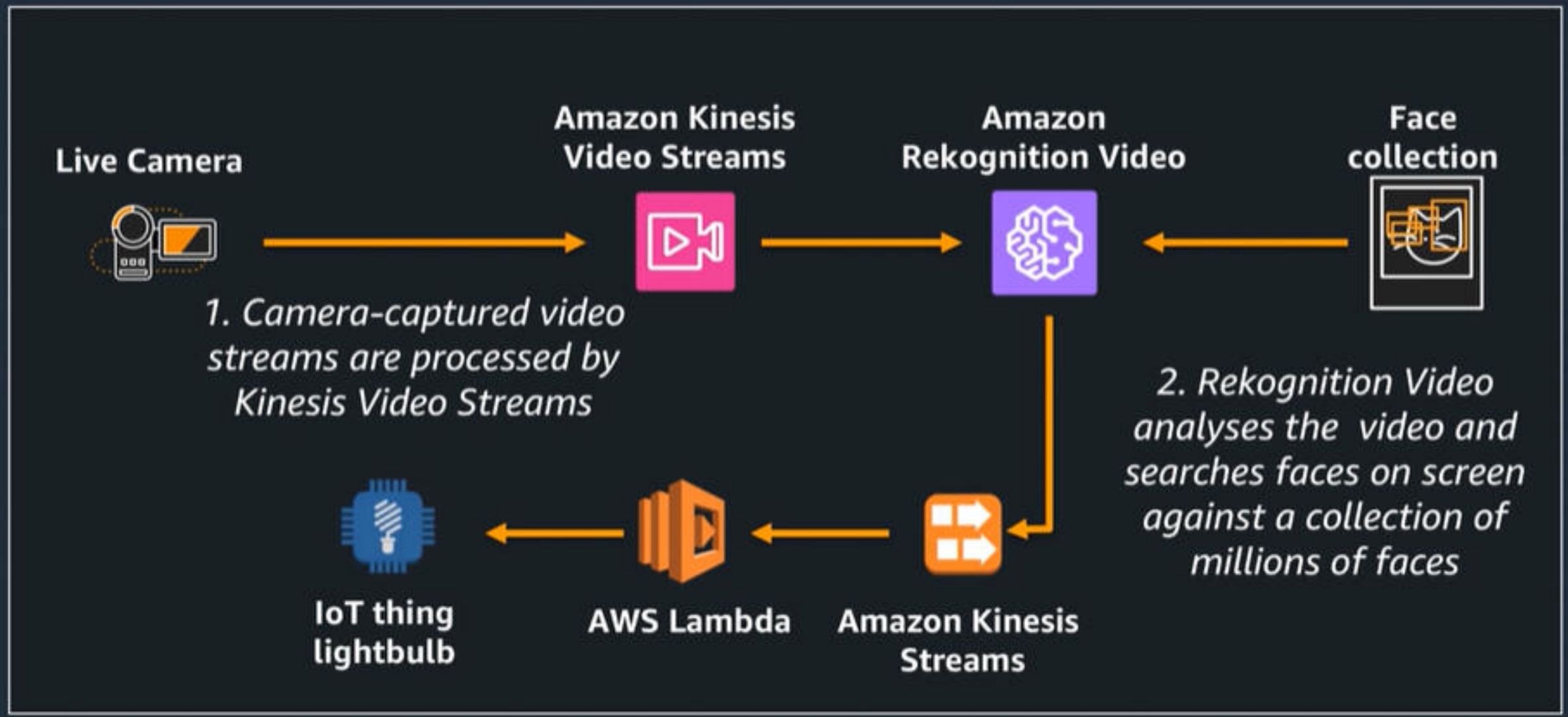
aws

Architecture diagram

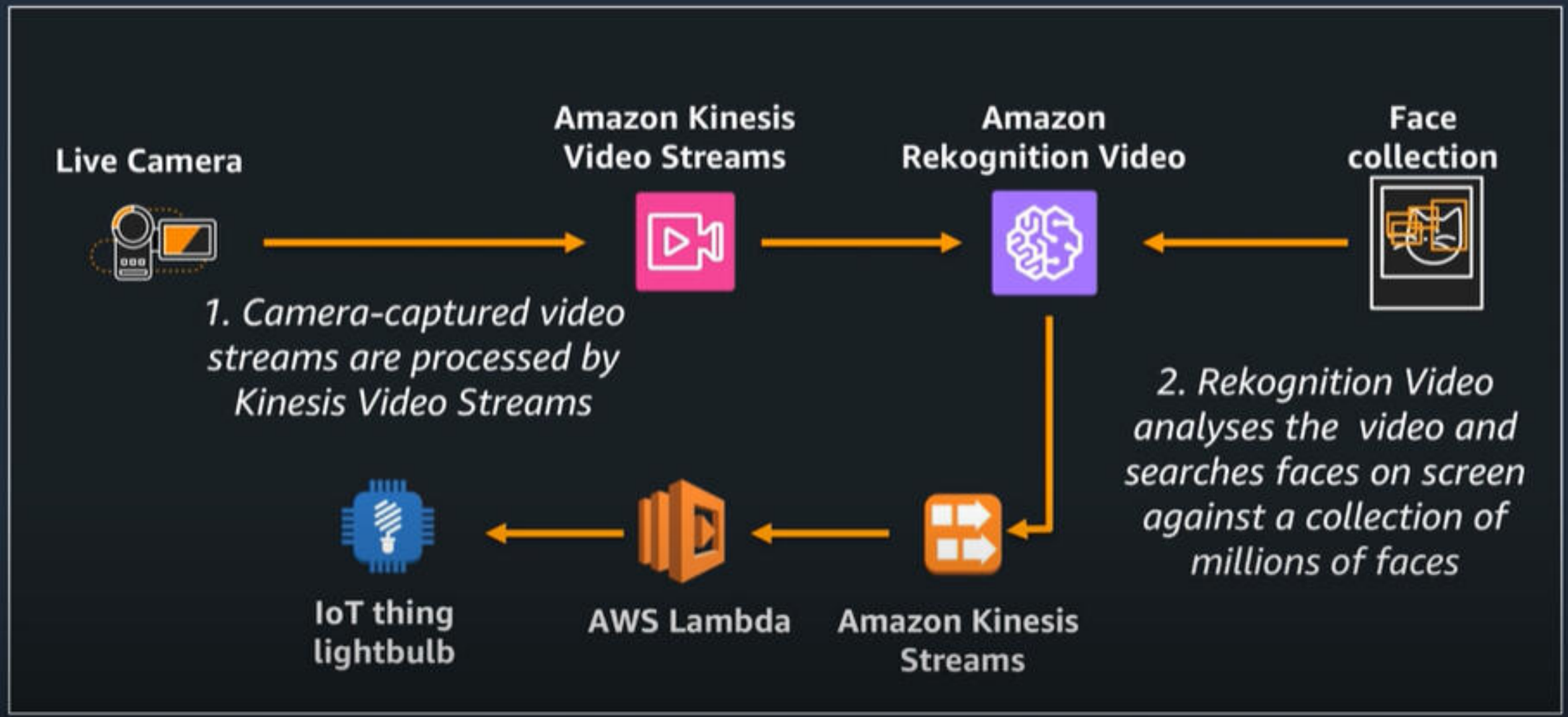


aws

Architecture diagram



Architecture diagram



Agenda

- Computer Vision
- Amazon Rekognition
- Amazon Rekognition API
- Use cases and Reference Architectures
- Best Practices

Computer Vision

Computer Vision


```
[[110 31  84  62  37  33  65  103 88  97  121 31  114 31  124 101]
 [48 104 64  67  77  99  122 93  98  67  71  60  49  103 31  125]
 [106  125 36  107 60  110 119 86  31  112 44  125 44  113 34  53]
 [89 54  114 98  43  126 48  59  114 59  108 36  60  54  99  38]
 [55 54  123 97  32  120 27  97  113 106 73  53  28  115 98  58]
 [66 63  96  51  126 72  98  115 67  25  44  125 71  55  37  119]
 [33 111 88  73  114 115 62  118 42  72  25  40  101 58  78  95]
 [62 27  34  110 80  29  110 96  94  89  32  52  41  118 82  102]
 [87 51  56  26  123 65  81  93  63  69  57  31  67  100 93  102]
 [48 123 49  117 52  48  72  97  56  115 53  44  105 92  76  39]
 [92 43  95  41  111 101 119 49  68  117 27  110 69  60  61  93]
 [125  69  64  82  41  60  74  123 73  87  124 36  48  122 106 120]
 [56 86  97  57  118 68  44  66  82  81  27  92  114 123 87  109]
 [50 75  37  52  112 80  44  68  117 81  61  53  47  95  44  72]
 [74 115 59  40  117 94  30  58  76  81  108 68  30  111 96  71]
 [92 53  103 120 73  116 95  31  78  53  96  113 38  86  26  40]
 [34 26  63  77  117 120 79  45  45  61  118 91  31  96  114 65]
 [99 95  65  55  64  126 64  118 68  47  74  36  91  106 103 106]
 [51 101 42  56  123 107 71  114 50  117 79  67  122 116 65  28]
 [33 74  68  73  36  58  96  44  78  71  89  88  42  103 109 65]
 [83 91  101 96  93  85  30  27  37  37  116 46  62  46  55  98]
 [115  52  122 70  47  80  92  111 118 99  42  93  98  72  115 41]
 [49 47  124 93  90  111 121 106 43  47  82  57  50  96  66  25]
 [108  115 59  76  99  31  110 28  59  96  121 111 110 87  26  32]]
```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Amazon Machine Learning Stack

APPLICATION SERVICES

Rekognition | Transcribe | Translate | Polly | Comprehend | Lex

PLATFORM SERVICES

Amazon SageMaker

FRAMEWORKS & INTERFACES

AWS Deep Learning AMIs

Caffe2 | CNTK | Apache MXNet | PyTorch | TensorFlow | Chainer | Keras | Gluon

EDUCATION

AWS DeepLens

aws

Amazon Rekognition Customers

Openinfluence
C-SPAN
bynder
SPOKEO
HYPETAP
vidmob
scrippsnetworks interactive
Cloudinary
MARINUS ANALYTICS
Influential
SmugMug
THORN
witlee
THETAKE
make.tv
HYPR
POPSUGAR
Limbik
zmags
here
SPORTOGRAF.COM
SOCIAL SOUP
wia
SOUL
Mobilink
SEN
毎日新聞
Sygic Travel
Artfinder
butterfleye
campsite
aws

Amazon Rekognition Image

Deep learning-based image analysis service

Object & Scene Detection

Facial Analysis

Face Recognition

Celebrity Recognition

Unsafe Image Detection

Text in Image

aws

Amazon Rekognition Video

Deep learning-based video analysis service

Object & Activity Detection

Pathing

Face Detection & Recognition

Celebrity Recognition

Unsafe Video Detection

Real-time Live Stream

aws

Amazon Rekognition Video

Deep learning-based video analysis service

Object & Activity Detection

Pathing

Face Detection & Recognition

Celebrity Recognition

Unsafe Video Detection

Real-time Live Stream

aws

Object & Scene Detection

Identify objects and scenes with confidence scores

Object and scene detection makes it easy for you to add features that search, filter, and curate large image libraries.

aws

Facial Analysis

Analyze facial characteristics in multiple dimensions

aws

Facial Analysis

Analyze facial characteristics in multiple dimensions

Demographic Data

Age Range	29-45
Gender:Male	96.5%

Facial Landmarks

EyeLeft,EyeRight,Nose
RightPupil,LeftPupil
MouthRight,LeftEyeBrowUp
Bounding Box...

Image Quality

Brightness	23.6%
Sharpness	99.9%

Emotion Expressed

Happy	83.8%
Surprised	0.65%

General Attributes

Smile:True	23.6%
EyesOpen:True	99.8%
Beard:True	99.5%
Mustache:True	99.9%...

Facial Pose

Pitch	1.446
Roll	5.725
Yaw	4.383

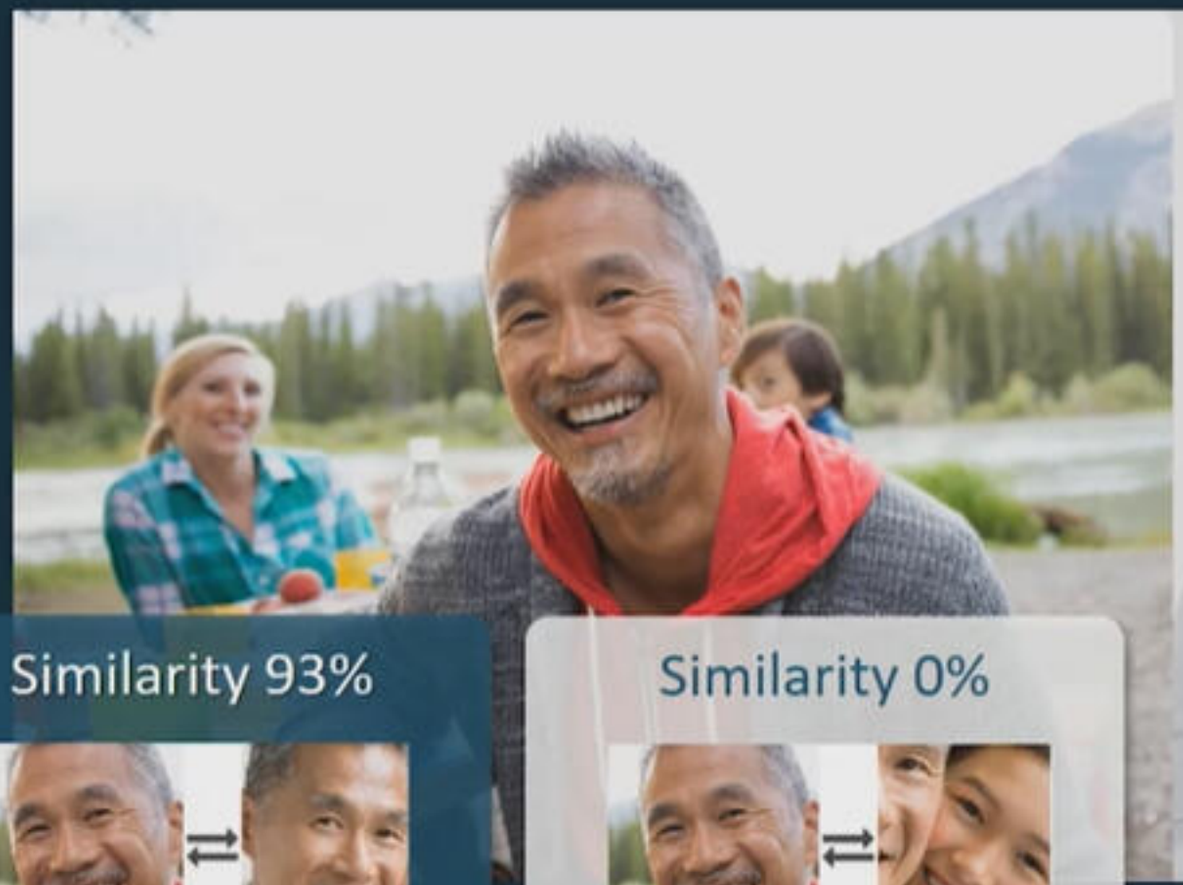
aws

Facial Detection and Analysis - Crowd

Support for up to 100 faces

Face Comparison

Measure the likelihood that faces are of the same person



Similarity 93%

Similarity 0%

aws

Facial Recognition

Identify a person in a photo or video using your private repository of face images

Unsafe Content Detection

Detect explicit and suggestive content

Explicit and Suggestive Content Labels

Top-Level Category	Second-Level Category
Explicity Nudity	Nudity
	Graphic Male Nudity
	Graphic Female Nudity
	Sexual Activity
	Partial Nudity
Suggestive	Female Swimwear or Underwear
	Male Swimwear of Underwear
	Revealing Clothes

aws

Explicit and Suggestive Content Labels

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	Sexual Activity
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Suggestive	Female Swimwear or Underwear
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	Revealing Clothes

aws

Celebrity Recognition

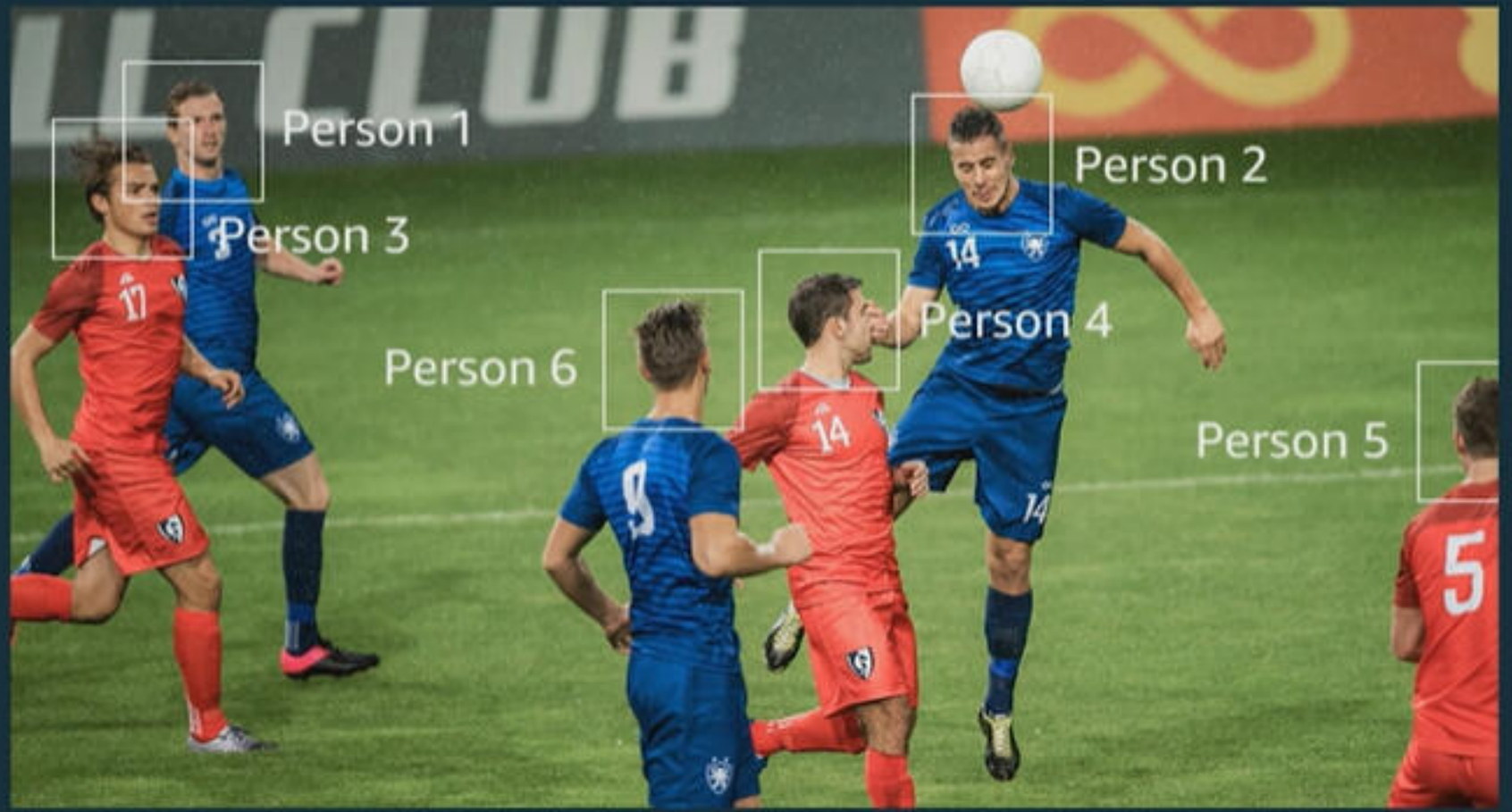
Recognize thousands of famous individuals

Detecting Text

Detect and recognize text from images

Pathing

Capture the path of people in the scene



Amazon Rekognition API

Object & Scene Detection – Image API

```
{
 "Image": {
      "Bytes": blob,
      "S3Object": {
            "Bucket": "string",
            "Name": "string",
            "Version": "string"
       }
   },
 "MaxLabels": number,
 "MinConfidence": number
}
```

DetectLabels

aws

Object & Scene Detection – Image API

```
{
 "Image": {
      "Bytes": blob,
      "S3Object": {
            "Bucket": "string",
            "Name": "string",
            "Version": "string"
       }
   },
 "MaxLabels": number,
 "MinConfidence": number
}
```

DetectLabels

```
{
 "Labels": [
    {
        "Confidence": number,
        "Name": "string"
    }
  ],
 "OrientationCorrection": "string"
}
```


aws

Object & Scene Detection – Video API

```
{
   "ClientRequestToken": "string",
   "JobTag": "string",
   "MinConfidence": number,
   "NotificationChannel": {
          "RoleArn": "string",
          "SNSTopicArn": "string"
},
"Video": {
    "S3Object": {
          "Bucket": "string",
          "Name": "string",
          "Version": "string"
    }
  }
}
```

StartLabelDetection

aws

Object & Scene Detection – Video API

```
{
   "ClientRequestToken": "string",
   "JobTag": "string",
   "MinConfidence": number,
   "NotificationChannel": {
          "RoleArn": "string",
          "SNSTopicArn": "string"
},
"Video": {
    "S3Object": {
          "Bucket": "string",
          "Name": "string",
          "Version": "string"
    }
  }
}
```

StartLabelDetection

aws

Object & Scene Detection – Video API

```
{
   "ClientRequestToken": "string",
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          "SNSTopicArn": "string"
},
"Video": {
    "S3Object": {
          "Bucket": "string",
          "Name": "string",
          "Version": "string"
    }
  }
}
```

StartLabelDetection

aws

Object & Scene Detection – Video API

```
{
   "ClientRequestToken": "string",
   "JobTag": "string",
   "MinConfidence": number,
   "NotificationChannel": {
          "RoleArn": "string",
          "SNSTopicArn": "string"
},
"Video": {
    "S3Object": {
          "Bucket": "string",
          "Name": "string",
          "Version": "string"
    }
  }
}
```

StartLabelDetection

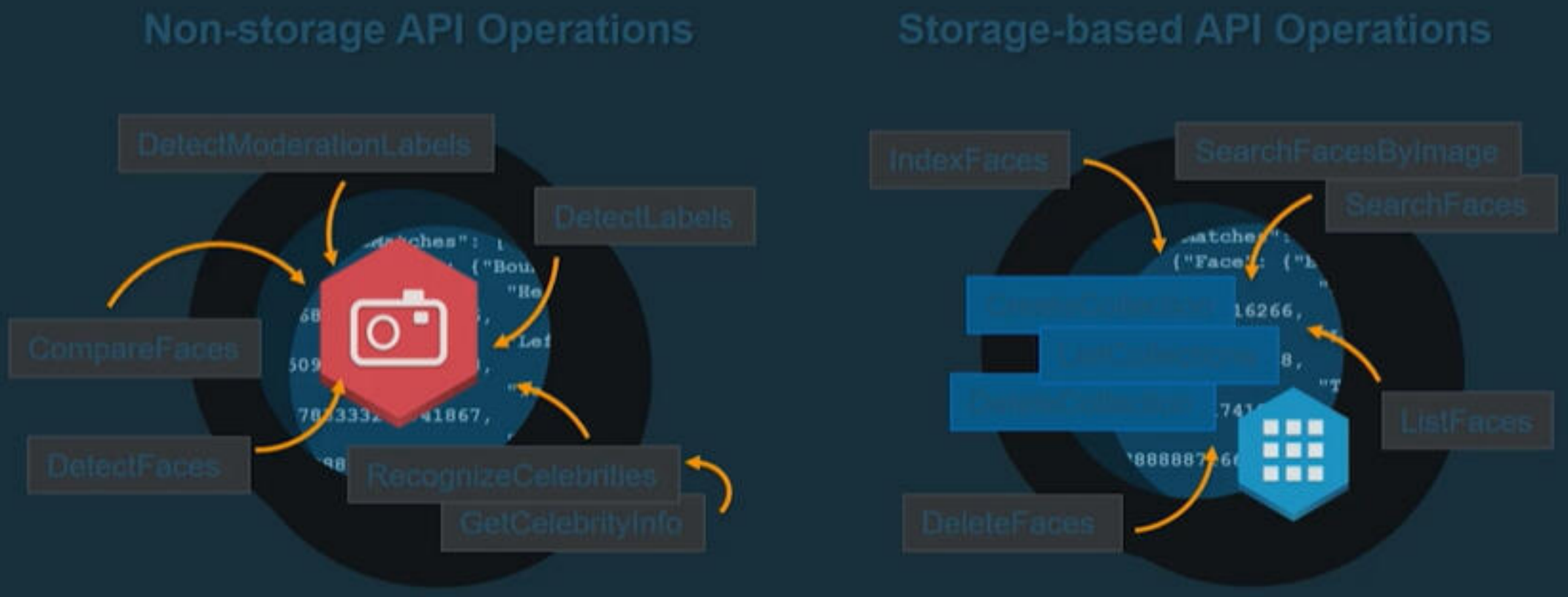
JobId

GetLabelDetection

```
{
    "JobStatus": string,
    "StatusMessage": string,
    "VideoMetadata": {
        "Format": string,
        "Codec": string,
        "DurationMillis": number,
        "FrameRate": float,
        "FrameWidth": number,
        "FrameHeight": number
    },
    "NextToken": string,
    "Labels": [
        {
            "Timestamp": number,
            "Label":
              {
                  "Name": string,
                  "Confidence": float
              }
        }
    ],
...
```

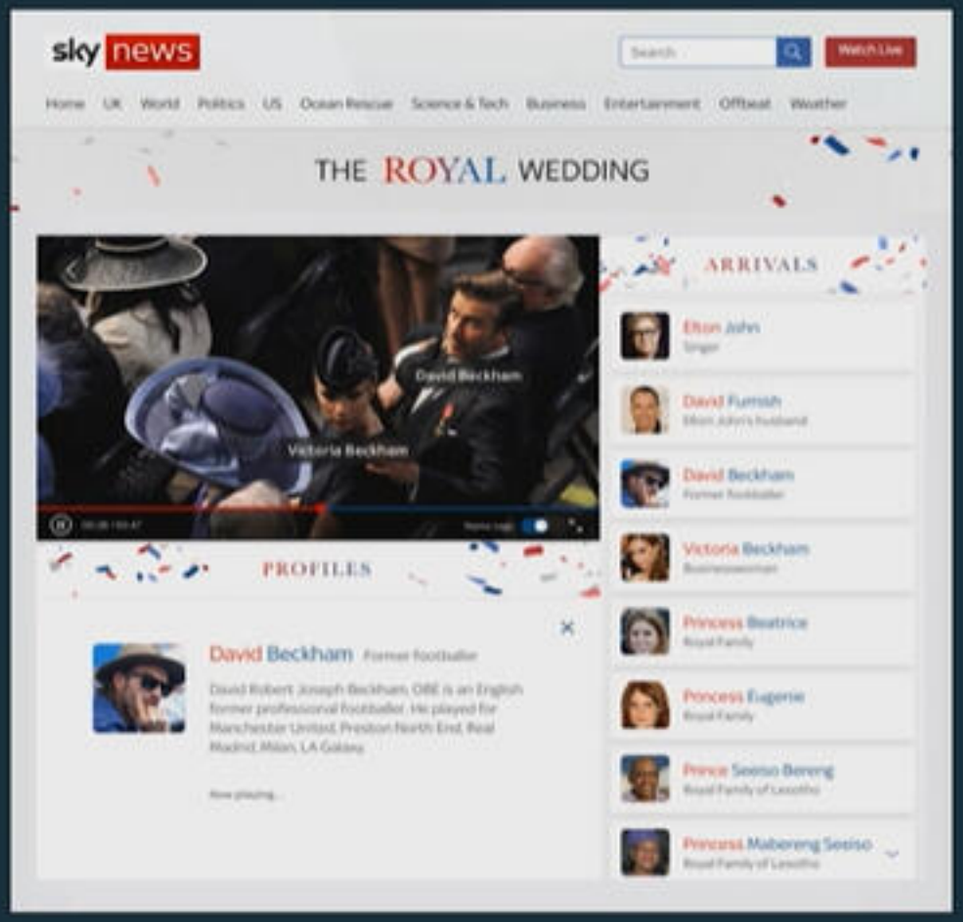

aws

Rekognition APIs – Overview



Rekognition's computer vision API operations can be grouped into Non-storage API operations, and Storage-based API operations

Celebrity Guests at the Royal Wedding



- "Who's Who Live" function
- Celebrity guests identified in live stream
- On Screen captions of relation to the royal couple

PROFILES

Princess Michael of Kent

The wife of Prince Michael, the Queen's cousin, was born in 1945 in what was part of Germany, now the Czech Republic. She was an interior designer before becoming an author.

Watch arrival

Will Greenwood

Caroline Greenwood

Duchess of York

Norma Major

Sir John Major

Mike Tindall

Princess Michael of Kent

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sky news
JAMES MIDDLETON
PADDY HARVERSON
JAMES MATTHEWS
CAROLE MIDDLETON
MICHAEL MIDDLETON


DAVID BECKHAM


DORIA RAGLAND


DUKE OF EDINBURGH
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DORIA RAGLAND


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PRINCE HARRY
DUKE OF CAMBRIDGE

Amazon Rekognition and sports media tagging

- Player recognition
- Motion path tracking
- Objects, activities, and event detection

Combatting Human Trafficking on AWS

ML supporting law enforcement and victim rescue

MARINUS ANALYTICS

- Machine learning and analytics platforms for law enforcement

International Centre FOR MISSING & EXPLOITED CHILDREN

- Match photos of exploited children to those on the dark web

THORN

- Reduces the time and effort to identify and rescue victims

aws

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- Reduces the time and effort to identify and rescue victims

aws

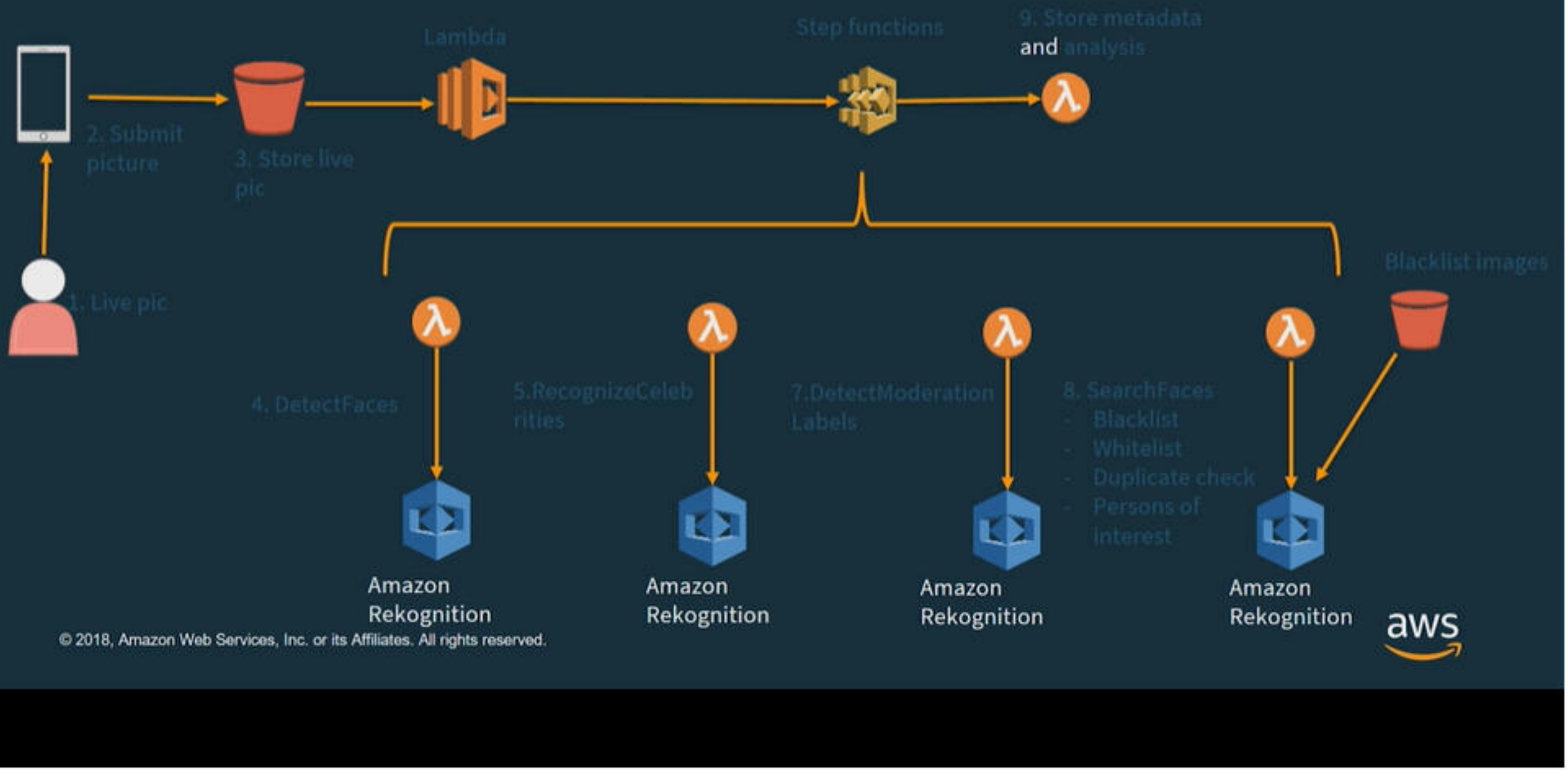
Analyze User Generated Content

Person 99.2%
Dog 95.7%

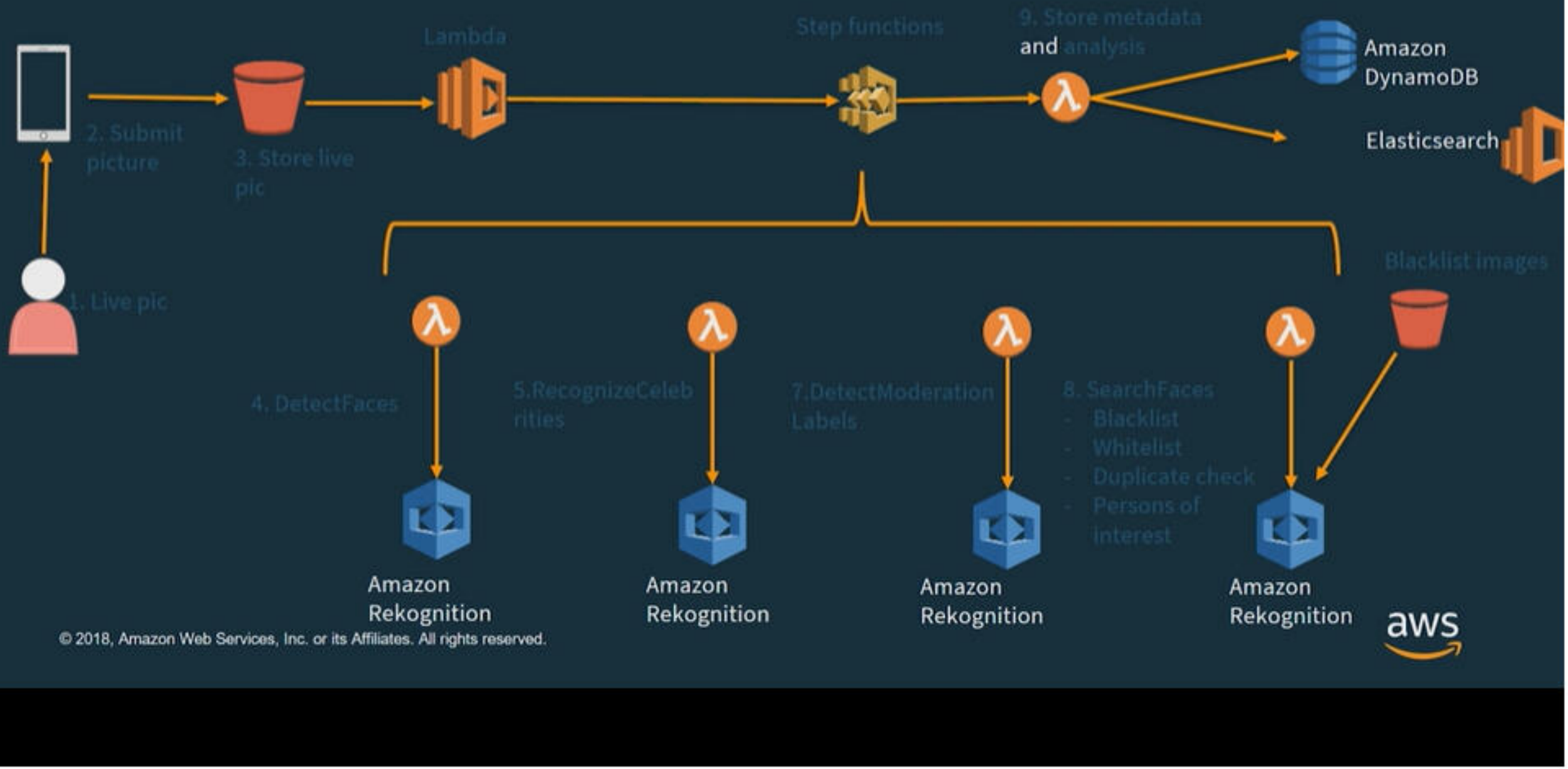
Person 99.2%
Snowboarding 98.1%

No Moderation labels detected

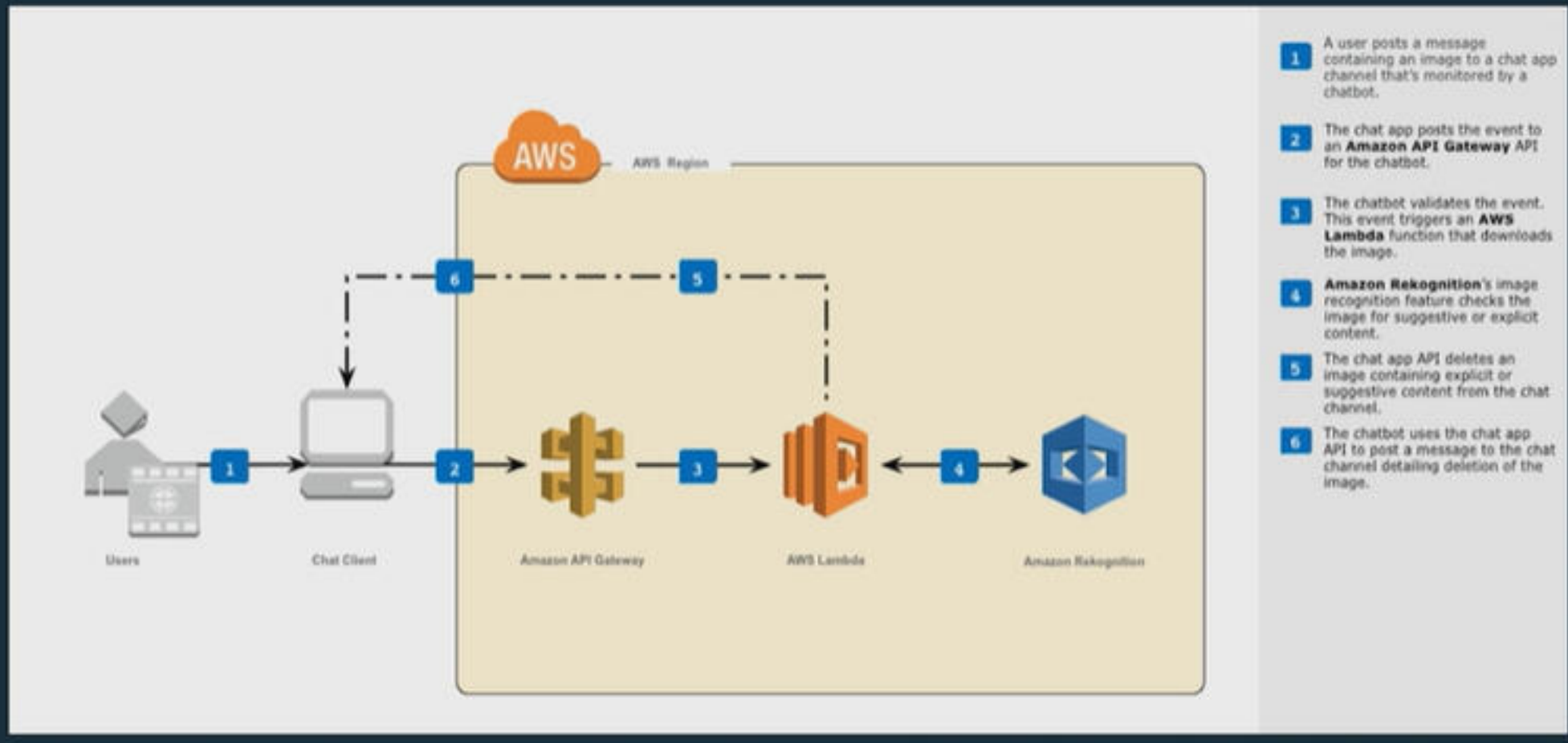
AWS solution



AWS solution



Chat moderation



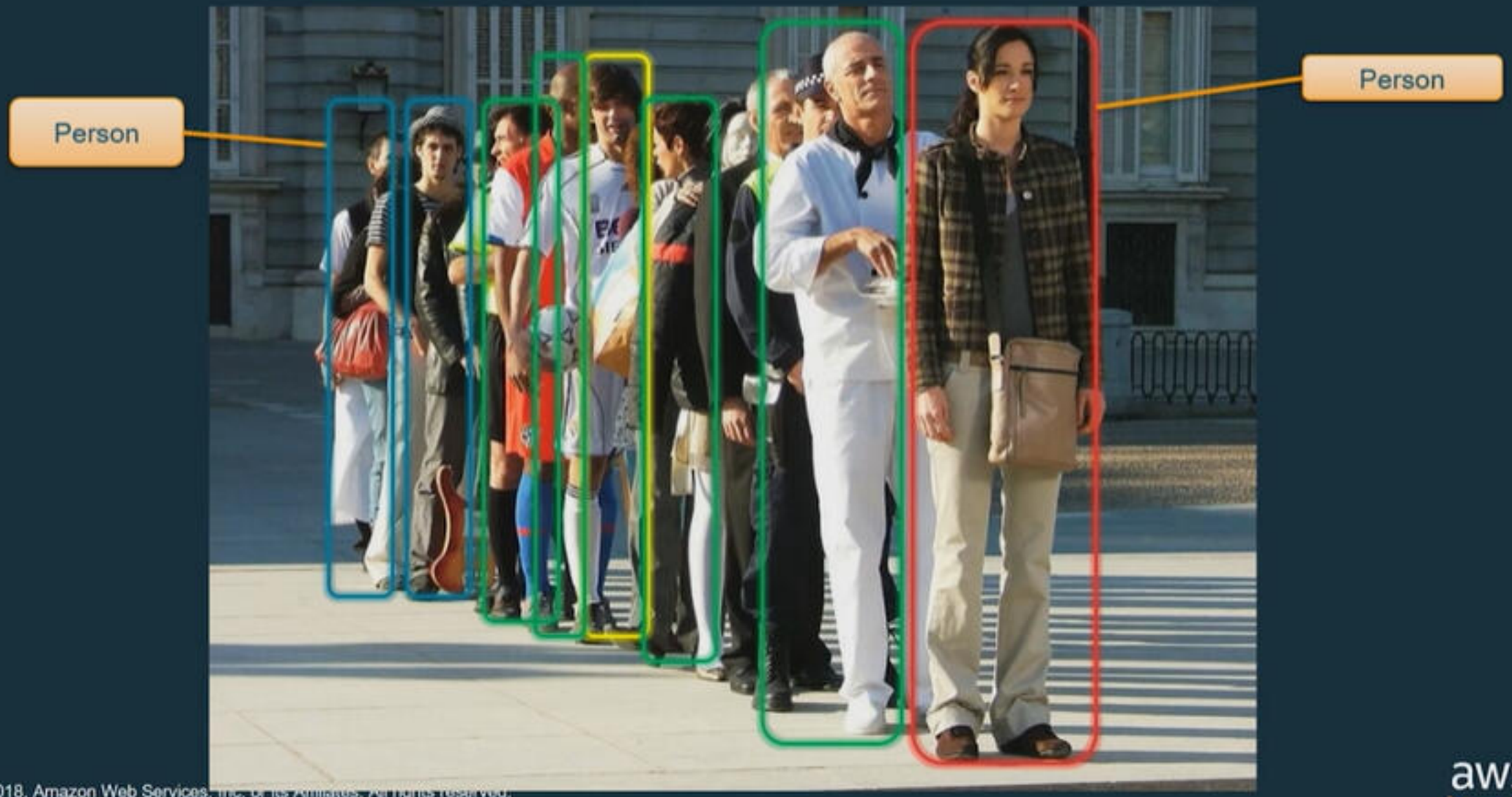
https://github.com/aws-samples/lambda-refarch-image-moderation-chatbot

How long people have to wait in the line?

aws

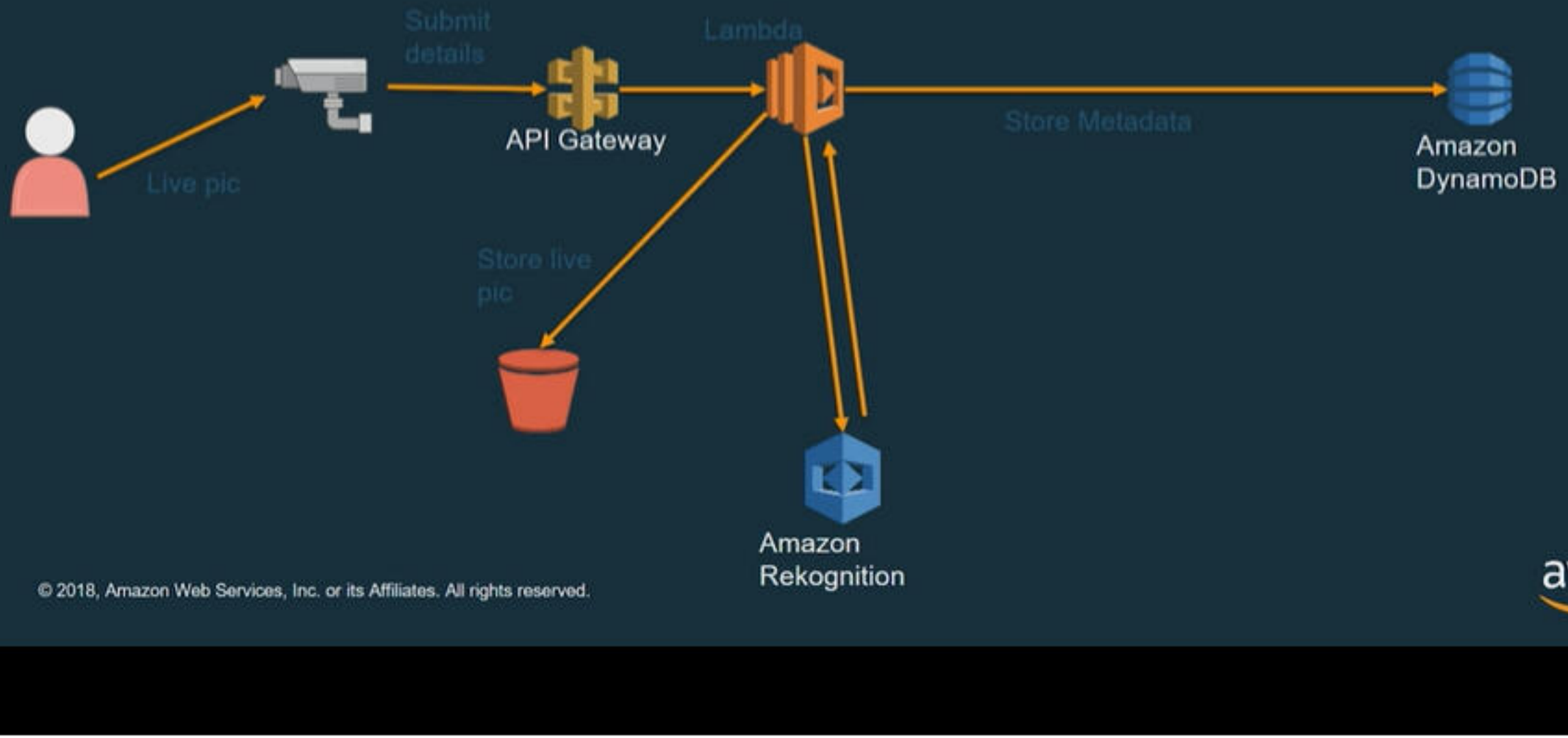
18:00 / 26:24

How long people have to wait in the line?



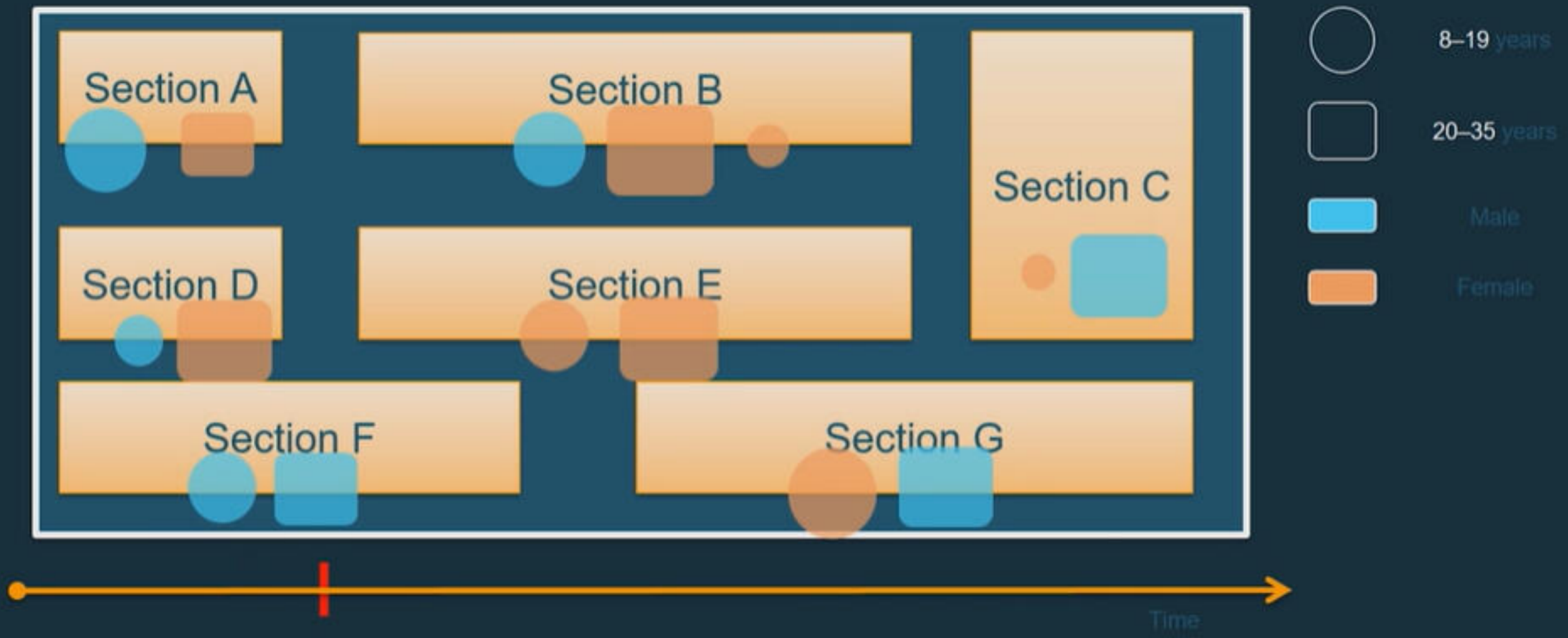
Live demographic analysis

AWS solution

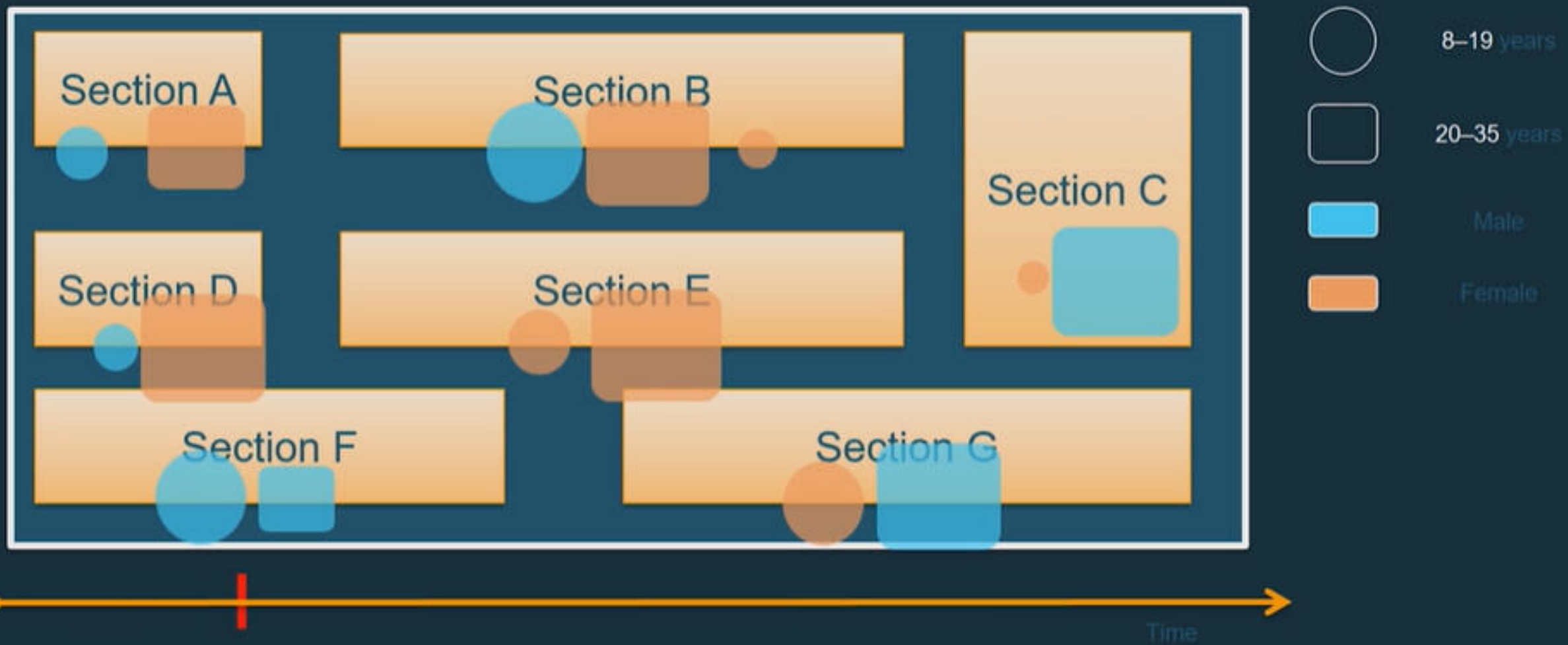


Live demographic analysis

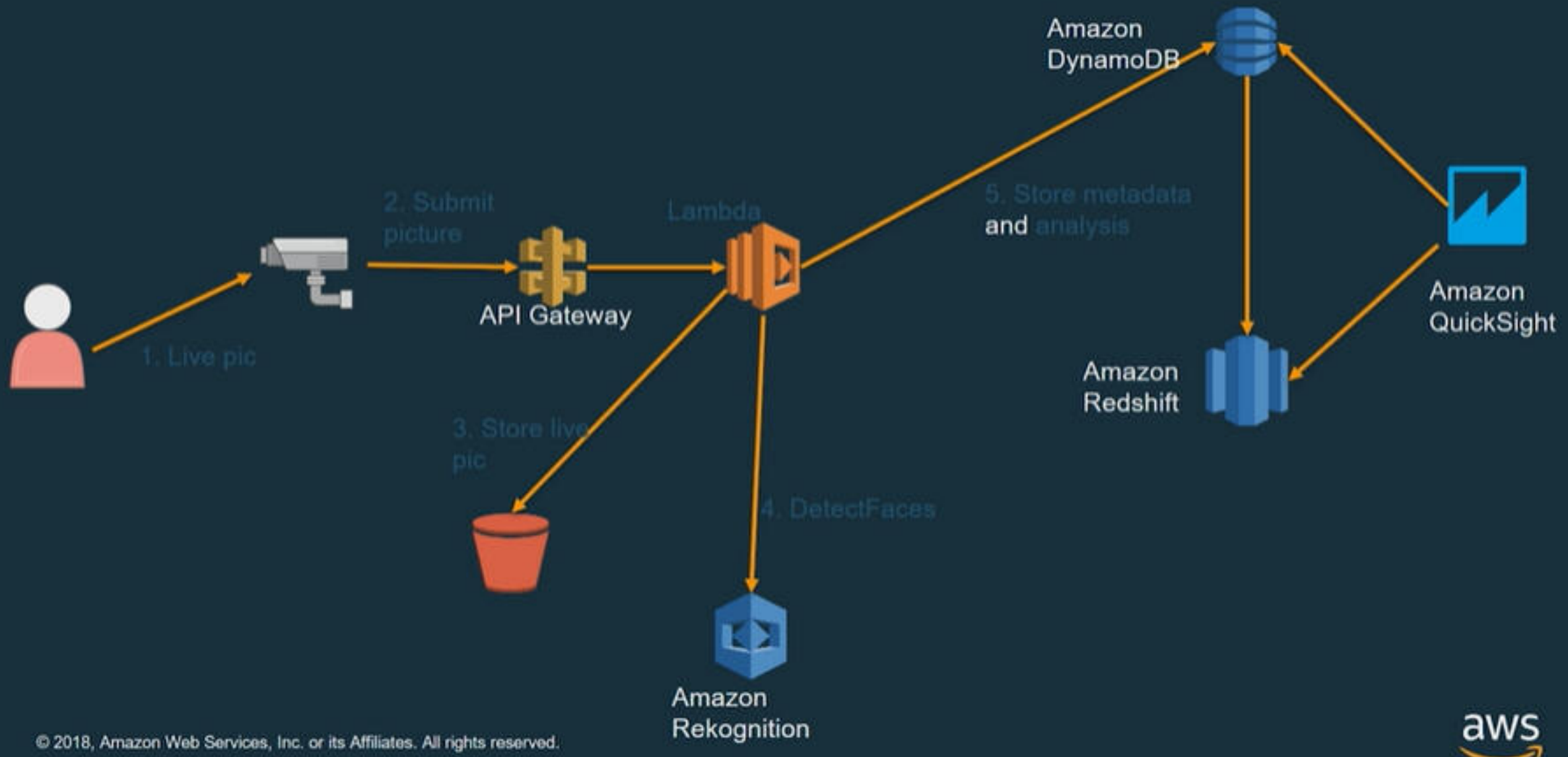
Real-time store heat map



Real-time store heat map



AWS solution



Best practices: Interfacing with Amazon Rekognition

- Image format
  - PNG or JPEG
- Max image size
  - Amazon S3 : 15 MB
  - API calls: 5 MB (base64 encoded)
- Video format
  - mp4, mov
- Video Codec
  - H264
- Max video size
  - 8 GB

aws

Best practices: Interfacing with Amazon Rekognition

- Image resolution
  - Min 80 px
- Collections are for faces! (not cats, cartoons, …)
- Max number of faces in a single face collection is 20 million
  - Latency still under a second!
- Max matching faces the search API returns = 4096
- Keep your images to re-index collection for future versions

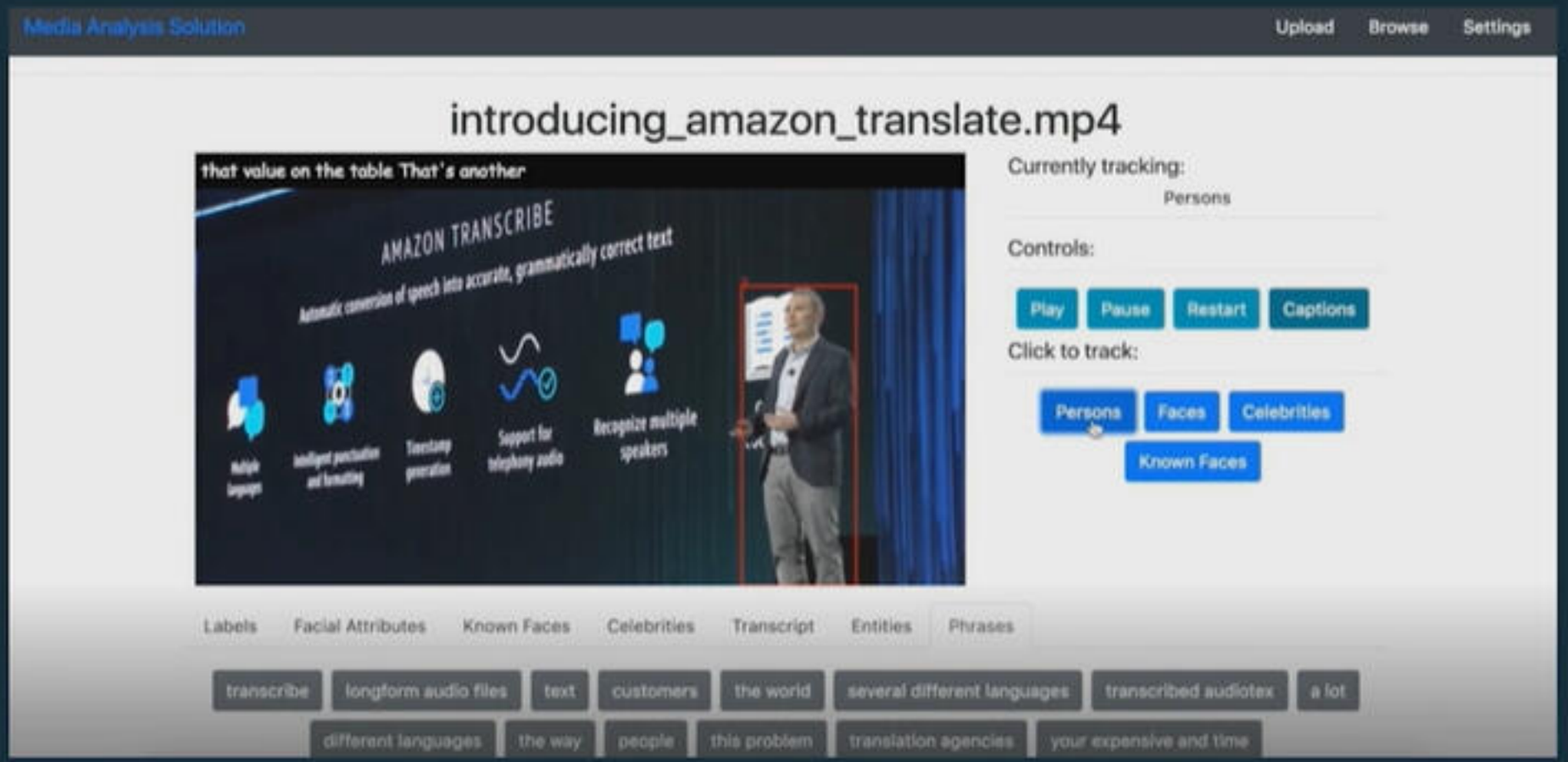
aws

Best practices: Interfacing with Amazon Rekognition

- IndexFaces detects largest 100 faces in the input image and adds them to the specified collection
- SearchFacesByImage detects the largest face in the image, and then searches the specified collection for matching faces

aws

Media Analysis Solution



https://aws.amazon.com/answers/media-entertainment/media-analysis-solution/

References

- Amazon Rekognition
- Amazon Rekognition on AWS AI blog
- Media Analysis Solution
- Rekognition-Lambda-SQS
- Custom Celebrities
- Serverless Image Recognition processing backend
- Policing user content
- API Reference
    - Actions
    - Data Types

aws

Amazon SageMaker

Satellite Image Classification In SageMaker

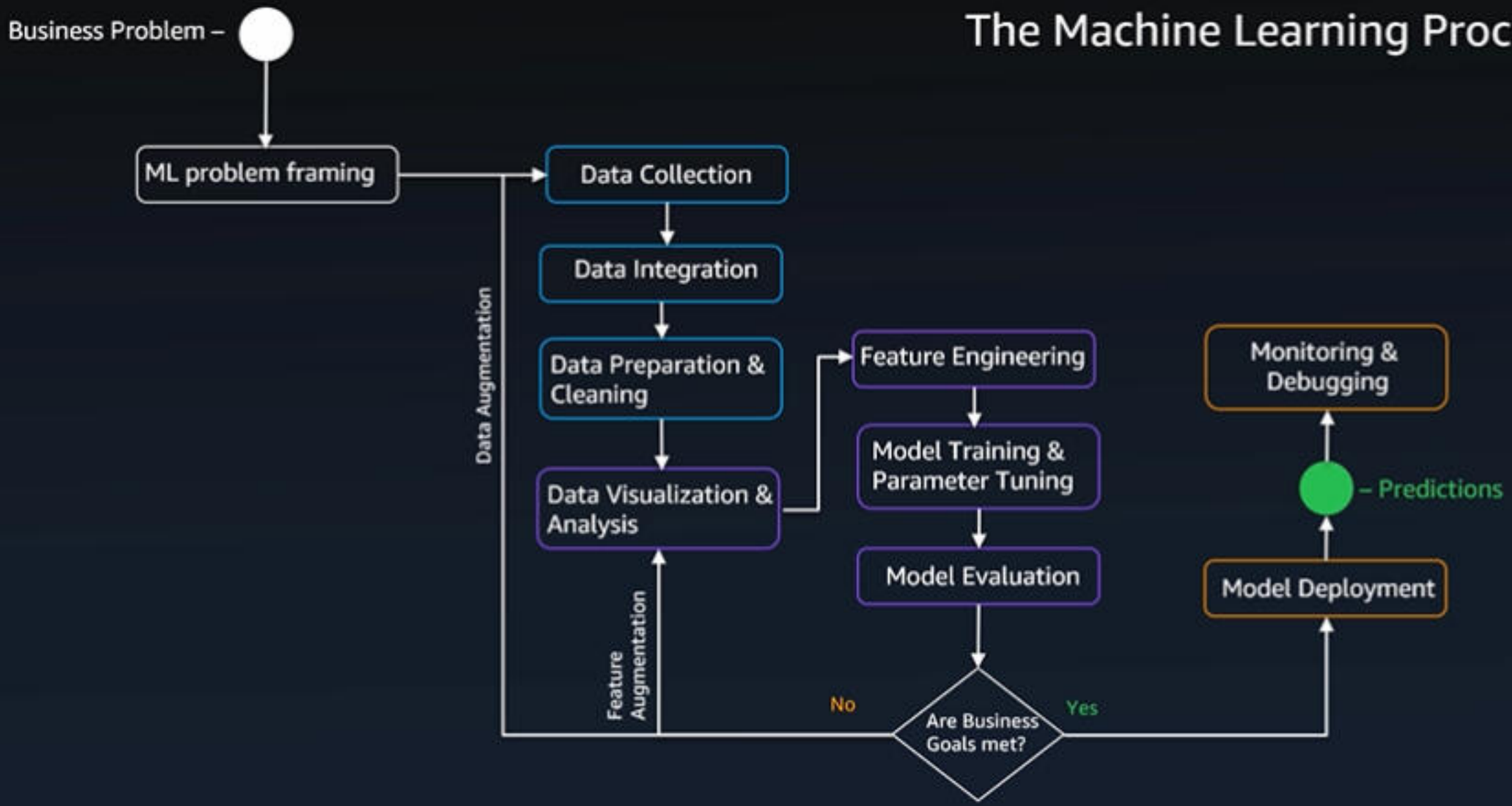
Bardia Nikpourian – Sr. *Specialist TAM – Artificial Intelligence*

Varun Jain - *Global Accounts Solutions Architect*

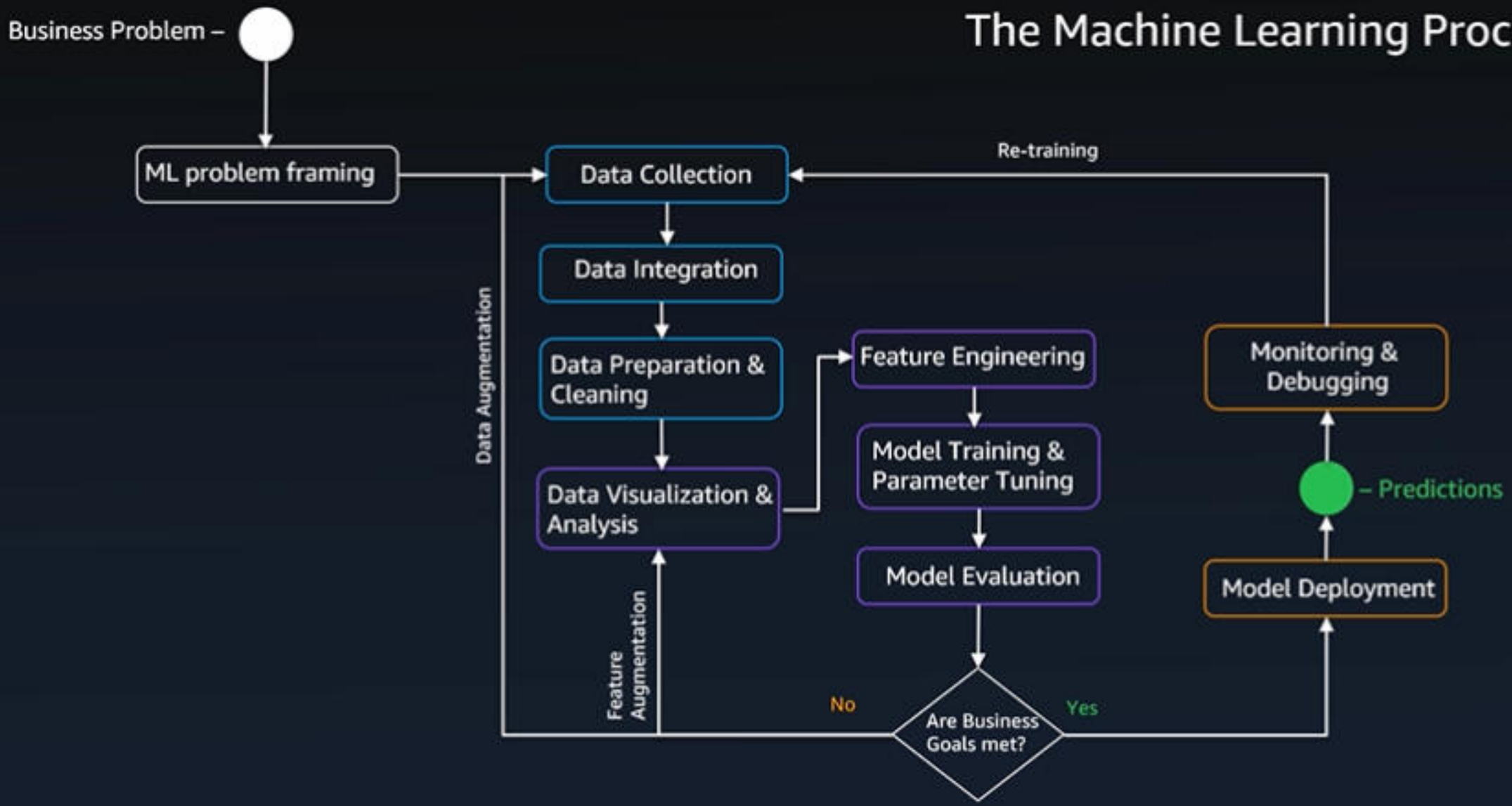
aws

00:01 / 17:05

The Machine Learning Process



The Machine Learning Process



Satellite Image Recognition: The Business Problem

Problem Statement :

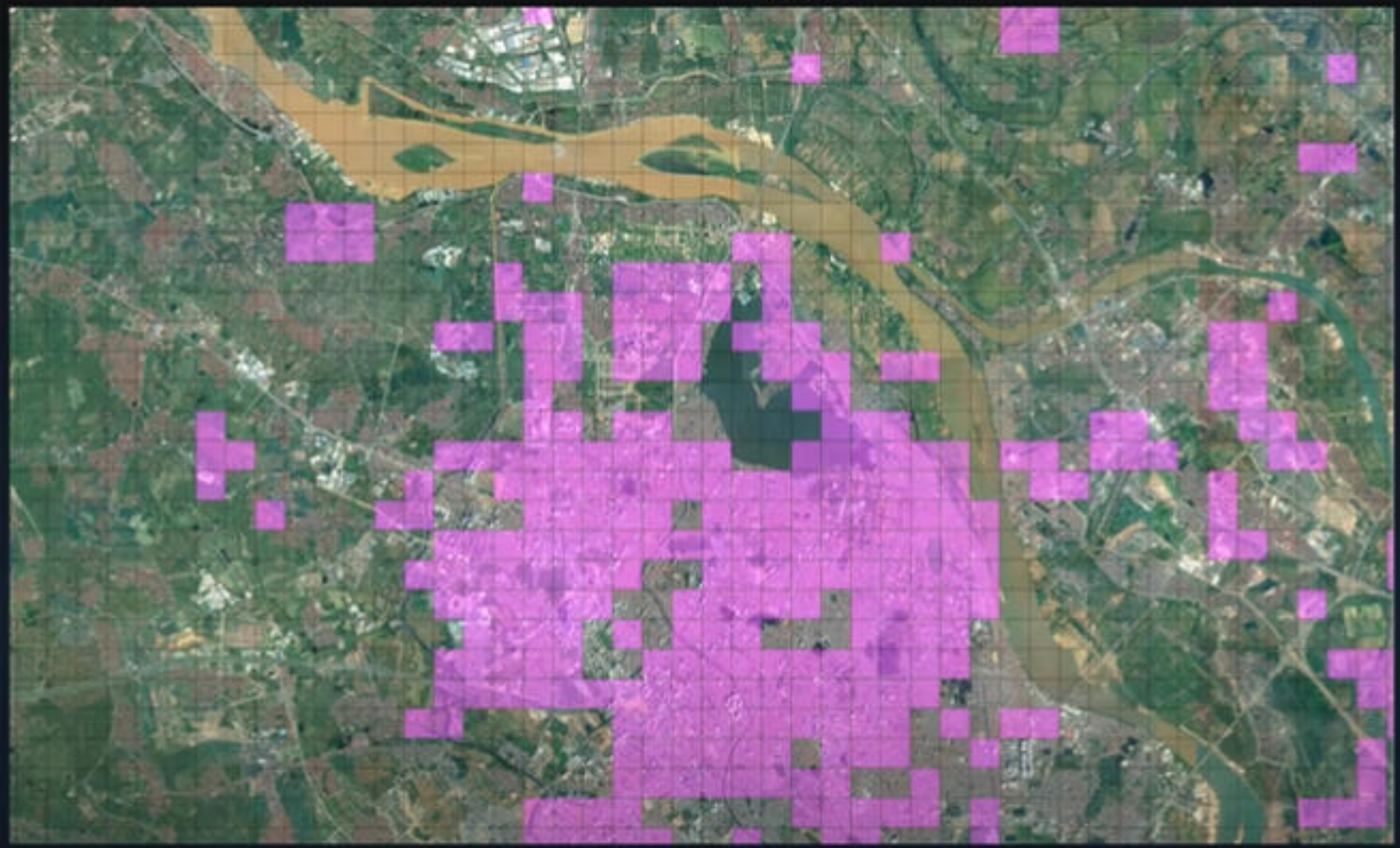
- Identifying and counting the number of specific items in an image is a human cognition task that's both costly and inefficient.

ML Problem Framing:

- Create a machine learning model capable of *classifying* objects such as roads, automobiles, and buildings in images that can be operated in production and be retrained as new data and locales become available.

aws

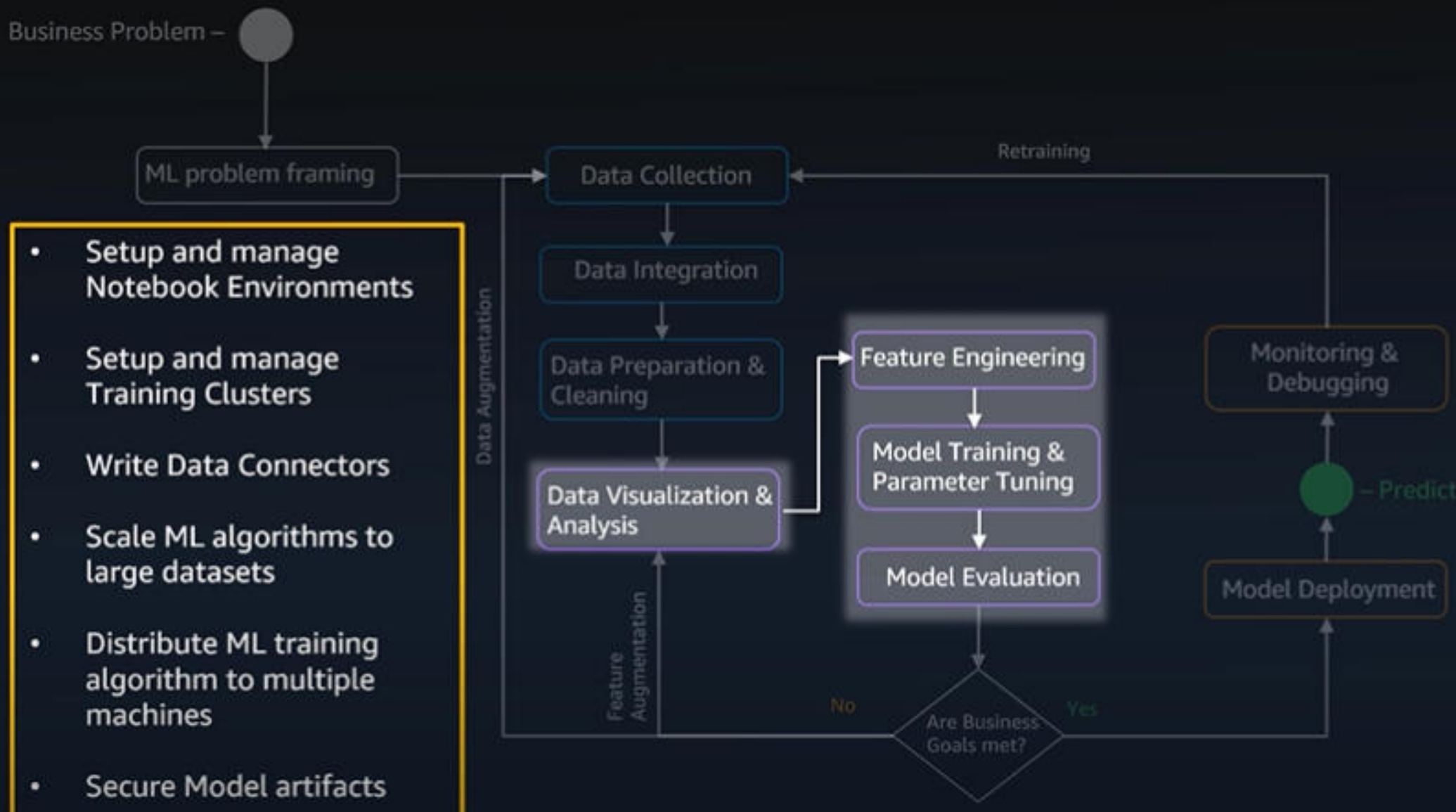
Data Preparation : Labeling Digital Globe Images



https://github.com/developmentseed/label-maker

aws

03:11 / 17:05



aws

Amazon SageMaker

A **fully managed service** that enables **data scientists** and **developers** to quickly and easily **build** machine-learning based models **into production** smart applications.

aws

Amazon SageMaker

Build

Pre-built notebook instances

Highly-optimized machine learning algorithms

aws

Amazon SageMaker

Build

Pre-built notebook instances

Highly-optimized machine learning algorithms

GLUON

Train

One-click training for ML, DL, and custom algorithms

Easier training with hyperparameter optimization

aws

Amazon SageMaker

Build

Pre-built notebook instances

Highly-optimized machine learning algorithms

GLUON

Train

One-click training for ML, DL, and custom algorithms

Easier training with hyperparameter optimization

Deploy

Deployment without engineering effort

Fully-managed hosting at scale

aws

Amazon SageMaker: Launch Customers

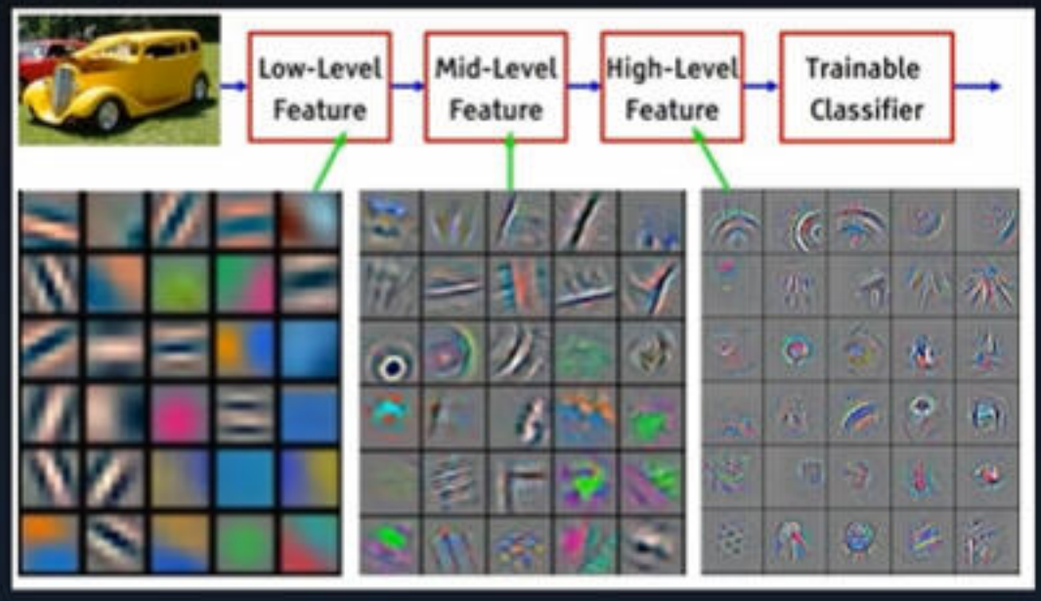
"As the world's leading provider of high-resolution Earth imagery, data and analysis, DigitalGlobe works with enormous amounts of data every day. DigitalGlobe is making it easier for people to find, access, and run compute against our entire 100PB image library, which is stored in AWS's cloud, to apply deep learning to satellite imagery. We plan to use Amazon SageMaker to train models against petabytes of Earth observation imagery datasets using hosted Jupyter notebooks, so DigitalGlobe's Geospatial Big Data Platform (GBDX) users can just push a button, create a model, and deploy it all within one scalable distributed environment at scale."

- Dr. Walter Scott, CTO of Maxar Technologies and founder of DigitalGlobe

aws

Convolution Fundamentals

Filters detect patterns, edges, shapes, textures etc. A filter is a small matrix with a given number of columns and rows and the same depth as the input data because a filter is computing a dot product with a chunk of the image.



Low Level Features:

- Edge Detection

Mid Level Features:

- Shapes (Circles, Squares)

High Level Features:

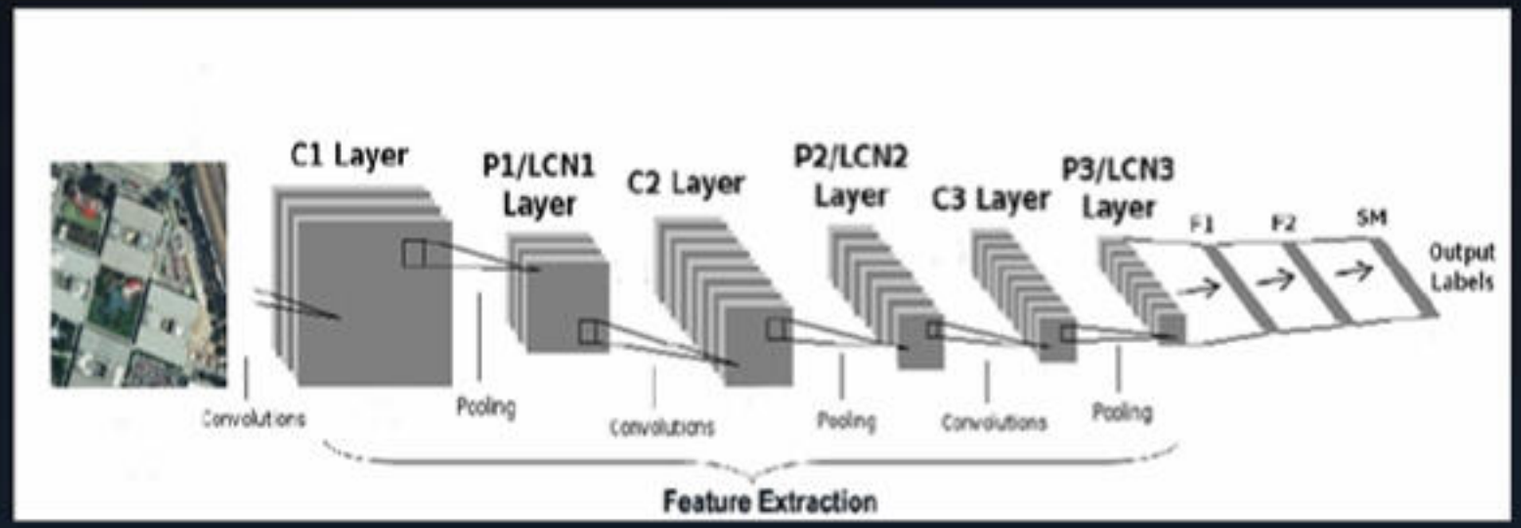
- Buildings, Roads, Automobiles

Example:
http://scs.ryerson.ca/~aharley/vis/conv/

aws

Le-Net

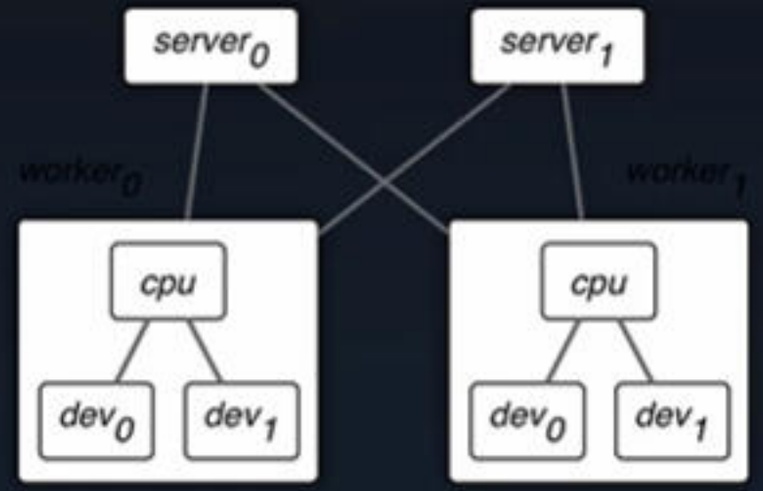
- Network Architecture
  - 3 Conv Layers
  - 3 Pooling Layers
  - 2FC Layers
  - 1 Classifier SoftMax
- Optimizer
  - SGD → ADAM
- Hyperparameters
  - learning_rate: 0.1
  - momentum: 0.9
- Batch Size: 16 , Epochs: 500
- TTT = 13m



Training Across Multiple GPUs with SageMaker and MXNet

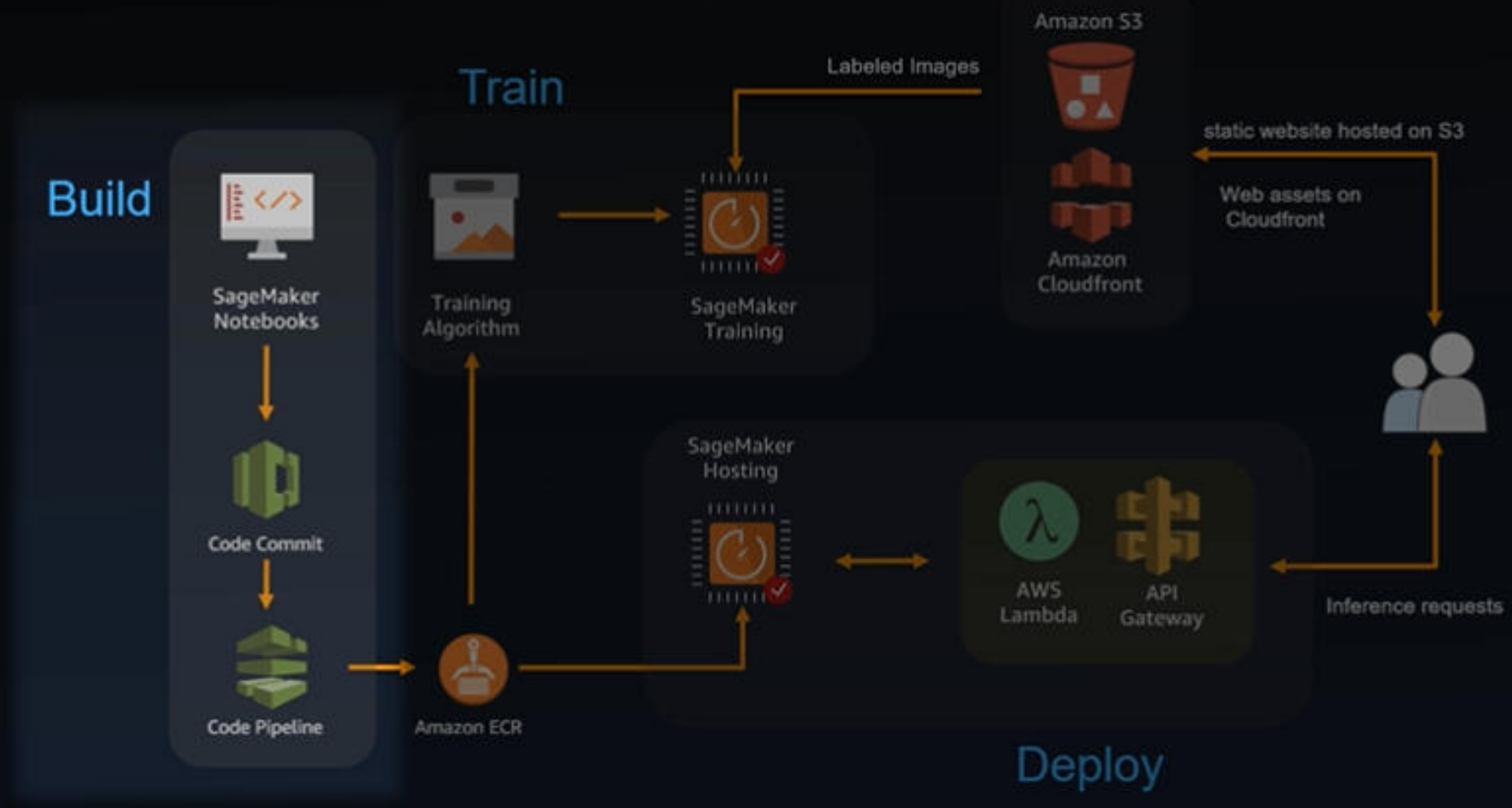
You can run a multi-machine, distributed MXNet training using the MXNet Estimator.

- When you run multi-machine training, SageMaker will import your training script and invoke train on each host in the cluster.
- When using an MXNet Estimator, SageMaker automatically starts MXNet kvstore server and scheduler processes on hosts in your training job cluster.



aws

SageMaker Sample End-to-End Architecture: SAR Image Classification



Amazon SageMaker | Home | SageMaker_mx_lenet(2)

Secure | https://us-west-2.console.aws.amazon.com/sagemaker/home?region=us-west-2#/notebook-instances

aws | Services | Resource Groups | Oregon | Support

Amazon SageMaker

- Dashboard
- Notebook
  - Notebook instances
  - Lifecycle configurations
- Training
  - Training jobs
  - Hyperparameter tuning jobs
- Inference
  - Models
  - Endpoint configurations
  - Endpoints

Amazon SageMaker > Notebook instances

Notebook instances

Open | Start | Update settings | Actions | Create notebook instance

Search notebook instances

1

Name	Instance	Creation time	Status	Actions
AIWorkshop	ml.m4.4xlarge	May 30, 2018 18:55 UTC	InService	Open | Stop
Jupyter	ml.p2.xlarge	Dec 04, 2017 21:03 UTC	InService	Open | Stop

Feedback | English (US)

 Privacy Policy | Terms of Use

Amazon SageMaker | Home | SageMaker_mx_lenet(2)

Secure | https://jupyter.notebook.us-west-2.sagemaker.aws/notebooks/SageMaker_mx_lenet(2).ipynb

jupyter SageMaker_mx_lenet(2) Last Checkpoint: 04/12/2018 (autosaved)

File Edit View Insert Cell Kernel Widgets Help | Trusted | conda_mxnet_p36

Code

```
    num_gpus: apply to the same rule above
    '''
    train_iter, val_iter = prep_data(data_path)
    lenet = mx_lenet()
    lenet_model = mx.mod.Module(
        symbol=lenet,
        context=get_train_context(num_cpus, num_gpus))
    logging.getLogger().setLevel(logging.DEBUG)
    lenet_model.fit(train_iter,
                    eval_data=val_iter,
                    kvstore=kvstore,
                    optimizer='ADAM',
                    optimizer_params={'learning_rate': 0.1, 'momentum': 0.9},
                    eval_metric='acc',
                    batch_end_callback=mx.callback.Speedometer(batch_size, 10),
                    num_epoch=100)
    return lenet_model



def get_train_context(num_cpus, num_gpus):
    '''
    Define the model training instance.
    Parameters
    ----------
    num_cpus: If train the model on an aws GPS machine, num_cpus = 0 and num_gpus = 1, vice versa.
    num_gpus: apply to the same rule above
    '''
    if num_gpus > 0:
        return mx.gpu()
    return mx.cpu()
def get_train_context(num_cpus, num_gpus):
    if num_gpus > 0:
        print("It's {} instance".format(num_gpus))
        return mx.gpu()
    print("It's {} instance".format(num_cpus))
    return mx.cpu()
```

```
Overwriting mx_lenet_sagemaker.py
```

In [2]:

```
%%time
from sagemaker.mxnet import MXNet
from sagemaker import get_execution_role

mxnet_estimator = MXNet("mx_lenet_sagemaker.py",
                        role=get_execution_role(),
                        train_instance_type="ml.p2.8xlarge",
                        train_instance_count=1)
mxnet_estimator.fit("s3://bucketexample") ## give your s3 bucket URL here.
```

14:42 / 17:05