

Intel® AI DevCon 2018



INTEL AI DEVCON 2018
SAN FRANCISCO | MAY 23-24

AWS DeepLens Workshop: Building a Computer Vision App

Jyothi Nookula - Senior Product Manager, Amazon Web Services

May 23rd 2018



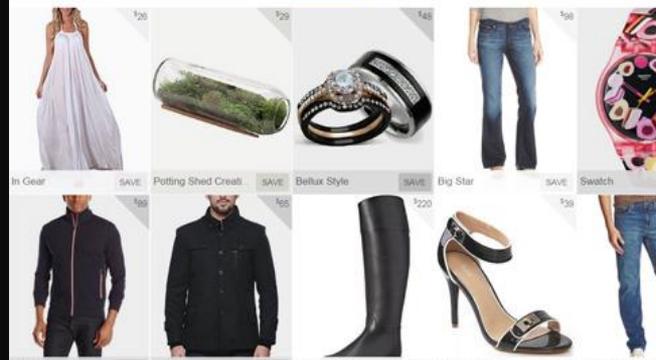
AWS DeepLens
is not a
video camera ...

It's the
world's first
deep learning
enabled
developer kit



Beautiful things, updated daily

ALL WOMEN MEN YOUR SAVES



Artificial Intelligence at Amazon



THE 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

Get Started with Sample Projects

Artistic style transfer



Object detection



Face detection / recognition



Activity detection



Hot dog / not hot dog



Cat vs. dog



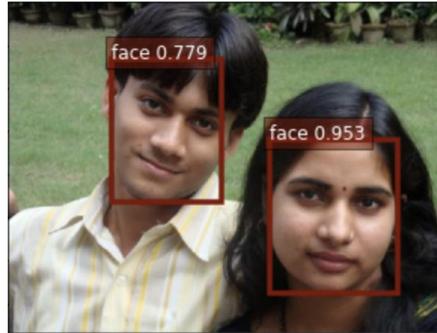
Add **custom functionality**
Or
Create your **own project**

Today We Will Cover

1. Machine learning overview



2. Training a model in Amazon SageMaker



3. Deploying a model to AWS DeepLens



4. Extending a project



AWS Lambda



Amazon S3



Amazon Rekognition

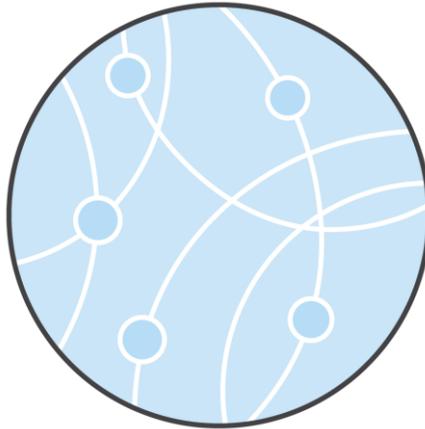
1. Machine Learning Overview



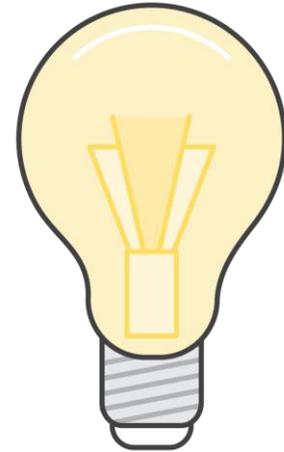
Overview of Deep Learning



Data

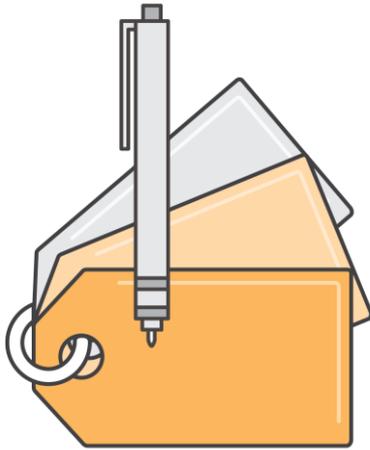


Model training

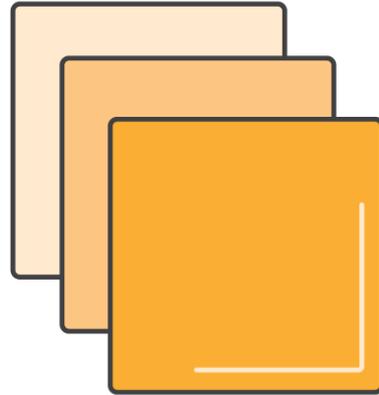


Inference

Data



Annotate



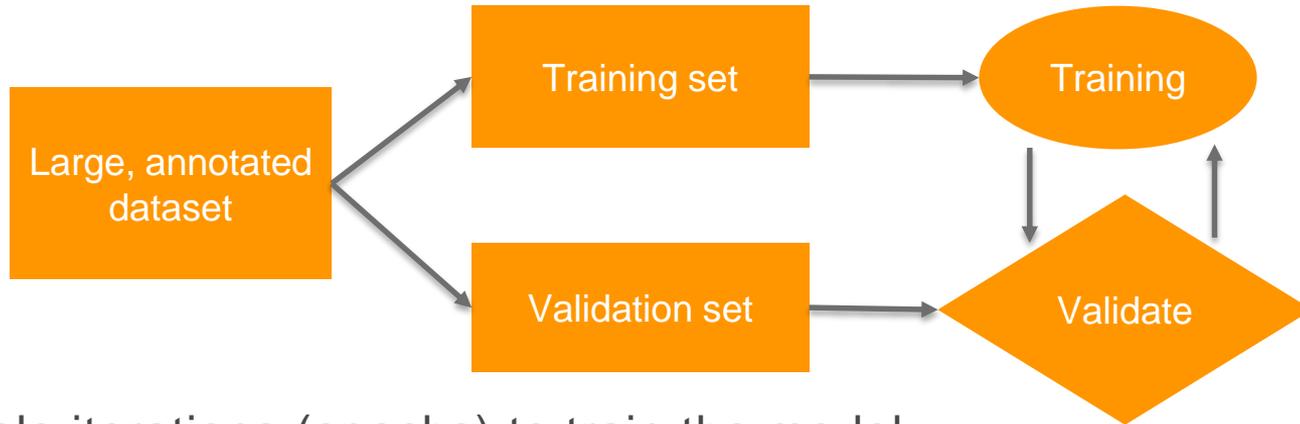
Preprocess



Data split

Model Training

- Define model architecture
- Input the annotated and cleaned data into the model



- Multiple iterations (epochs) to train the model
- Validate with held back dataset

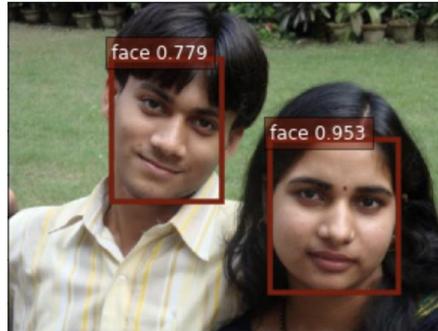
Inference

It's where the magic happens!

1. Preprocess the new data or image just like a training set.
2. Feed image back to the trained model to get a predicted output.

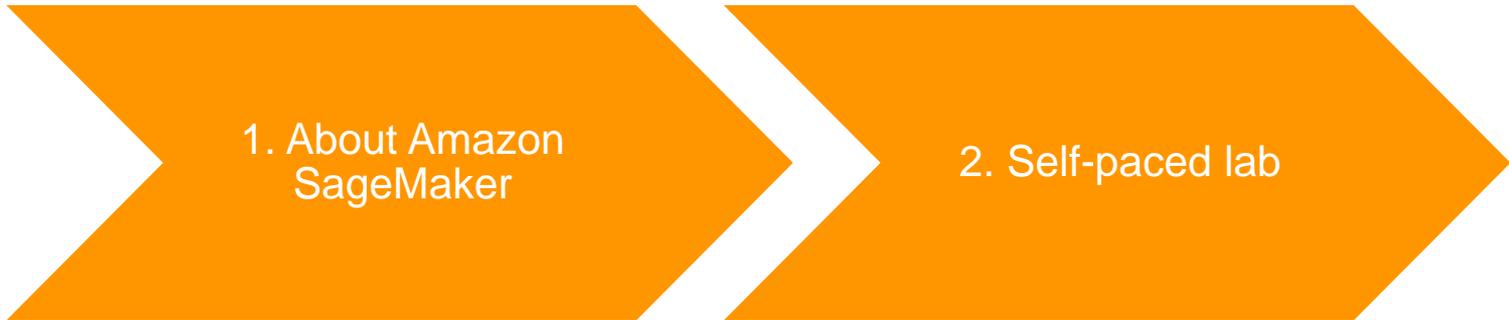


2. Training a Model in Amazon SageMaker



Lab #1: Training a Model in Amazon SageMaker

- Objective: You will learn how to build and train a face recognition model
- Time: 40 min.
- Steps:



Amazon SageMaker



Pre-built notebooks for common problems



Built-in, high-performance algorithms



One-click training



Hyperparameter optimization



One-click deployment



Fully managed hosting with auto-scaling

Build

Train

Deploy

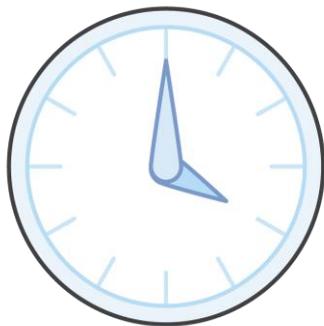
Lab Details – Amazon SageMaker

The self-paced lab will include the following steps:

1. Import a prepared Jupyter Notebook into Amazon SageMaker.
2. The notebook walks you through building a face recognition model in Amazon SageMaker.
3. Create an S3 bucket, and export the updated model there.

Self-Paced Lab – #1

1. Turn on DeepLens/ if it is turned on- access monitor and open Firefox
2. Find the instructions manual here: <https://github.com/fibonacci/DeepLens-workshops>
3. Access Hands-on Lab 1 tutorial



40 minutes

IMPORTANT NOTE!

Please ensure you STOP the SageMaker notebook instance to avoid ongoing charges to your AWS account.

The screenshot shows the AWS SageMaker console interface. At the top, there's a navigation bar with the AWS logo, 'Services', 'Resource Groups', and user information. A green notification banner at the top reads: "Success! Your notebook instance is being created. Open the notebook instance when status is InService and open a template notebook to get started." Below this, the 'Amazon SageMaker' sidebar is visible on the left, with 'Notebook instances' selected. The main content area shows a list of notebook instances. The table below contains the following data:

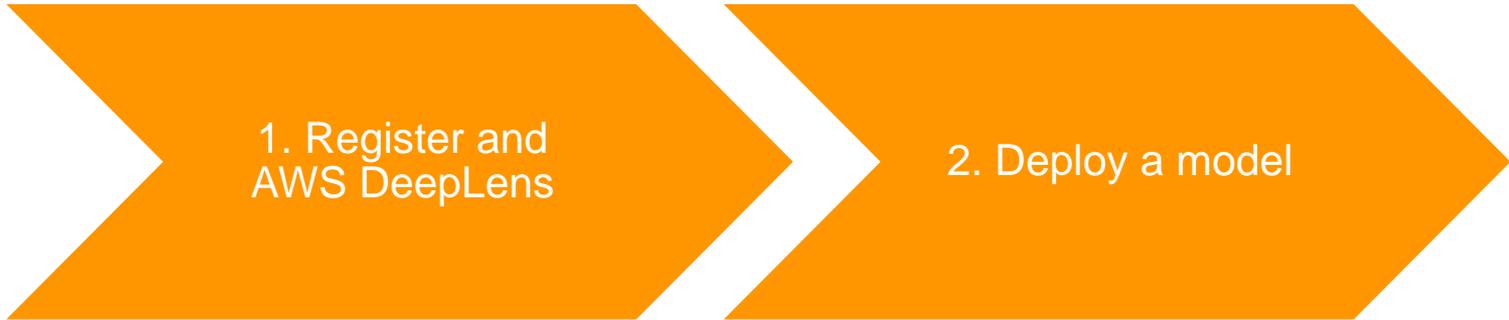
Name	Instance	Creation time	Status	Actions
SR-TEST	ml.t2.medium	May 22, 2018 20:53 UTC	InService	Open Stop
test2	ml.p3.2xlarge	May 05, 2018 00:01 UTC	InService	Open Stop
test	ml.p2.xlarge	May 05, 2018 00:00 UTC	Stopped	Start
face-detection	ml.t2.large	Apr 12, 2018 18:42 UTC	Stopped	Start

3. Deploying a Model to DeepLens



Lab #2: Deploying a Model to AWS DeepLens

- Objective: You will learn how to configure AWS DeepLens and deploy a model
- Time: 40 min.
- Steps:



Follow Along Instructions

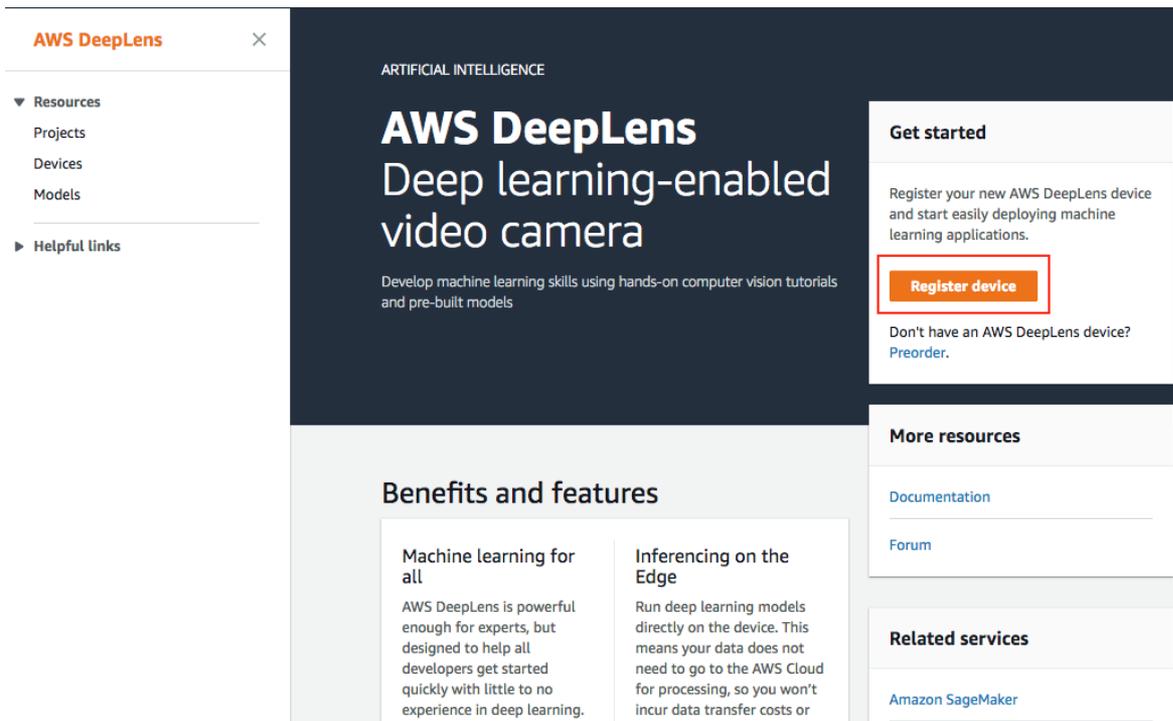
1. Find the instructions manual here: <https://github.com/fibonacci/DeepLens-workshops>
2. Access Hands-on Lab 2: Register your DeepLens and deploy to device



We're going to use the AWS DeepLens connected to the monitor and keyboard for device registration.

Register AWS DeepLens

1. Choose Register device.



The screenshot shows the AWS DeepLens website interface. On the left is a navigation sidebar with the following items: 'AWS DeepLens' (with a close button), 'Resources' (expanded), 'Projects', 'Devices', 'Models', and 'Helpful links'. The main content area has a dark blue header with 'ARTIFICIAL INTELLIGENCE' and 'AWS DeepLens Deep learning-enabled video camera'. Below the header is a sub-header 'Benefits and features' with two columns: 'Machine learning for all' and 'Inferencing on the Edge'. On the right side, there are three sections: 'Get started' with a 'Register device' button highlighted by a red box, 'More resources' with links for 'Documentation' and 'Forum', and 'Related services' with a link for 'Amazon SageMaker'.

ARTIFICIAL INTELLIGENCE

AWS DeepLens

Deep learning-enabled video camera

Develop machine learning skills using hands-on computer vision tutorials and pre-built models

Get started

Register your new AWS DeepLens device and start easily deploying machine learning applications.

[Register device](#)

Don't have an AWS DeepLens device? [Preorder.](#)

More resources

[Documentation](#)

[Forum](#)

Related services

[Amazon SageMaker](#)

Benefits and features

Machine learning for all
AWS DeepLens is powerful enough for experts, but designed to help all developers get started quickly with little to no experience in deep learning.

Inferencing on the Edge
Run deep learning models directly on the device. This means your data does not need to go to the AWS Cloud for processing, so you won't incur data transfer costs or

Register AWS DeepLens

2. Provide a name for your device, for example, *yourname-sf-AIDC*
3. Choose **Next**.

DeepLens > Devices > Register a DeepLens device

Step 1
Name device

Step 2
Set permissions

Step 3
Download certificate

Name device

Device

Device name

The AWS DeepLens device name can contain alphanumeric characters and hyphens. It must be no longer than 100 characters.

 AWS DeepLens is an AWS service offering. Your use of the device is governed by the terms and policies located at <https://aws.amazon.com/legal>.

Cancel **Next**

Manage Permissions

DeepLens > Devices > Register a DeepLens device

Step 1
Name device

Step 2
Set permissions

Step 3
Download certificate

Set permissions

Permissions Refresh IAM roles

These IAM roles grant the AWS DeepLens service permissions it needs to create required resources and make calls on your behalf. [Learn more](#)

IAM role for AWS DeepLens
This role grants the AWS DeepLens service permissions it needs to create required resources and make calls on your behalf.

[Create a role in IAM](#)

IAM role for AWS Greengrass
AWS Greengrass helps deploy AWS Lambda functions to devices for local execution of applications. This role grants the AWS Greengrass service permissions it needs to create required resources and make calls on your behalf. We will pass this role to AWS Greengrass.

[Create a role in IAM](#)

IAM group role for AWS Greengrass
This role grants Lambda functions running on the device the permissions it needs to interact with AWS. We will pass this role to AWS Greengrass.

[Create a role in IAM](#)

IAM role for Amazon SageMaker
Amazon SageMaker helps build and train machine learning models, to be directly deployed into a hosted environment. Apart from model training, Amazon SageMaker helps AWS DeepLens with optimizing the model to be deployed to the device. This role grants Amazon SageMaker permissions it needs to read input from S3 and write logs/metrics. We will pass this role to Amazon SageMaker.

[Create a role in IAM](#)

IAM role for AWS Lambda
AWS Lambda lets you run code without provisioning or managing servers. AWS Lambda requires a role to create AWS Lambda functions. We will pass this role to AWS Lambda.

[Create a role in IAM](#)

Cancel Previous Next

Manage Permissions

Create role



Review

Provide the required information below and review this role before you create it.

Role name*

Maximum 64 characters. Use alphanumeric and '+,=,@,-_' characters.

Role description

Maximum 1000 characters. Use alphanumeric and '+,=,@,-_' characters.

Trusted entities AWS service: deeplens.amazonaws.com

Policies



[AWSDeepLensServiceRolePolicy](#)

* Required

Cancel

Previous

Create role

Manage Permissions

DeepLens > Devices > Register a DeepLens device

Set permissions

Permissions Refresh IAM roles

These IAM roles grant the AWS DeepLens service permissions it needs to create required resources and make calls on your behalf. [Learn more](#)

IAM role for AWS DeepLens
This role grants the AWS DeepLens service permissions it needs to create required resources and make calls on your behalf.

AWSDeepLensServiceRole

[Create a role in IAM](#)

IAM role for AWS Greengrass
AWS Greengrass helps deploy AWS Lambda functions to devices for local execution of applications. This role grants the AWS Greengrass service permissions it needs to create required resources and make calls on your behalf. We will pass this role to AWS Greengrass.

Choose a role

[Create a role in IAM](#)

IAM group role for AWS Greengrass
This role grants Lambda functions running on the device the permissions it needs to interact with AWS. We will pass this role to AWS Greengrass.

Choose a role

[Create a role in IAM](#)

Manage Permissions

Permissions

Refresh IAM roles

These IAM roles grant the AWS DeepLens service permissions it needs to create required resources and make calls on your behalf. [Learn more](#)

IAM role for AWS DeepLens
This role grants the AWS DeepLens service permissions it needs to create required resources and make calls on your behalf.

AWSDeepLensServiceRole

[Create a role in IAM](#)

IAM role for AWS Greengrass
AWS Greengrass helps deploy AWS lambda functions to devices for local execution of applications. This role grants the AWS Greengrass service permissions it needs to create required resources and make calls on your behalf. We will pass this role to AWS Greengrass.

AWSDeepLensGreengrassRole

[Create a role in IAM](#)

IAM group role for AWS Greengrass
This role grants Lambda functions running on the device the permissions it needs to interact with AWS. We will pass this role to AWS Greengrass.

AWSDeepLensGreengrassGroupRole

[Create a role in IAM](#)

IAM role for Amazon SageMaker
Amazon SageMaker helps build and train machine learning models, to be directly deployed into a hosted environment. Apart from model training, Amazon SageMaker helps AWS DeepLens with optimizing the model to be deployed to the device. This role grants Amazon SageMaker permissions it needs to read input from S3 and write logs/metrics. We will pass this role to Amazon SageMaker.

AWSDeepLensSageMakerRole

[Create a role in IAM](#)

IAM role for AWS Lambda
AWS Lambda lets you run code without provisioning or managing servers. AWS Lambda requires a role to create AWS Lambda functions. We will pass this role to AWS Lambda.

AWSDeepLensLambdaRole

[Create a role in IAM](#)

Cancel Previous Next

Download Certificate

1. Choose **Download certificate**.
2. Choose **Finish**.

DeepLens > Devices > Register a DeepLens device

Download certificate

Certificate

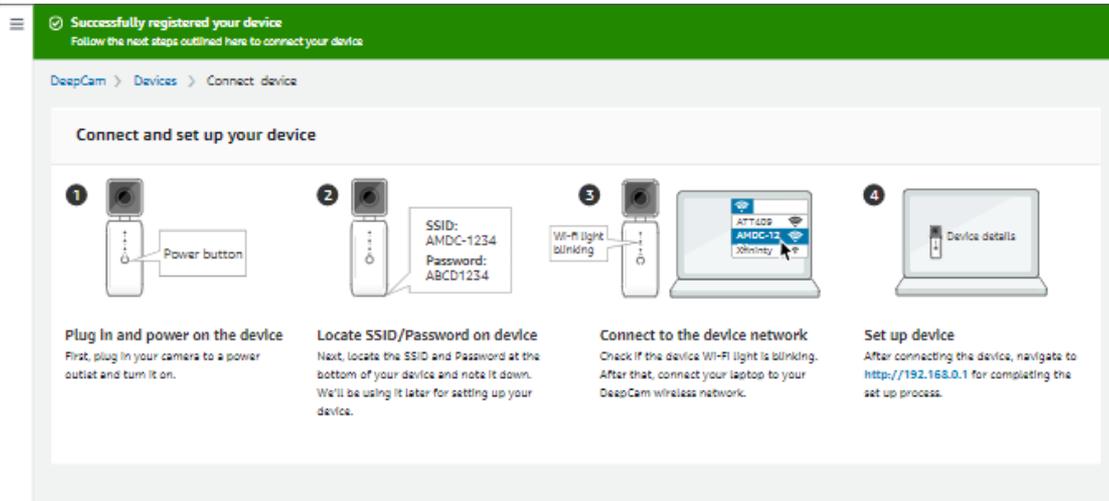
Download this certificate. You'll use it later to complete registration. You'll need to connect to the device and attach the certificate. **You won't be able to download it after you leave this page.**

Download certificate

Cancel Previous Register

Configure AWS DeepLens

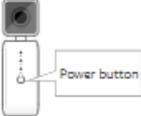
1. Find the reset pin in the back of the AWS DeepLens device.
2. Use the provided pin to reset the device. You should hear a click.
3. The middle LED (Wi-Fi) will be blinking.
4. Connect to 192.168.0.1.



Successfully registered your device
Follow the next steps outlined here to connect your device

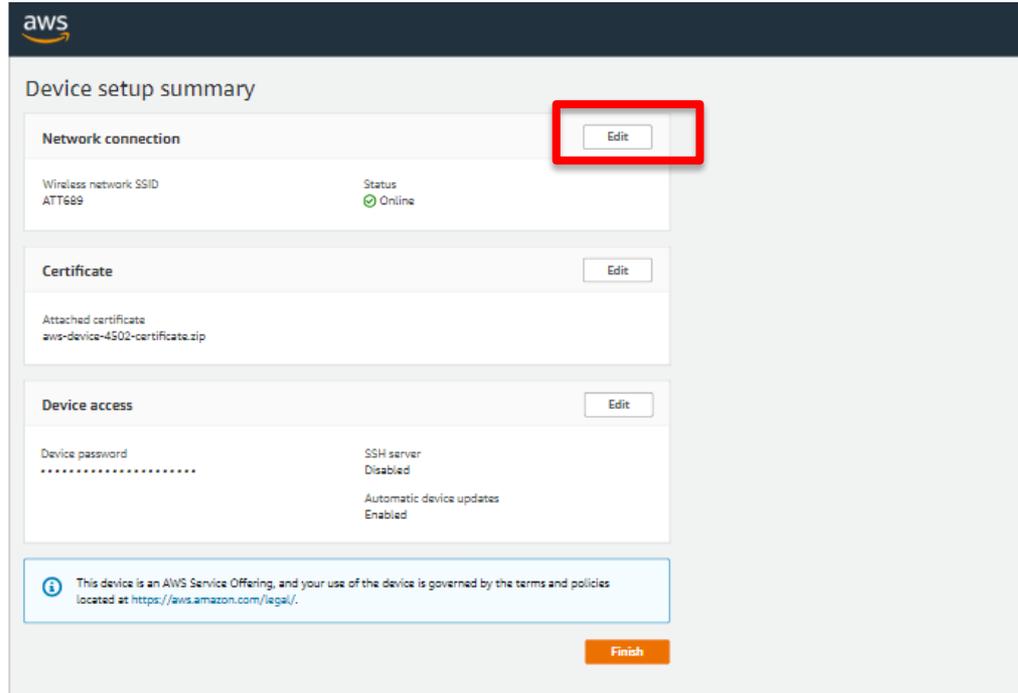
DeepCam > Devices > Connect device

Connect and set up your device

- 1** 
Plug In and power on the device
First, plug in your camera to a power outlet and turn it on.
- 2** 
Locate SSID/Password on device
Next, locate the SSID and Password at the bottom of your device and note it down. We'll be using it later for setting up your device.
- 3** 
Connect to the device network
Check if the device Wi-Fi light is blinking. After that, connect your laptop to your DeepCam wireless network.
- 4** 
Set up device
After connecting the device, navigate to <http://192.168.0.1> for completing the set up process.

Configure AWS DeepLens

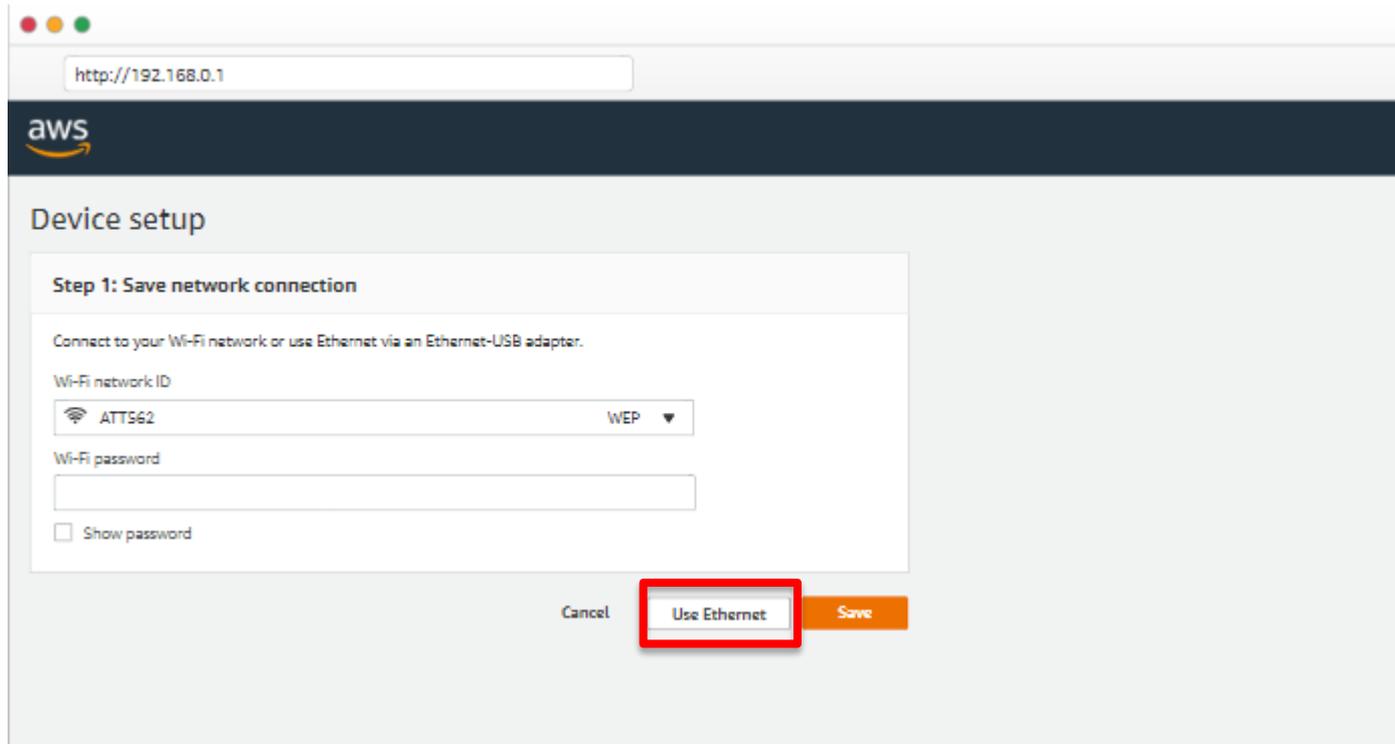
5. For Network connection, choose Edit.



The screenshot displays the AWS DeepLens device setup summary page. The page is titled "Device setup summary" and features three main sections: "Network connection", "Certificate", and "Device access". Each section has an "Edit" button. The "Network connection" section is highlighted with a red box, and its "Edit" button is also highlighted with a red box. The "Network connection" section shows "Wireless network SSID" as "ATT689" and "Status" as "Online". The "Certificate" section shows "Attached certificate" as "aws-device-4502-certificate.zip". The "Device access" section shows "Device password" as ".....", "SSH server" as "Disabled", and "Automatic device updates" as "Enabled". At the bottom of the page, there is a "Finish" button and a blue information box with a question mark icon and text: "This device is an AWS Service Offering, and your use of the device is governed by the terms and policies located at <https://aws.amazon.com/legal/>."

Configure AWS DeepLens

6. Choose **Use Ethernet**.



The screenshot shows a web browser window with the URL `http://192.168.0.1`. The page features the AWS logo and a section titled "Device setup". Within this section, a dialog box titled "Step 1: Save network connection" is displayed. The dialog contains the instruction "Connect to your Wi-Fi network or use Ethernet via an Ethernet-USB adapter." Below this, there are fields for "Wi-Fi network ID" (containing "ATTS62" and a "WEP" dropdown) and "Wi-Fi password" (an empty field). A "Show password" checkbox is also present. At the bottom of the dialog, there are three buttons: "Cancel", "Use Ethernet" (which is highlighted with a red rectangular box), and "Save".

Configure AWS DeepLens

7. For **Certificate**, choose **Edit**.

The screenshot shows the AWS DeepLens 'Device setup summary' page. It features three main sections: 'Network connection', 'Certificate', and 'Device access'. The 'Certificate' section is highlighted with a red box, and its 'Edit' button is also highlighted with a red box. The 'Network connection' section shows 'Wireless network SSID' as 'ATT689' and 'Status' as 'Online'. The 'Device access' section shows 'Device password' as '.....', 'SSH server' as 'Disabled', and 'Automatic device updates' as 'Enabled'. A 'Finish' button is located at the bottom right of the page.

Network connection Edit

Wireless network SSID: ATT689 Status: Online

Certificate Edit

Attached certificate: aws-device-4502-certificate.zip

Device access Edit

Device password: SSH server: Disabled

Automatic device updates: Enabled

This device is an AWS Service Offering, and your use of the device is governed by the terms and policies located at <https://aws.amazon.com/legal/>.

Finish

Configure AWS DeepLens

8. Upload the .zip file you downloaded during registration.

9. Choose **Next**.

The screenshot shows the AWS DeepLens 'Device setup' interface. At the top, there is a URL input field containing 'http://192.168.0.1'. Below this is the AWS logo. The main heading is 'Device setup'. On the left, a sidebar lists three steps: 'Step 1: Save network connection', 'Step 2: Upload certificate' (which is the current step), and 'Step 3: Configure device access'. The main content area for Step 2 is titled 'Step 2: Upload certificate' and contains the instruction: 'To enable your device to connect to AWS, find the certificate that you downloaded from the management console and upload it to your device. By default, it's saved as a .zip file in your Downloads directory.' Below this instruction is a 'Certificate' label and a text input field containing the filename 'aws-device-4502-certificate.zip'. To the right of the input field is a 'Browse' button. At the bottom right of the page, there are two buttons: 'Back' and 'Next'. The 'Next' button is highlighted with a red border.

Configure AWS DeepLens

10. Choose Finish.

The screenshot displays the 'Device setup summary' page in the AWS DeepLens console. The page is divided into three main sections, each with an 'Edit' button:

- Network connection:** Shows 'Wireless network SSID' as 'ATT689' and 'Status' as 'Online' with a green checkmark.
- Certificate:** Shows 'Attached certificate' as 'aws-device-4502-certificate.zip'.
- Device access:** Shows 'Device password' as a series of dots, 'SSH server' as 'Disabled', and 'Automatic device updates' as 'Enabled'.

At the bottom of the page, there is a blue information box with a white 'i' icon and the text: 'This device is an AWS Service Offering, and your use of the device is governed by the terms and policies located at <https://aws.amazon.com/legal/>.' Below this box, the 'Finish' button is highlighted with a red rectangular border.

Run this step before moving ahead

1. Open **Terminal**, and run this command:

```
sudo systemctl restart greengrassd.service --no-block
```

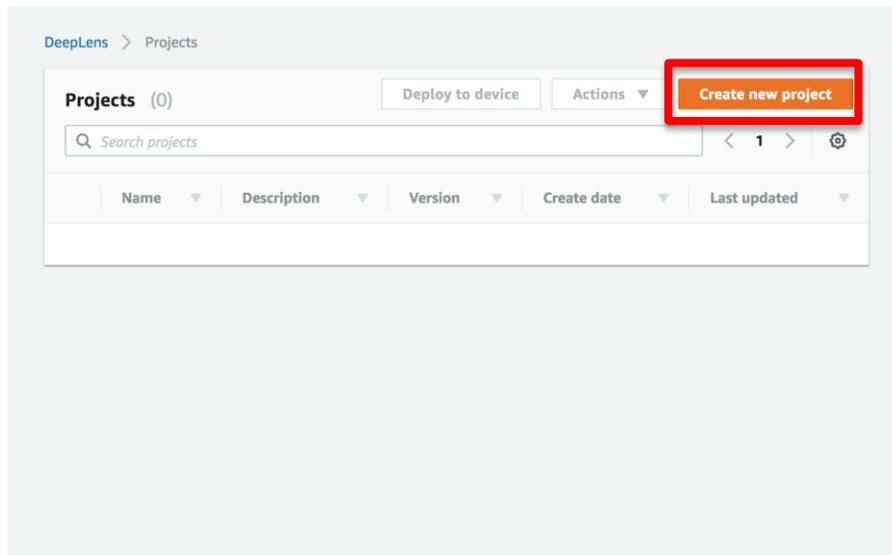
Now, It's Time to Create a Project

1. Log in to the AWS DeepLens console.

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

This is the AWS DeepLens console.

2. Choose **Create Project**.



Use a Face Detection Sample

3. Select **Use a project template**.
4. Select **Face detection** from sample project templates.
5. Choose **Next** at the bottom of screen.

The screenshot displays the AWS SageMaker console interface. At the top, there are two tabs: "Use a project template" (highlighted with a red box) and "Create a new blank project". Below the tabs is a section titled "Project templates" containing four cards. The "Face detection" card is highlighted with a red box. Each card includes a representative image, a title, and a brief description of the template's function.

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

- Object detection**
Detect 20 popular objects.
- Artistic style transfer**
Make your surroundings look like Van Gogh's paintings.
- Face detection**
Detect all faces in your surroundings.
- Hot dog recognition**
A hot dog or not a hot dog, that is the question.

Create a Project

6. Choose Create.

aws Services Resource Groups

DeepLens > Projects > Create project

Step 1
Choose project type

Step 2
Specify project details

Specify project details

Project information

Project name
Face-detection
The project name can contain alphanumeric characters and hyphens. It must be no longer than 100 characters.

Description - *Optional*
Detect all faces in your surroundings

Project content

A model contains the logic for your project. Lambda functions run instances of the model. Associate a model and at least one Lambda function with your project.

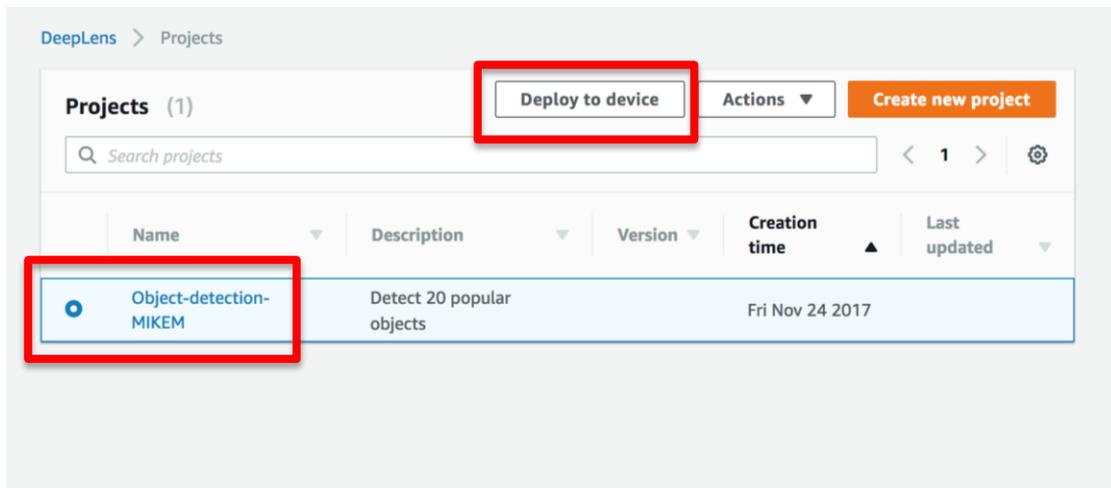
▶ Model	deeplens-face-detection	Remove
▶ Function	deeplens-face-detection	Remove

[Add model](#) | [Add function](#)

Cancel Previous **Create**

Deploy Project to the Device

- Find your project in the list (the one you just named).
- Choose the radio button.
- Choose **Deploy to device**.



The screenshot shows the AWS DeepLens interface for managing projects. The breadcrumb navigation at the top reads 'DeepLens > Projects'. Below this, there is a header section with 'Projects (1)' on the left, a 'Deploy to device' button in the center (highlighted with a red box), an 'Actions' dropdown menu, and a 'Create new project' button on the right. A search bar with the placeholder text 'Search projects' is located below the header. The main content area displays a table of projects with the following columns: Name, Description, Version, Creation time, and Last updated. The table contains one entry: 'Object-detection-MIKEM' with the description 'Detect 20 popular objects' and a creation time of 'Fri Nov 24 2017'. The 'Object-detection-MIKEM' project name and its corresponding radio button are highlighted with a red box.

Name	Description	Version	Creation time	Last updated
<input checked="" type="radio"/> Object-detection-MIKEM	Detect 20 popular objects		Fri Nov 24 2017	

Target Your Device

10. Select your device.

11. Choose **Review**.

Target device

Choose the device you want to deploy your project to.

Devices (1)

Search devices

< 1 > ⚙

Name ▾	Project ▾	Registration status ▾	Creation time ▲
<input checked="" type="radio"/> milleK9TB	-	✔ Completed	Fri Nov 24 2017

Cancel **Review**

Deploy!

12. Choose **Deploy**.

A note on costs ...



Review and deploy

Deployment check

AWS DeepLens will deploy the project below to your device. Choose Deploy to continue.

New project: Object-detection-MIKEM

Type	Name
Lambda	[arn:aws:lambda:us-east-1:742969847900:function:deeplens-object-detection:1]
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. [Learn more](#)

Cancel Previous **Deploy**

Feedback English (US) © 2008 - 2017, Amazon Web Services, Inc. or its affiliates. All rights reserved. Privacy Policy Terms of Use

Wait for the Project to be Deployed

Blue banner = Deployment in progress

- **Deployment of project Artistic-style-transfer, version 1.0 is in progress.**
Waiting for deployment workflow to begin.

Green banner = Deployment successful

- ✔ **Deployment of project Artistic-style-transfer, version 1.0 succeeded.**
Click on "View project stream" for instructions on how to view the filtered or transformed AWS DeepLens output.

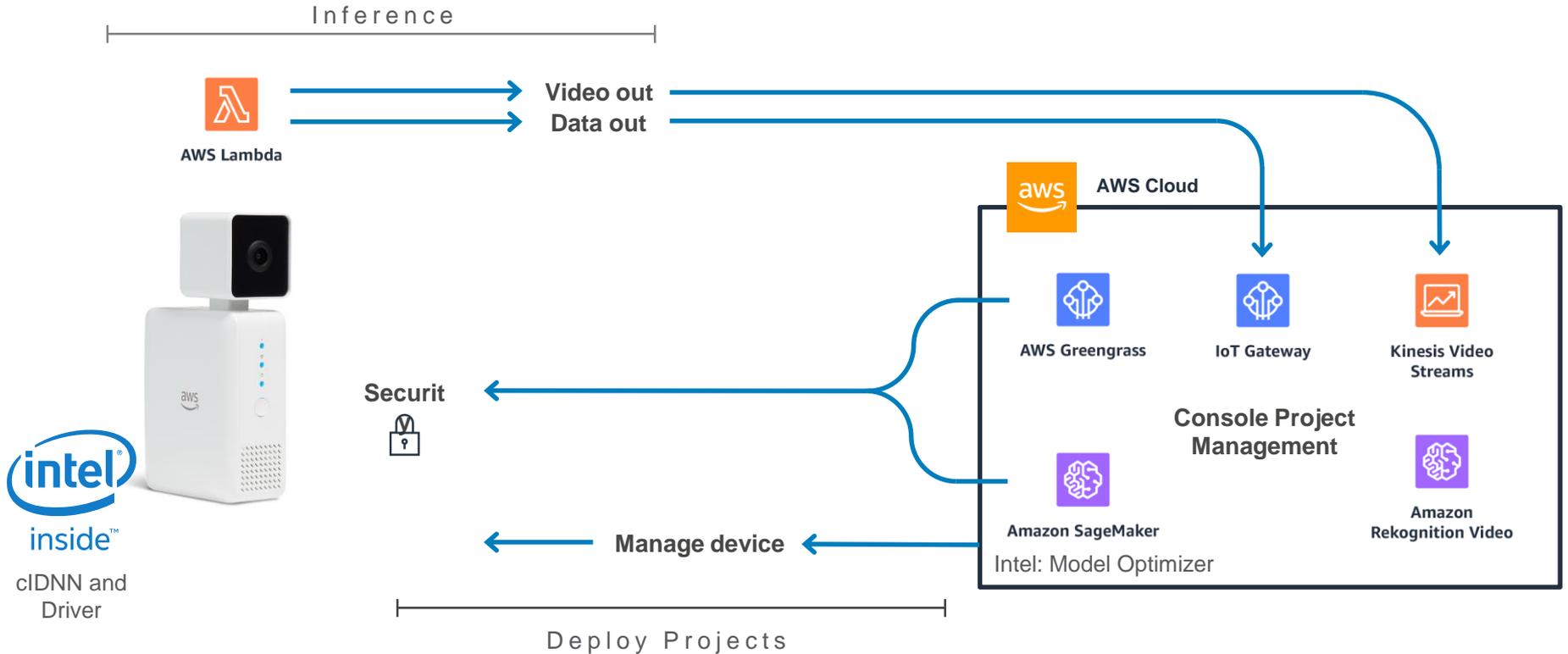
AWS DeepLens Specifications



- Intel Atom Processor
- Gen9 graphics
- Ubuntu OS- 16.04 LTS
- 100 GFLOPS performance
- Dual band Wi-Fi
- 8-GB RAM
- 16-GB storage (eMMC)
- 32-GB SD card
- 4 MP camera with MJPEG
- H.264 encoding at 1080p resolution
- 2 USB ports
- Micro HDMI
- Audio out
- AWS Greengrass preconfigured
- Intel cVNN Optimized for MXNet



AWS DeepLens Architecture

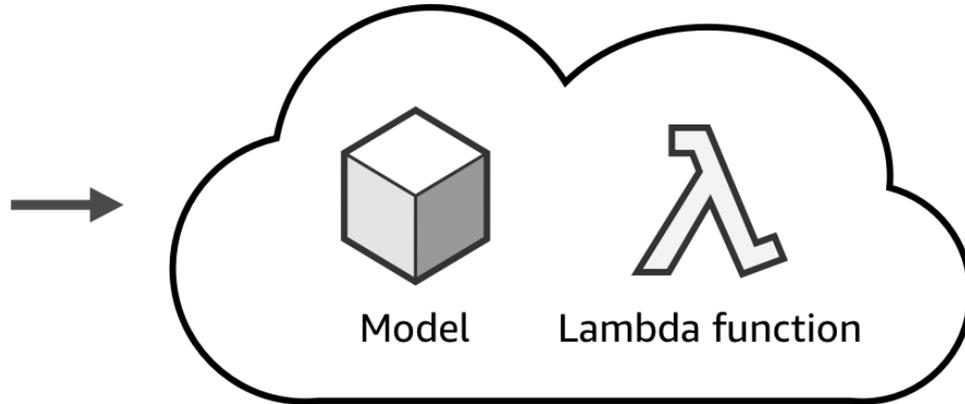


Under the Covers – Console

AWS DeepLens



Create project / Deploy project

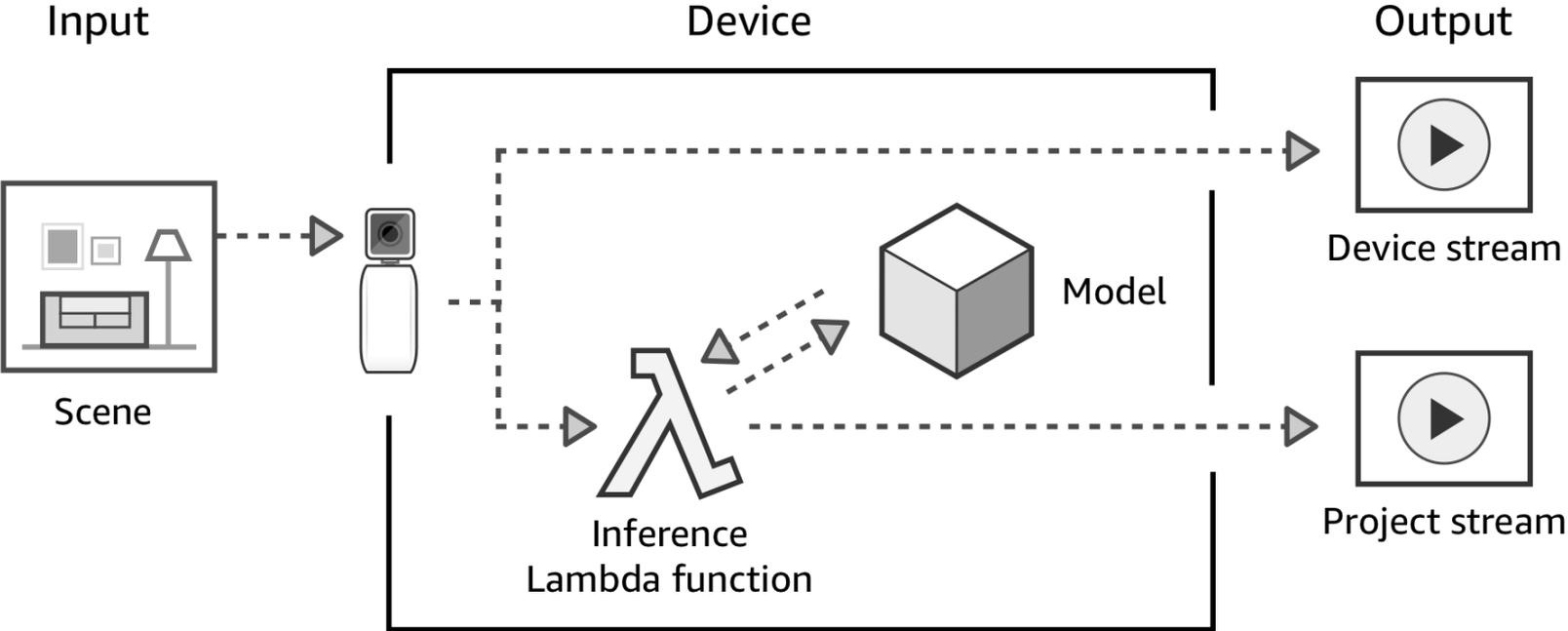


Device



Deploy

Under the Covers – Device



Let's go back to the console and view the output

13. Click **View project stream** for instructions.



Winners of the DeepLens Hackathon



First place



ReadToMe

Created by Alex Schultz

ReadToMe is a deep learning enabled application that is able to read books to kids. In this case, reading *Green Eggs and Ham*, by Dr. Seuss.

Second place



Dee

Created by Matthew Clark

Dee is a fun AWS DeepLens interactive device for children. The device asks children to answer questions by showing a picture of the answer.

Third place



SafeHaven

Created by Nathan Stone and Peter McLean

SafeHaven uses Alexa and AWS DeepLens to bring peace of mind for vulnerable people and their families.

View all 23 projects at: <https://aws.amazon.com/deeplens/community-projects>



4. Extending a Project: Audience Response Tracking with AWS





SUBMITTED TO



AWS DeepLens Challenge

CREATED BY



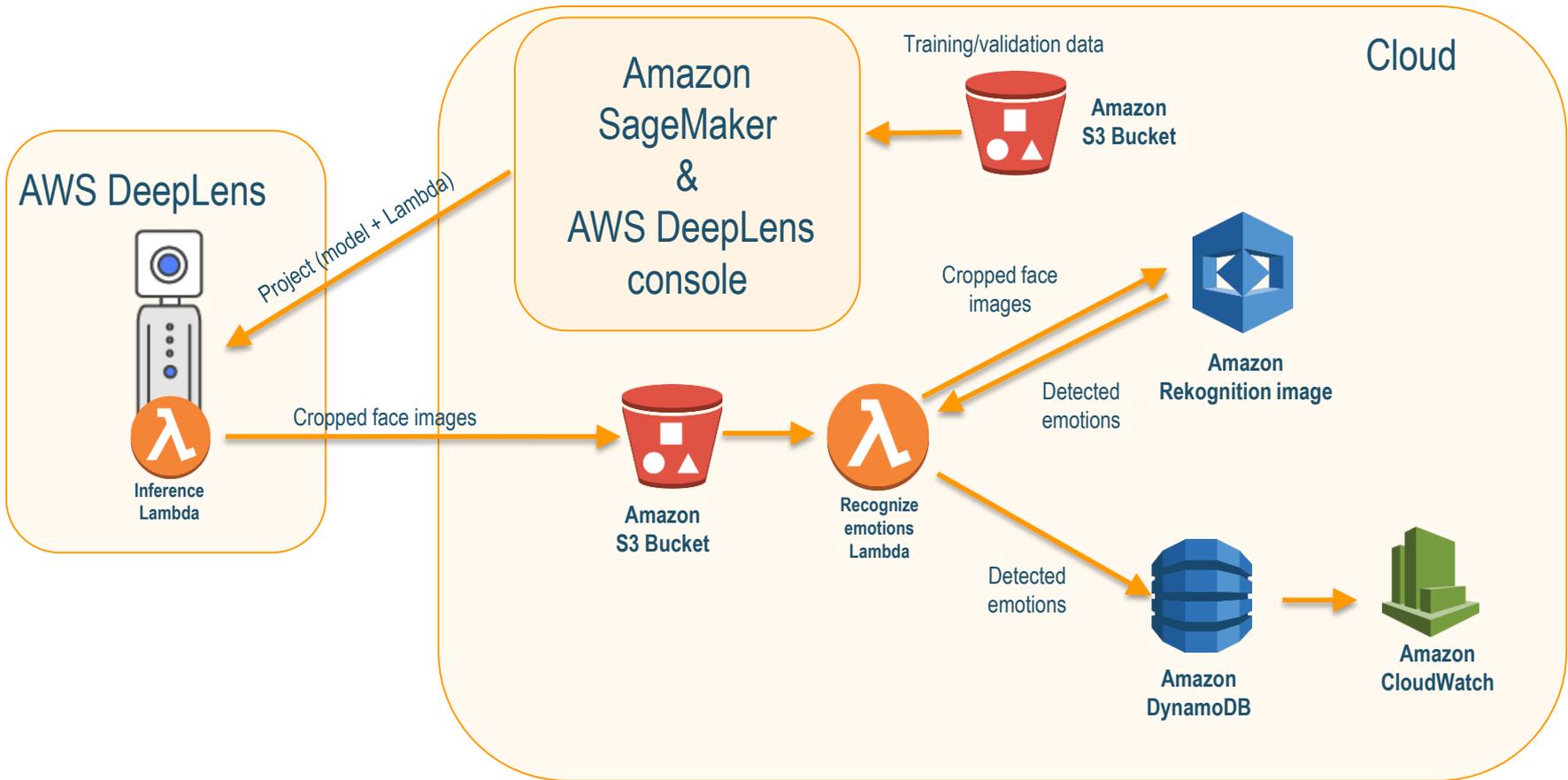
Ricardo Mota +



Jidesh
Veeramachaneni +

Report inappropriate content

Amazon statement regarding Amazon Rekognition: "our customers are really excited about how they can solve real world problems with Rekognition...as always, with all our services, we encourage our law enforcement customers to work with local government officials to develop acceptable use policies for facial recognition technologies that both protects the rights of citizens and enables law enforcement to do their job".



Now, let's see it in action.



WHAT'S NEW WITH AWS DEEPLENS



May 24th:

1. Introducing AWS DeepLens Tech Talk

Tell your friends to sign up now:

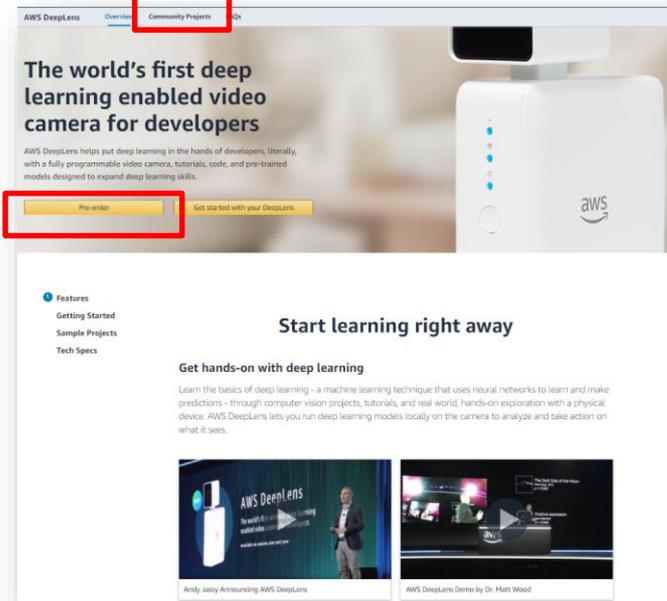
<https://aws.amazon.com/about-aws/events/>

June 14th:

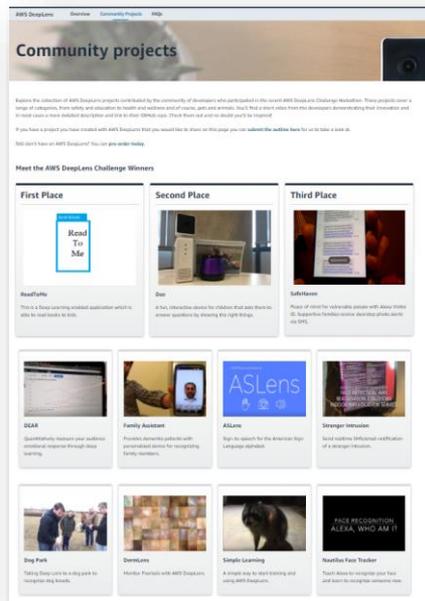
1. Shipping commences from Amazon.com
plus product updates and new features!

Thanks & Wrap-Up

Order your device
aws.amazon.com/deeplens/



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[aws.amazon.com/deeplens/
community-projects](https://aws.amazon.com/deeplens/community-projects)



Request a workshop
Work with your AWS account management team to request a hands-on Amazon SageMaker & AWS DeepLens workshop



Questions?





Thank you!