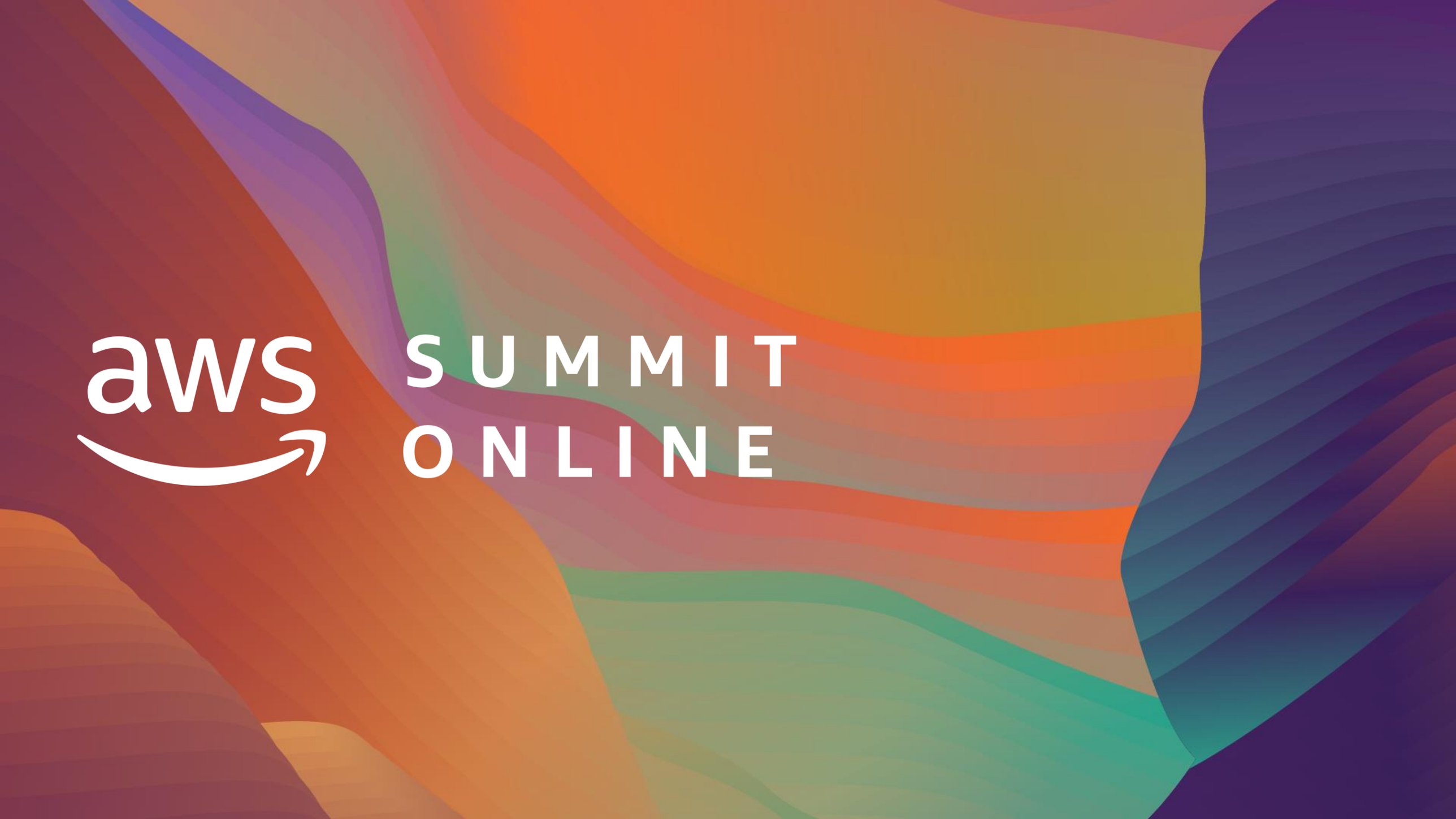
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Blackjack

Ramine Tinati
Senior AI/ML Advocate
Amazon Web Services

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Agenda

Machine learning (ML) on AWS

Building a custom image classification model

Solution demo

Wrap-up

ML on AWS

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Our mission at AWS

Put ML in the hands of every developer

Build your ML skills: No PhD required

Build now

AWS AI services
Multiple capabilities

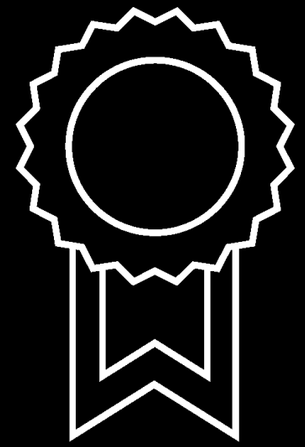
Learn hands-on

AWS DeepRacer
Reinforcement learning

AWS DeepLens
Deep learning

AWS DeepComposer
Generative adversarial networks (GANs)

Get certified



ML certification

The AWS ML stack

Broadest and most complete set of ML capabilities

AI services

Vision
- Amazon Rekognition

Speech
- Amazon Polly
- Amazon Transcribe *+Medical* NEW!

Text
- Amazon Comprehend *+Medical*
- Amazon Translate
- Amazon Textract

Search NEW!
- Amazon Kendra

Chatbots
- Amazon Lex

Personalization
- Amazon Personalize

Forecasting
- Amazon Forecast

Fraud NEW!
- Amazon Fraud Detector

Development NEW!
- Amazon CodeGuru

Contact centers NEW!
- Contact Lens *For Amazon Connect*

ML services

Amazon SageMaker

- Ground Truth
- Augmented AI
- ML Marketplace

Amazon SageMaker Studio IDE NEW!

- Built-in algorithms
- Notebooks NEW!
- Experiments NEW!
- Model training & tuning
- Debugger NEW!
- Autopilot NEW!
- Model hosting
- Model Monitor NEW!

Neo

ML frameworks & infrastructure

TensorFlow · mxnet · PYTORCH · GLUON · Keras · HOROVOD

Deep learning AMIs & containers | GPUs & CPUs | Amazon Elastic Inference | AWS Inferentia | FPGA

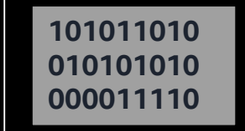
Amazon SageMaker helps you build, train, and deploy models

Prepare | **Build** | **Train & tune** | **Deploy & manage**

Web-based integrated development environment (IDE) for ML

Automatically build and train models

Fully managed data processing jobs and data labeling workflows



Collect and prepare training data

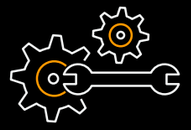
One-click collaborative notebooks and built-in, high-performance algorithms and models

Choose or build an ML algorithm

One-click training

Set up and manage environments for training

Debugging and optimization



Train, debug, and tune models

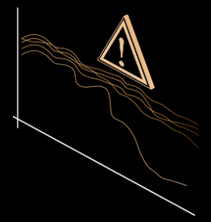
Visually track and compare experiments

Manage training runs

One-click deployment and automatic scaling

Deploy model in production

Automatically spot concept drift

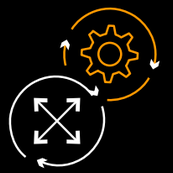


Monitor models

Add human review of predictions

Validate predictions

Fully managed with automatic scaling for 75% less



Scale manage the production environment

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Training a playing card detection neural network

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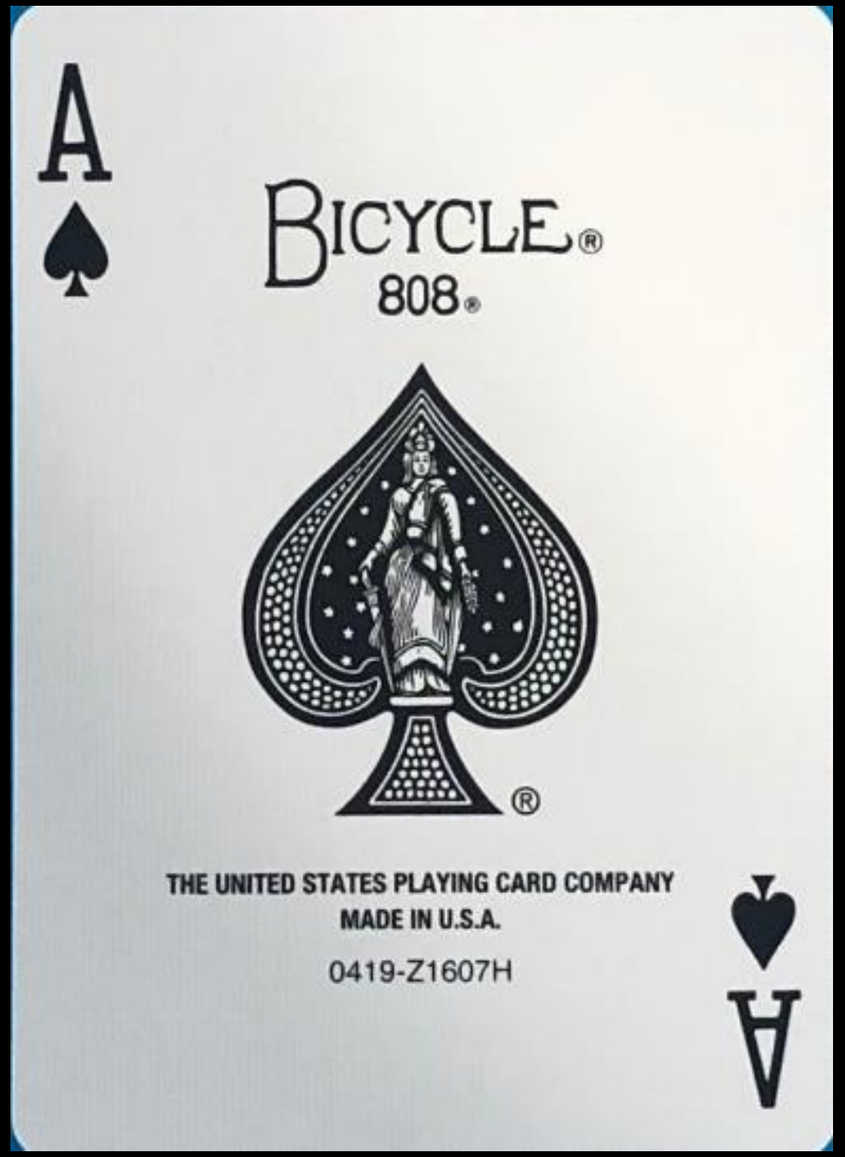
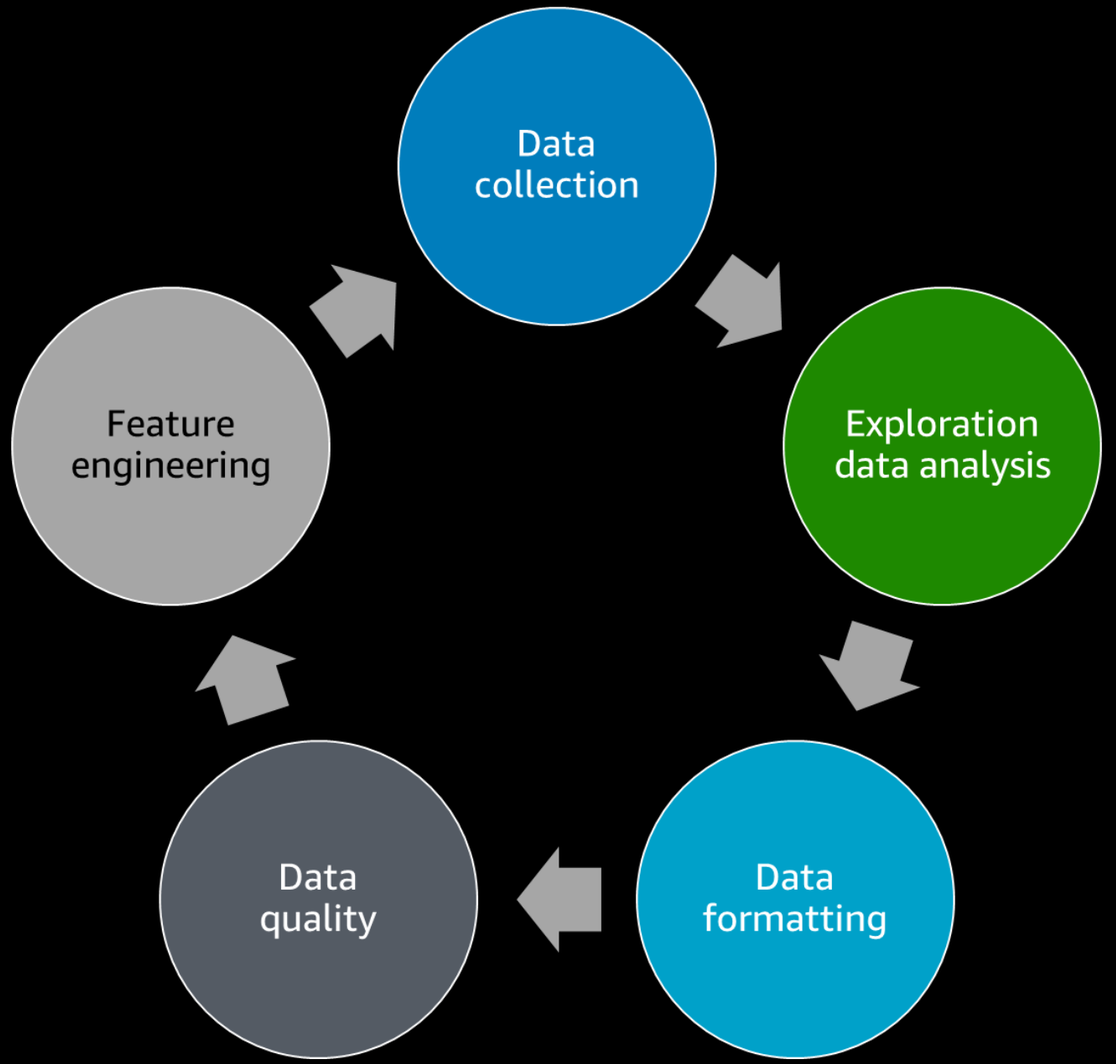
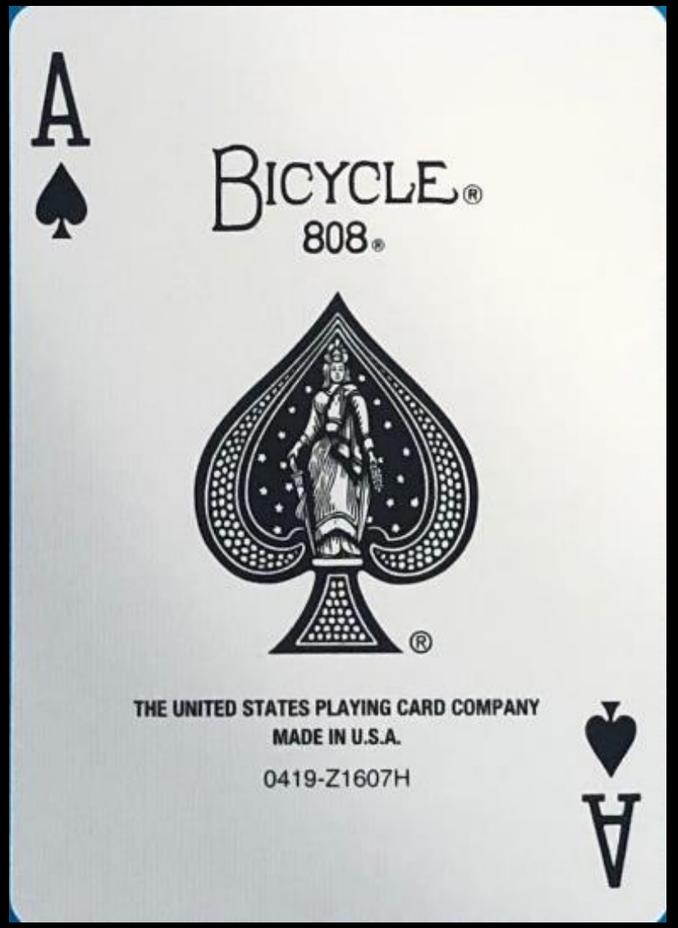


The development process



Capturing data



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Data challenges

Environment challenges

Final dataset

Data augmentation used to generate many different types of data

400,000 images generated from an initial size of 52 cards

Blur, skew, distortion, and background layering can be used to generate more samples

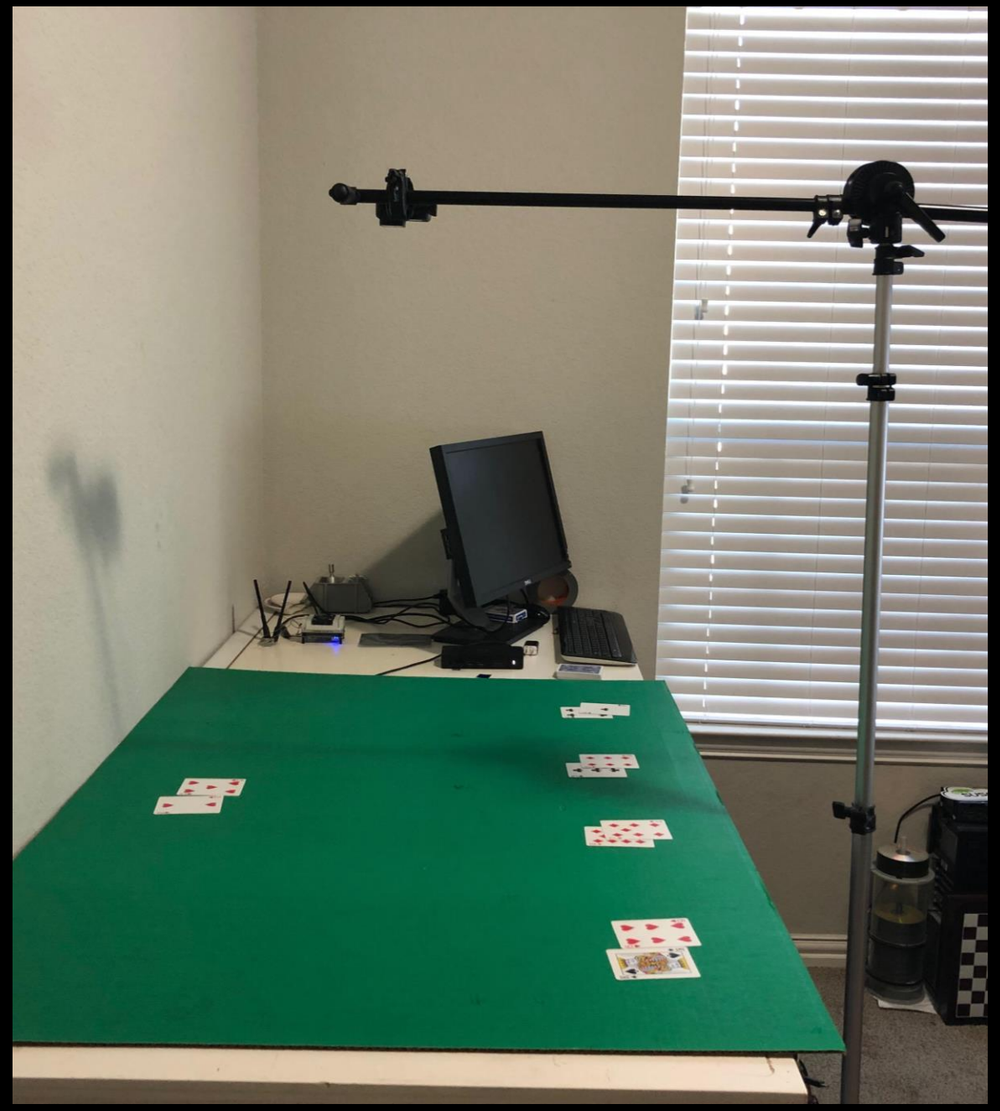
The final environment

GoPro HERO7 connected to a Raspberry Pi

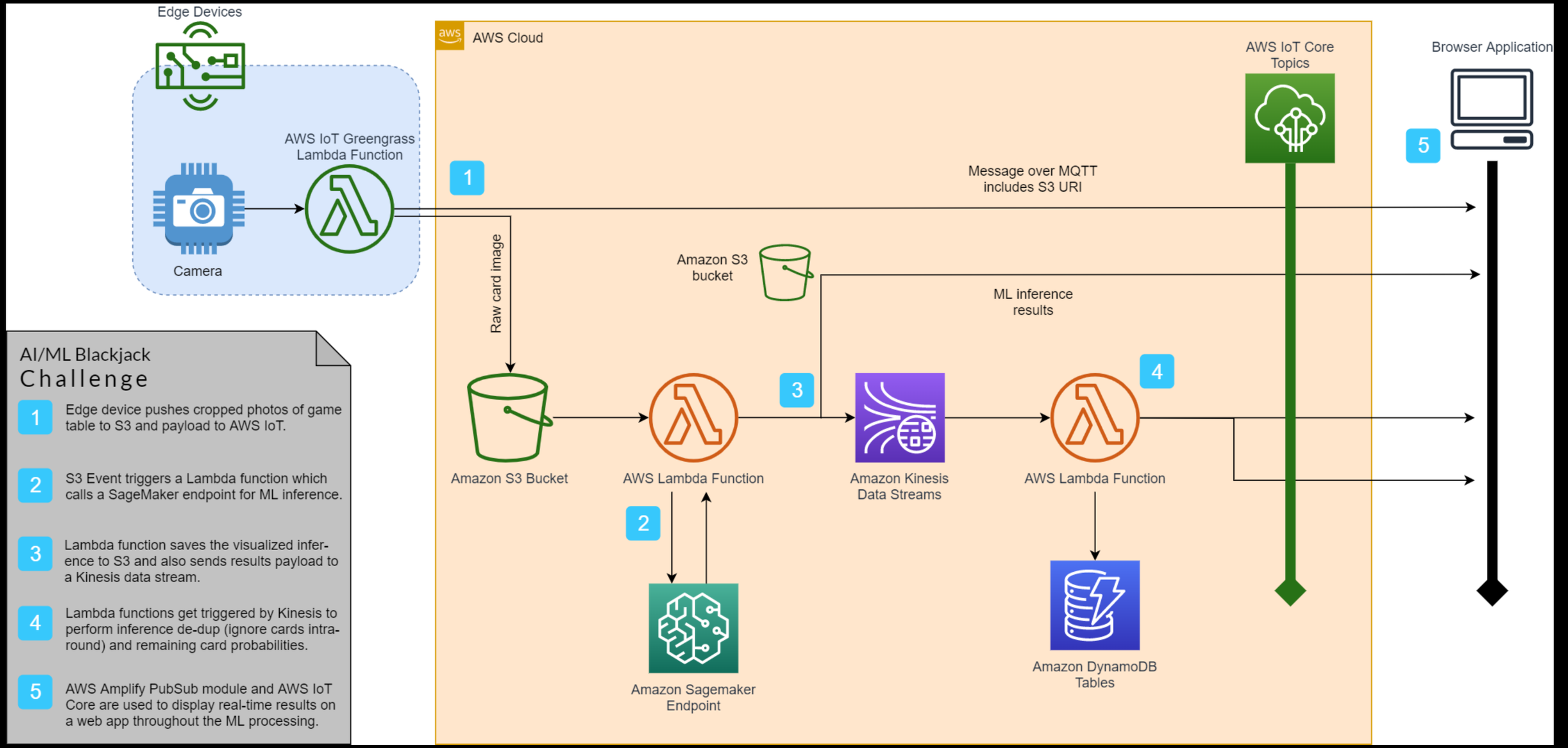
Camera mounted facing the table at 90 degrees

Green felt poker board

Same manufacturer brand playing cards



Solution architecture



AI/ML Blackjack Challenge

1. Edge device pushes cropped photos of game table to S3 and payload to AWS IoT.
2. S3 Event triggers a Lambda function which calls a SageMaker endpoint for ML inference.
3. Lambda function saves the visualized inference to S3 and also sends results payload to a Kinesis data stream.
4. Lambda functions get triggered by Kinesis to perform inference de-dup (ignore cards intra-round) and remaining card probabilities.
5. AWS Amplify PubSub module and AWS IoT Core are used to display real-time results on a web app throughout the ML processing.

Training and hosting on Amazon SageMaker

Amazon SageMaker training job

Built-in MXNet estimator

400,000 training images

P3dn instances, 8 training hours

Amazon SageMaker built-in object detection (single-shot multi-box detector)

GluonCV implementation – YOLO v3

Demo

https://github.com/laithalsaadoon/remars2019-revegas-workshop

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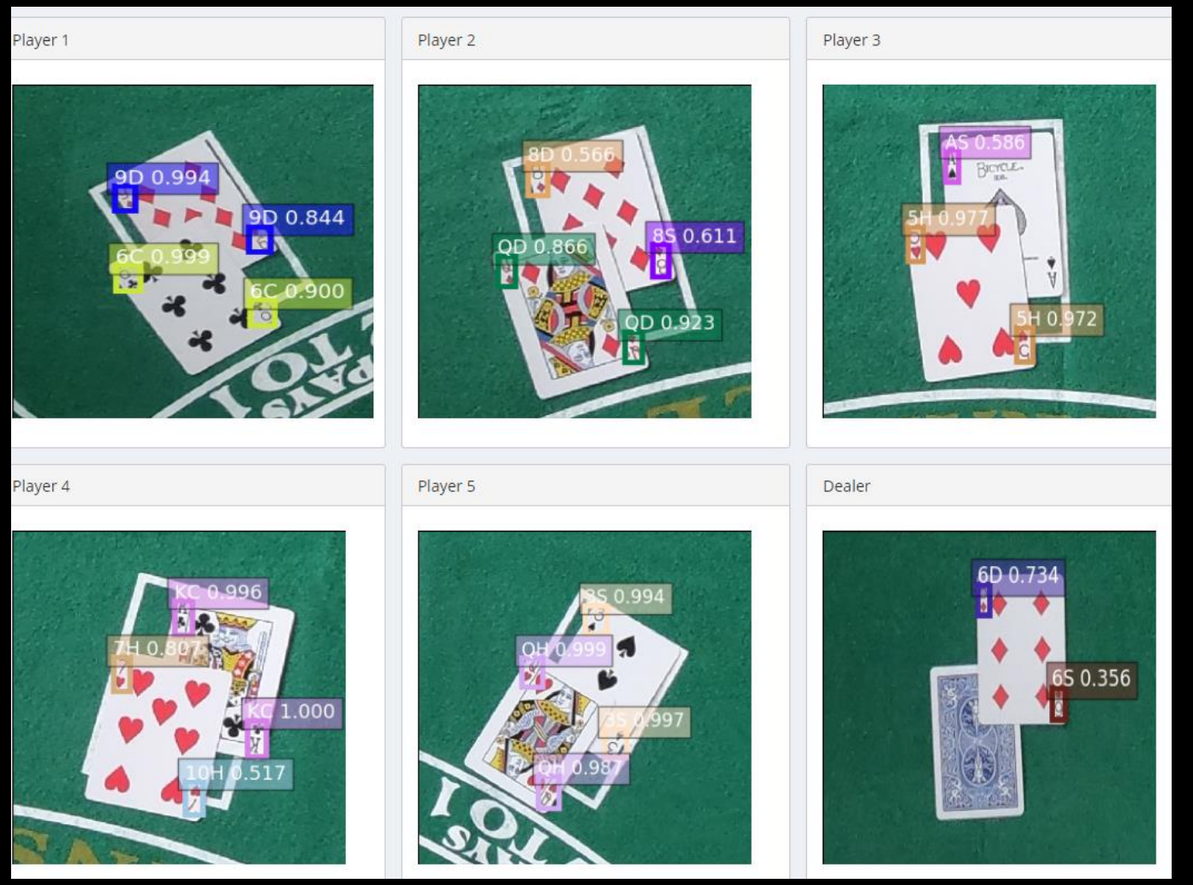
Wrap-up

Developing a relatively simple ML use case requires careful consideration of how the model will interact with and interpret the real-world environment

Building a custom image classifier can be performed with relatively small datasets with image augmentation tools

Using Amazon SageMaker's built-in image classification models vastly improved the performance of the playing card model



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Flexibility to learn your way

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