



# Solving Complex Business Challenges with Machine Learning at the Edge

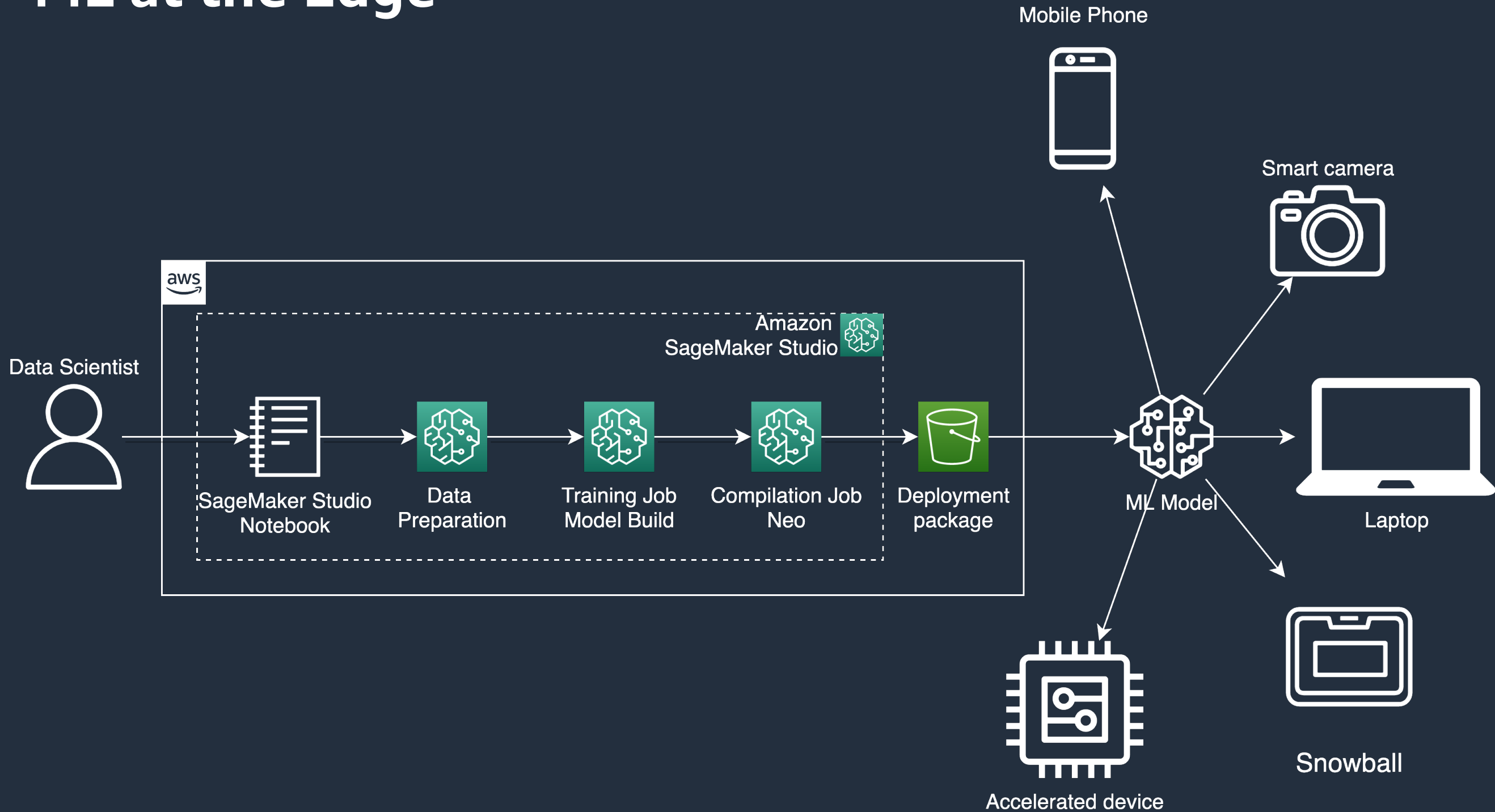
Samir Araújo  
Principal AI/ML Solutions Architect @ AWS

# What is ML at the edge (ML@Edge)?

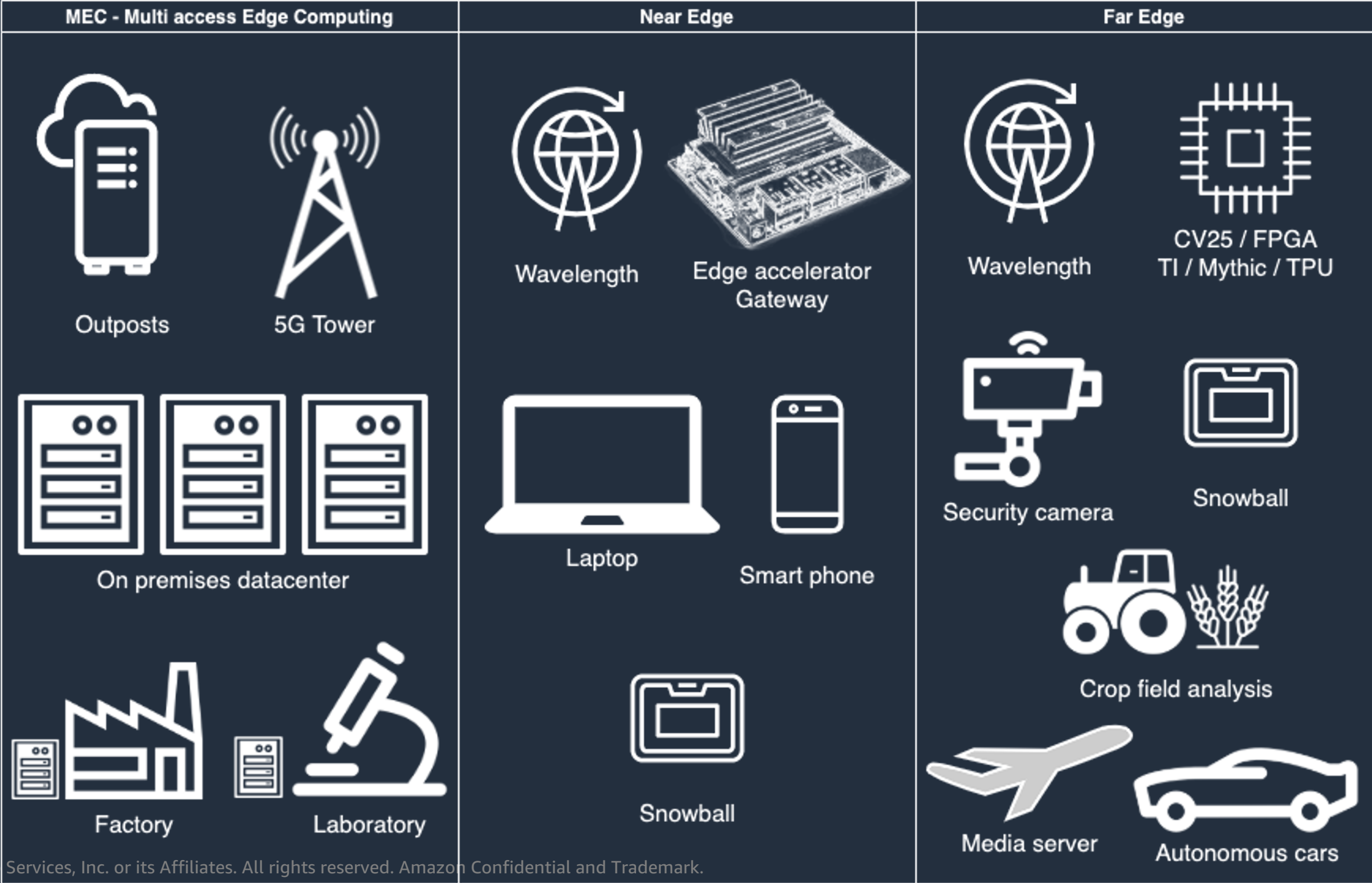
ML@Edge is not IoT

ML@Edge is about ML lifecycle only

# ML at the Edge



# Edge computing for ML



# Which areas can benefit of ML at the edge?



Predictive  
maintenance



Health and  
wellness services



Connected buildings  
and city systems



Personalized  
computing



Industrial IoT  
and robotics



Video  
security

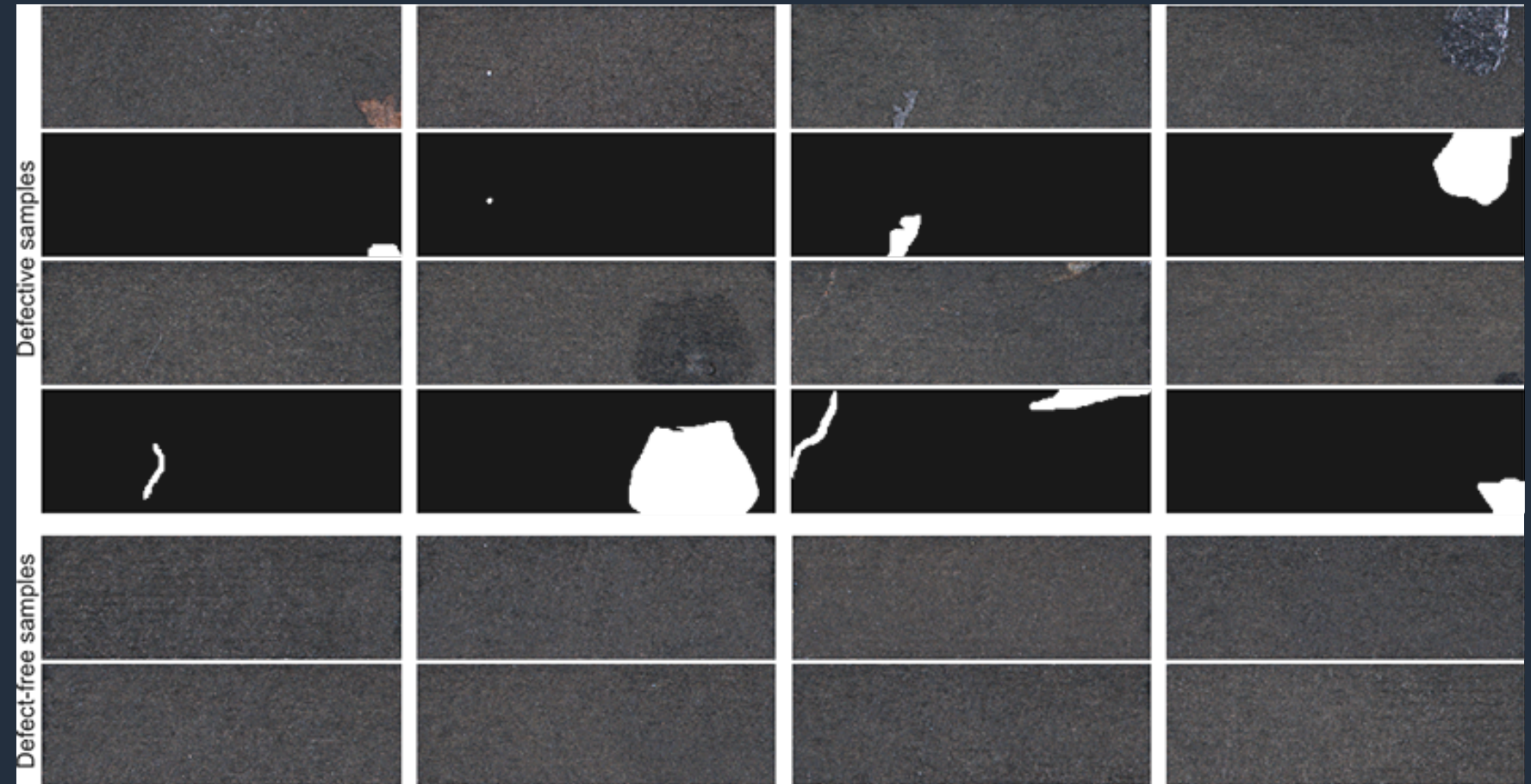
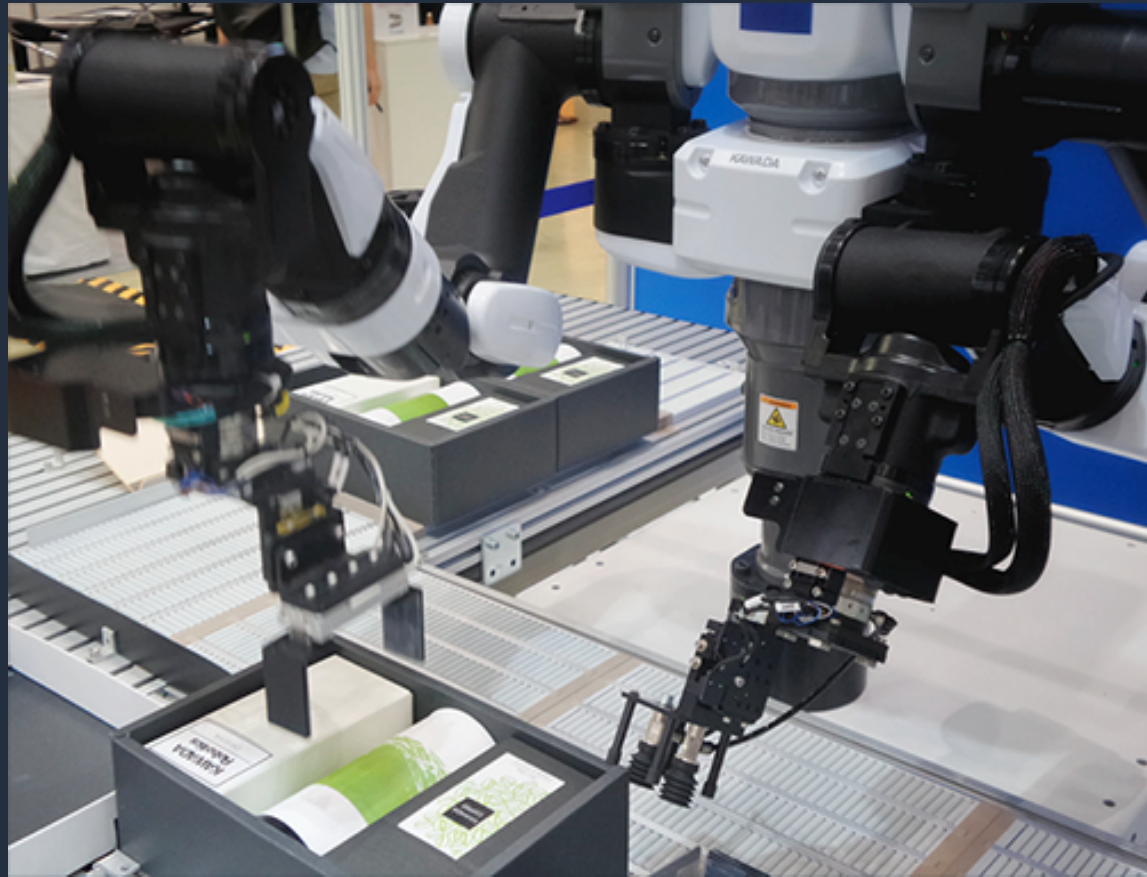
# Challenges

- How do I **operate** ML models on a **fleet of devices** at the edge?
- How do I **prepare** and deploy a ML model to multiple **edge devices**?
- How do I **secure** my model while **deploying/running** it at the edge?
- How do I **monitor** my model's **performance** and **retrain it, if needed**?
- How do I **eliminate** the need of installing a **big framework** like Tensorflow/Pytorch on my device?
- How do I **interface one or multiple models** with my edge **application** using a **simple API** ?
- How do I **create a new dataset** with the payloads and the predictions captured by the edge devices?
- How do I do **all these tasks automatically**? (MLOps + ML@Edge)

# Defect detection

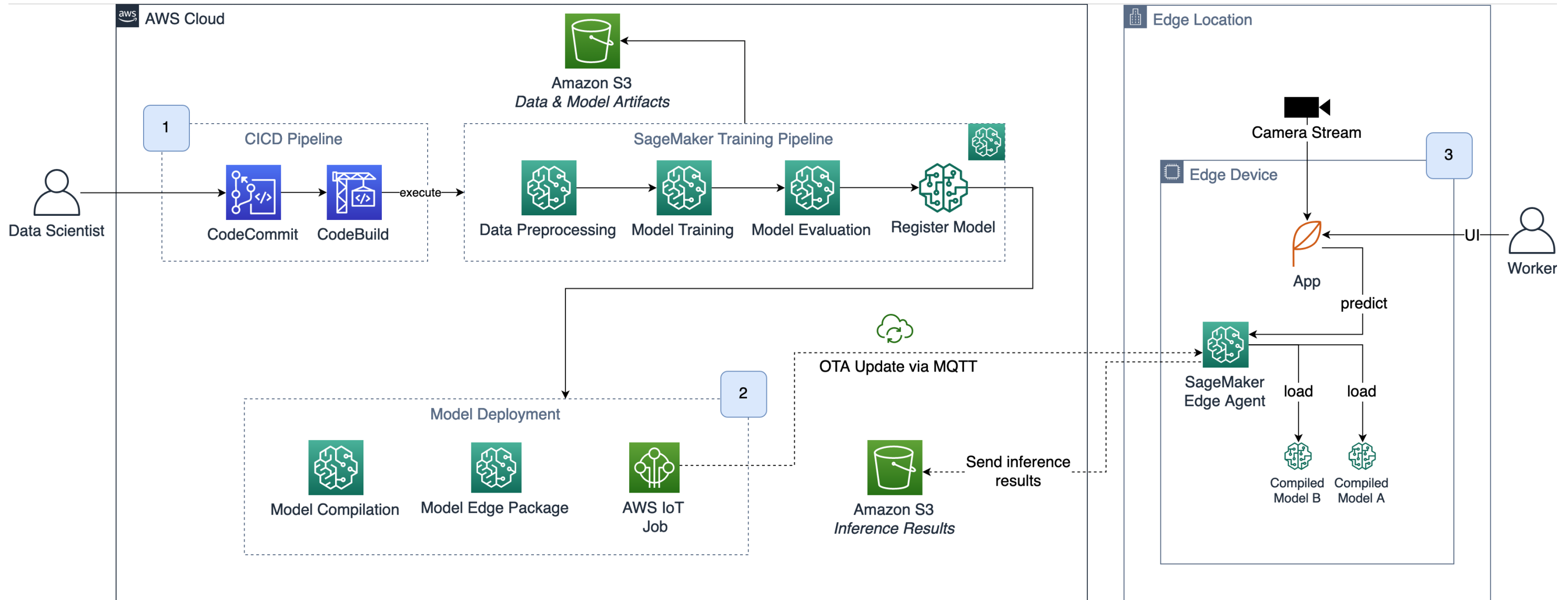
## Use case 1

# Defect Detection





# Defect Detection – Reference Architecture



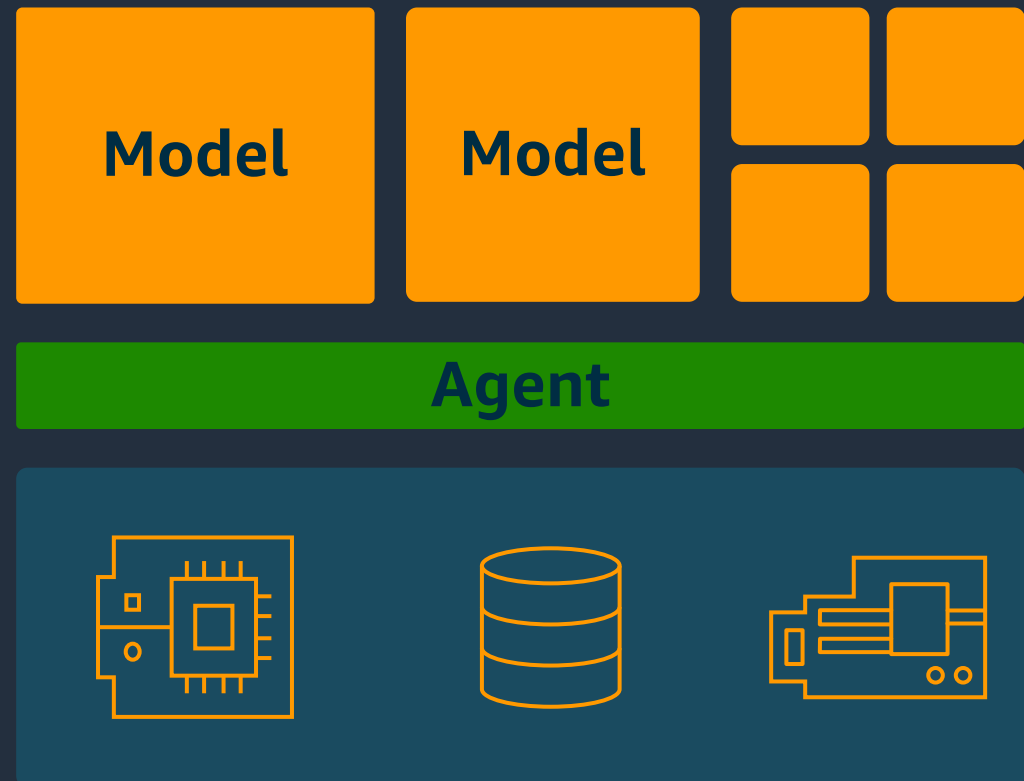
# Optimize models for the edge

SageMaker algorithms



- Ambarella
- ARM
- Intel
- NVIDIA
- NXP
- Qualcomm
- Texas Instruments
- Xilinx

# SageMaker Edge Manager



One agent serves multiple models

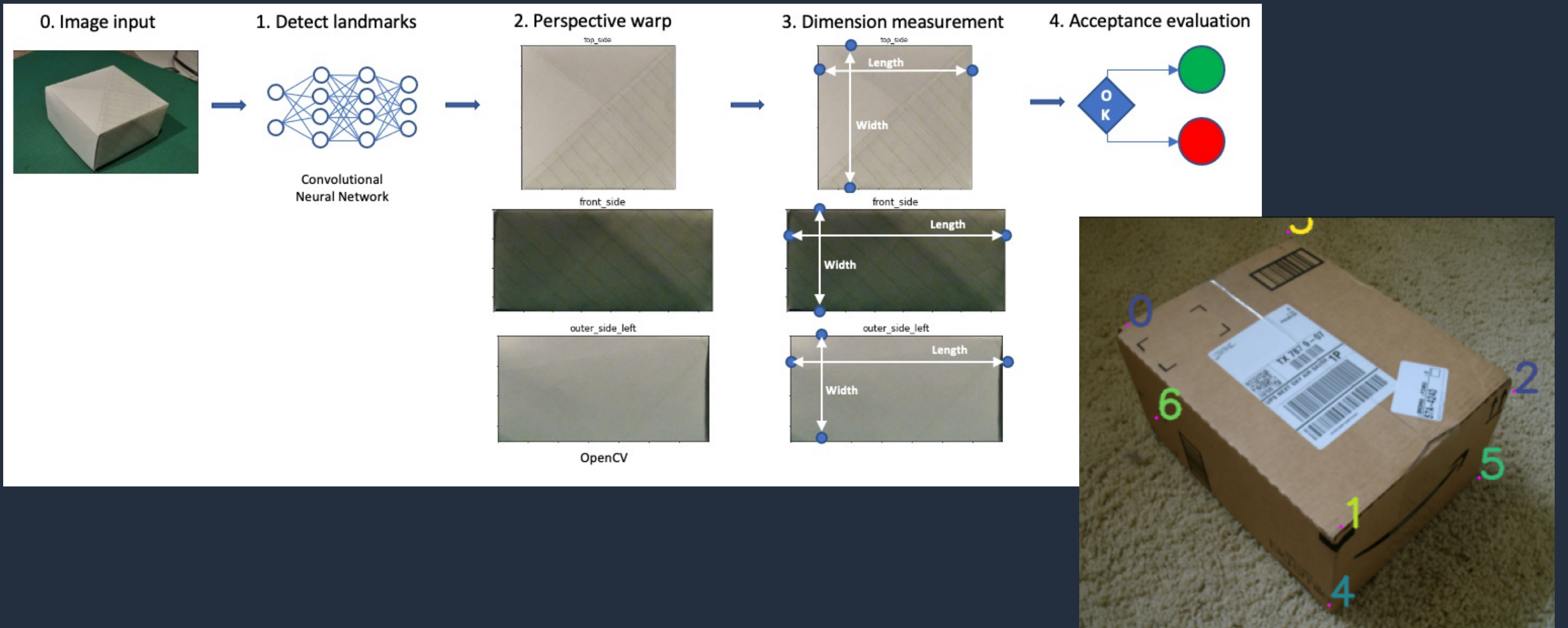
The agent consumes <2 MB memory, freeing up resources for multiple models

Applications can run multiple models in series or in parallel, increasing efficiency

# Measurement prediction

Use case 2

# Measurement Prediction – WIP/PoC



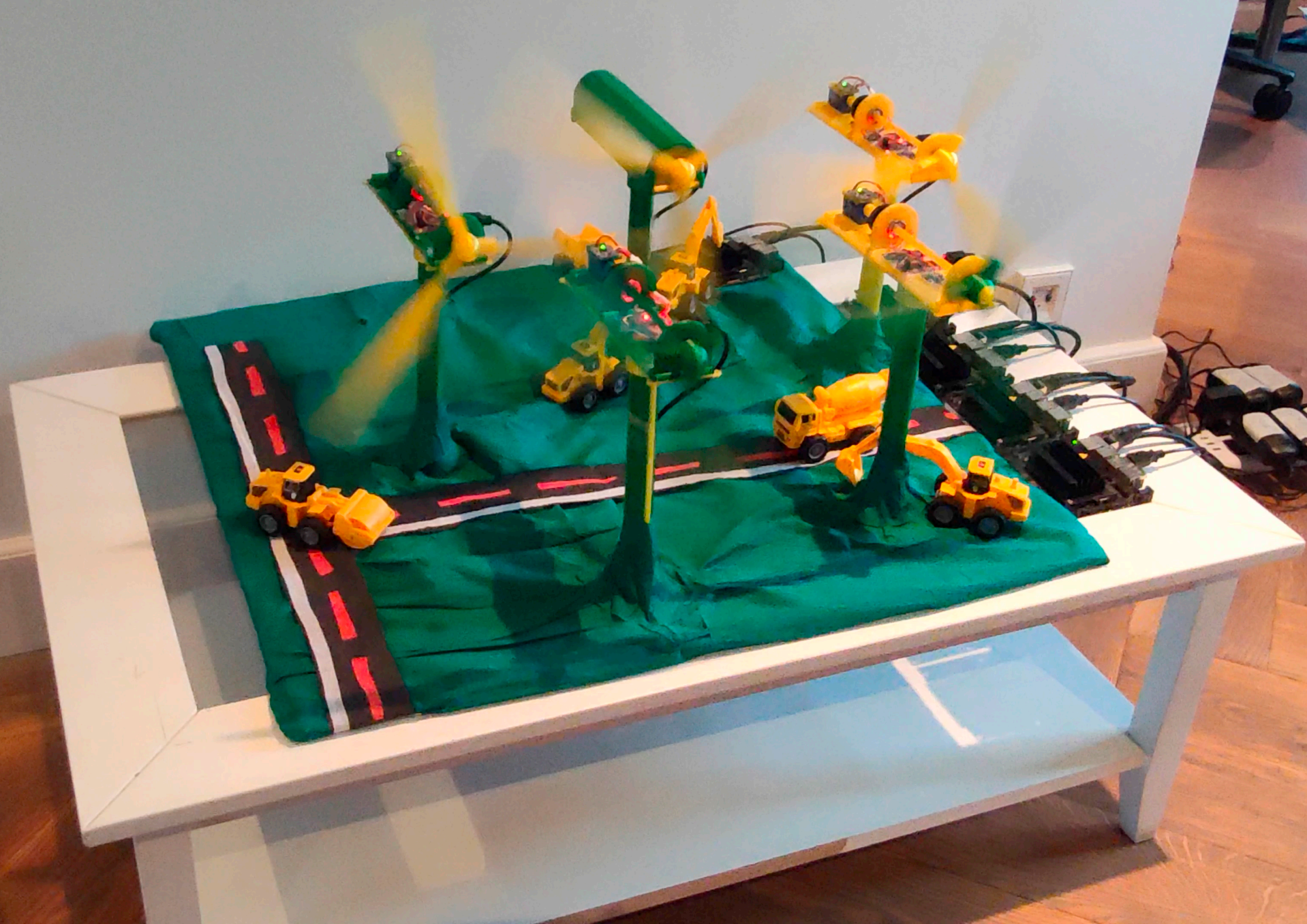
Source: [https://github.com/aws-samples/ml-edge-getting-started/blob/main/examples/02\\_BoxMeasurementsWithLandmarks/01\\_PredictingBoxMeasurements.ipynb](https://github.com/aws-samples/ml-edge-getting-started/blob/main/examples/02_BoxMeasurementsWithLandmarks/01_PredictingBoxMeasurements.ipynb)

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# Wind Turbine Farm Demo

Use case 3

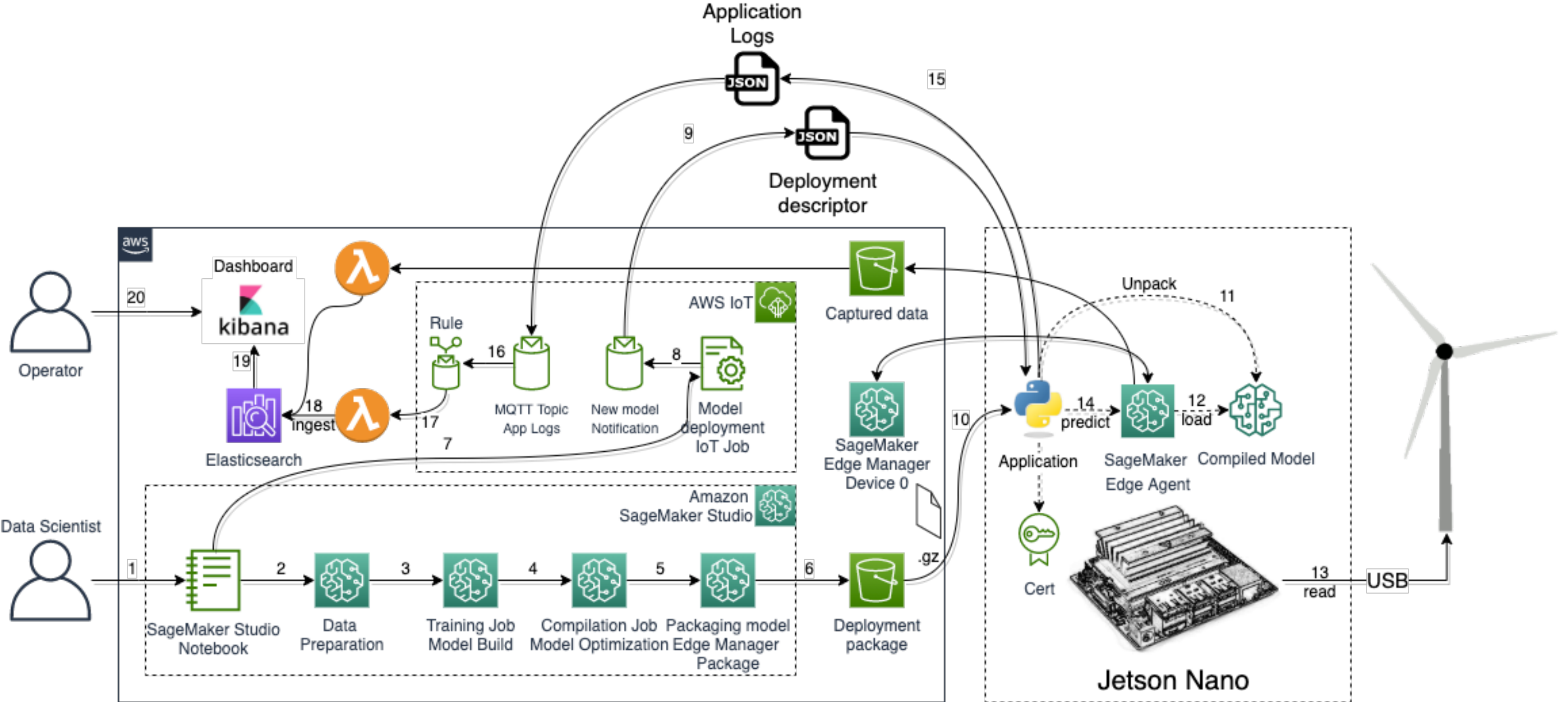




Video: [https://aws-ml-  
blog.s3.amazonaws.com/artifacts/monitor-manage-anomaly-  
detection-model-wind-turbine-fleet-sagemaker-  
neo/wind\\_farm.mp4](https://aws-ml-blog.s3.amazonaws.com/artifacts/monitor-manage-anomaly-detection-model-wind-turbine-fleet-sagemaker-neo/wind_farm.mp4)



# Demo: Reference architecture



# Mini Wind Turbine Specs

- Vibration Sensor: MPU6050
- Rotation Encoder (RPS)
- BME680
  - Temperature
  - Pressure
  - Air quality
  - Humidity
- Servo 9g as a voltage generator
- Arduino Mini PRO + FTDI – Serial/USB



# Thank you!

Samir Araújo