

The background features a vibrant, multi-colored gradient. A diagonal line divides the image into two main sections. The upper-left section is a solid blue, while the rest of the image is a complex gradient of purple, orange, and yellow. The text 'AWS re:Invent' is positioned on the left side, overlapping the blue and purple areas.

AWS
re:Invent

MDS408

Building and refining AI models with human-in-the-loop workflows

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Principal Solutions Architect
Amazon Web Services

Lidio Ramalho

Principal Solutions Architect
Amazon Web Services

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Software Development Engineer
Amazon Web Services

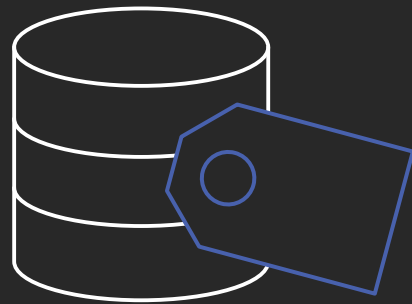
What is human in the loop

Human-in-the-loop (HITL) is an area of artificial intelligence that leverages both human and machine intelligence to create and augment machine-learning models

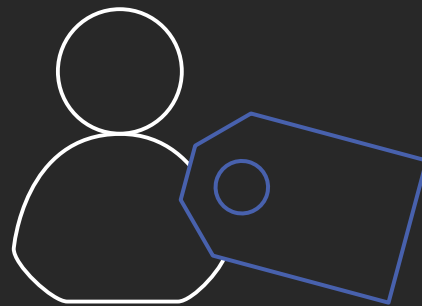
Humans in the training workflow

Amazon SageMaker Ground Truth

Label machine-learning training data easily and accurately



Quickly label training data



Easily integrate human labelers



Get accurate results

Key features

Automatic labeling via machine learning

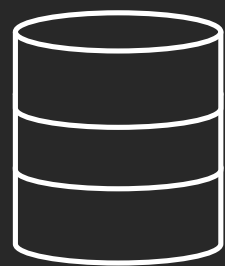
Ready-made and custom workflows

Private and public human workforce

Label management

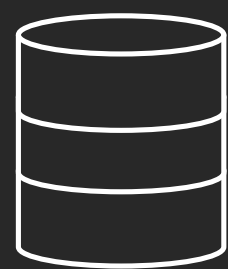


How it works: Amazon SageMaker Ground Truth



Raw data

How it works: Amazon SageMaker Ground Truth

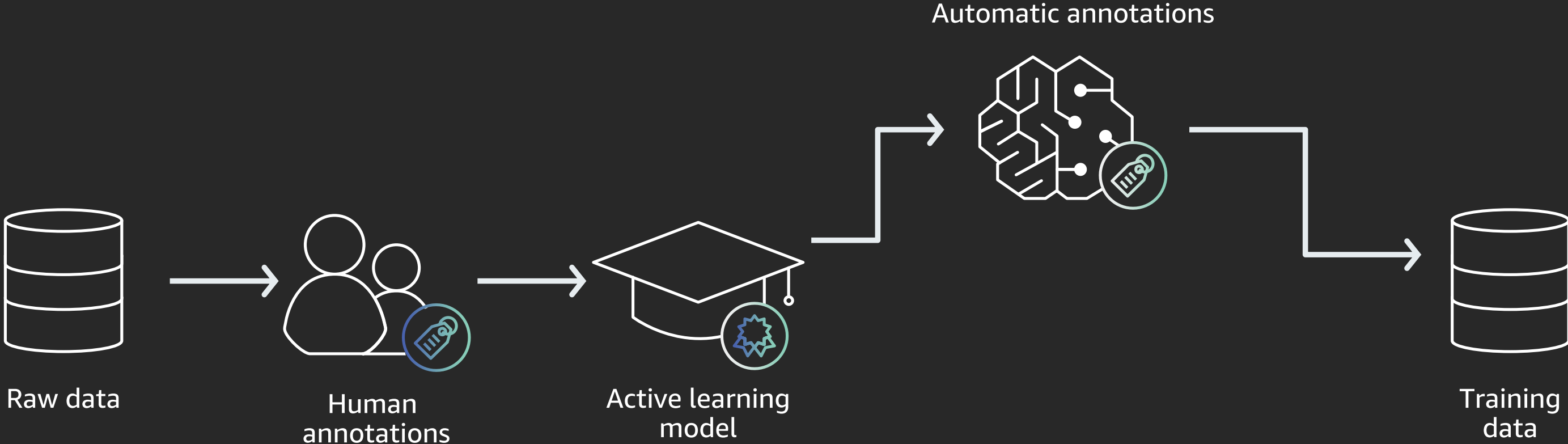


Raw data

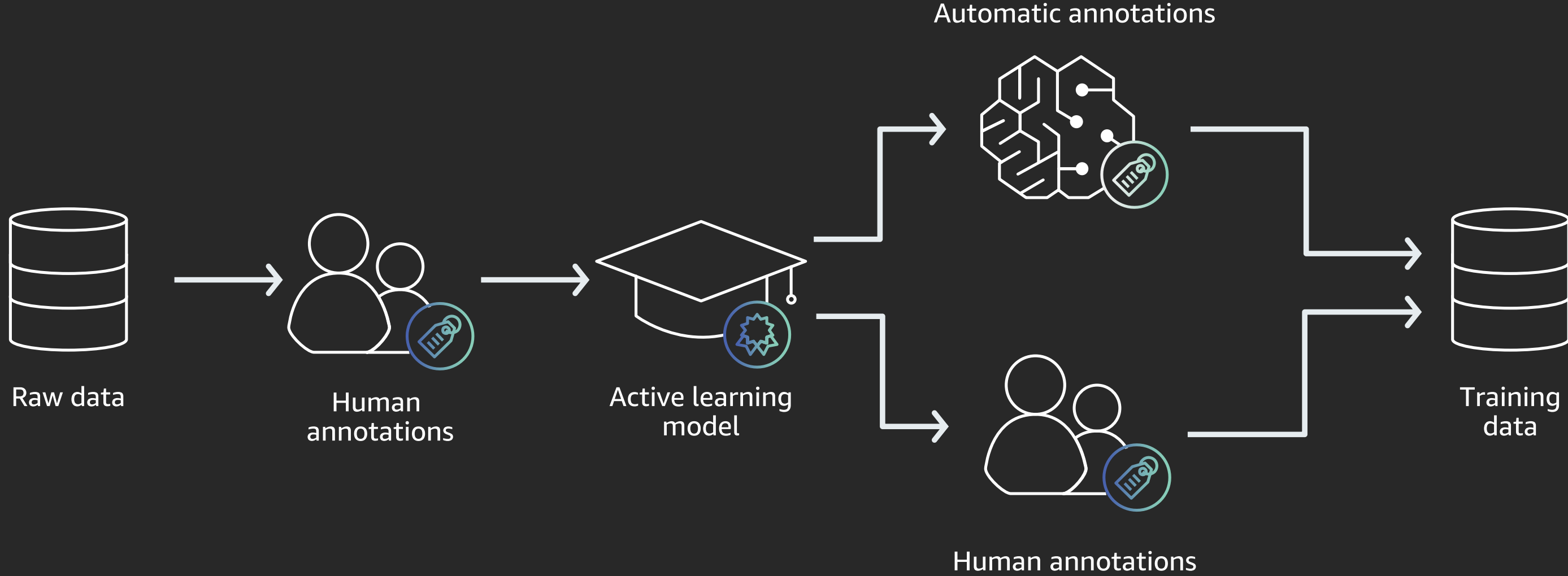


Human
annotations

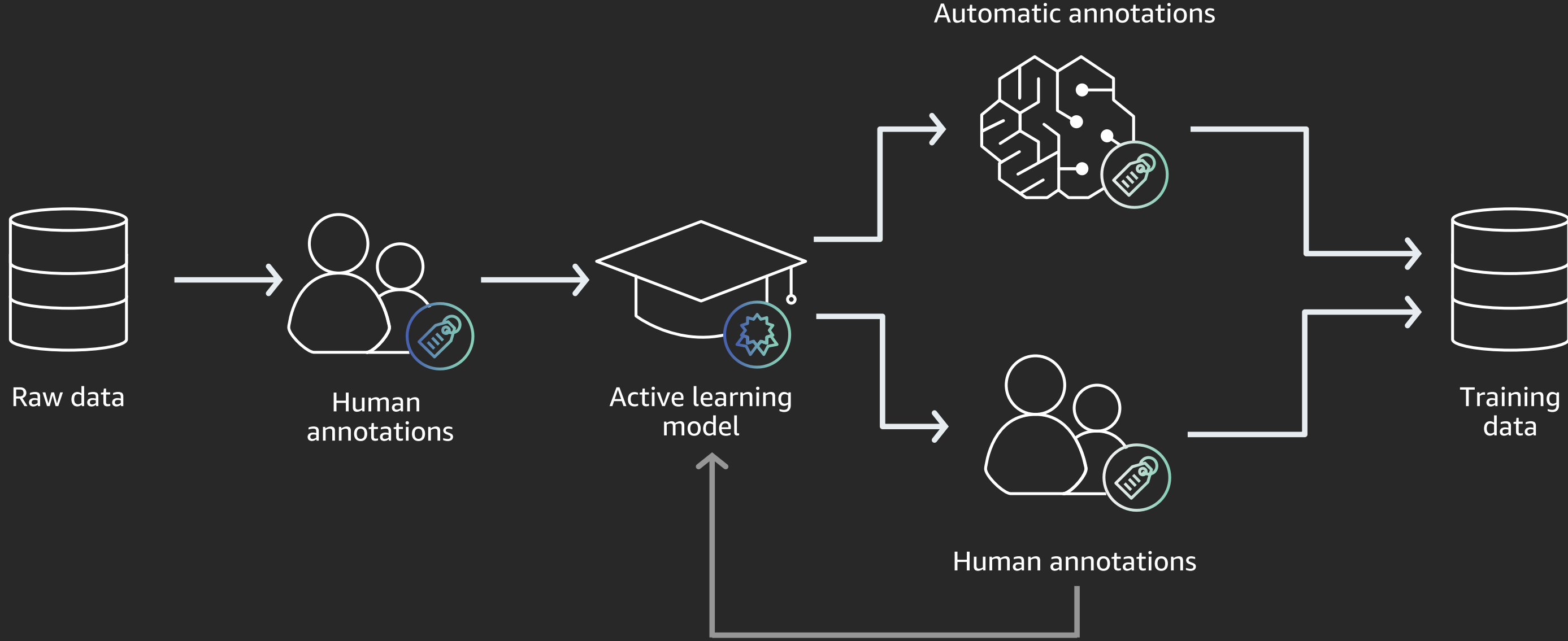
How it works: Amazon SageMaker Ground Truth



How it works: Amazon SageMaker Ground Truth



How it works: Amazon SageMaker Ground Truth



Human in the loop for review

Reviewing results



label: "Human"
confidence: "99.70584106445312"
label: "Person"
confidence: "99.70584106445312"
label: "Computer Hardware"
confidence: "99.43254089355469"
label: "Computer"
confidence: "99.43254089355469"
label: "Electronics"
confidence: "99.43254089355469"
label: "Hardware"
confidence: "99.43254089355469"
label: "Computer Keyboard"
confidence: "99.43254089355469"
label: "Keyboard"
confidence: "99.43254089355469"
label: "Pc"
confidence: "95.65735626220703"
label: "Screen"
confidence: "95.09449005126953"
label: "Display"
confidence: "95.09449005126953"
label: "Monitor"
confidence: "95.09449005126953"
label: "LCD Screen"
confidence: "95.09449005126953"
label: "Laptop"
confidence: "60.761051177978516"
label: "Clinic"
confidence: "52.86223220825195"
label: "Clothing"
confidence: "48.341880798339844"
label: "Shorts"
confidence: "48.341880798339844"
label: "Apparel"
confidence: "48.341880798339844"
label: "School"
confidence: "47.865745544433594"
label: "Hair"
confidence: "47.18296432495117"
label: "Student"
confidence: "43.582454681396484"

label: "Classroom"
confidence: "43.131507873535156"
label: "Office"
confidence: "42.91470718383789"
label: "Table"
confidence: "42.74911880493164"
label: "Furniture"
confidence: "40.99614715576172"
label: "Teacher"
confidence: "40.69967269897461"
label: "Doctor"
confidence: "40.1298469543457"
label: "Patient"
confidence: "39.20441436767578"
label: "Mouse"
confidence: "37.528411865234375"
label: "Hospital"
confidence: "35.05763626098633"
label: "Transportation"
confidence: "33.30857849121094"
label: "Ct Scan"
confidence: "32.48872375488281"
label: "X-Ray"
confidence: "32.236602783203125"
label: "Face"
confidence: "32.236602783203125"
label: "Television"
confidence: "32.03763198852539"
label: "TV"
confidence: "32.03763198852539"
label: "Machine"
confidence: "30.783615112304688"
label: "Advertisement"
confidence: "29.70494842529297"
label: "Reading"
confidence: "27.97711753845215"
label: "Military"
confidence: "27.60711669921875"
label: "Art"
confidence: "23.11285972595215"
label: "Painting"
confidence: "23.11285972595215"

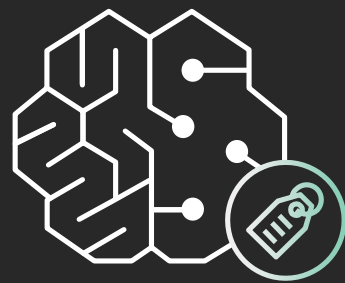
Reviewing results



label: "Human"
confidence: "99.70584106445312"
label: "Person"
confidence: "99.70584106445312"
label: "Computer Hardware"
confidence: "99.43254089355469"
label: "Computer"
confidence: "99.43254089355469"
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confidence: "48.341880798339844"
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label: "School"
confidence: "47.865745544433594"
label: "Hair"
confidence: "47.18296432495117"
label: "Student"
confidence: "43.582454681396484"

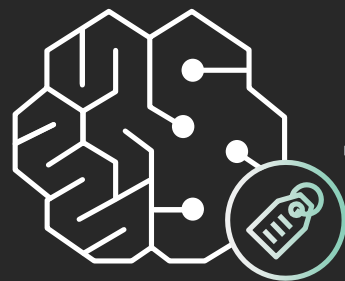
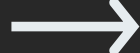
label: "Classroom"
confidence: "43.131507873535156"
label: "Office"
confidence: "42.91470718383789"
label: "Table"
confidence: "42.74911880493164"
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label: "Military"
confidence: "27.60711669921875"
label: "Art"
confidence: "23.11285972595215"
label: "Painting"
confidence: "23.11285972595215"

Inference against an ML model



ML model

Defining a threshold



ML model



Person - 99.70%
Computer - 99.43%
Monitor - 95.09%

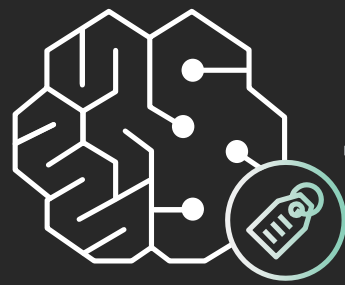
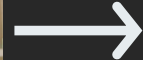
90%

...
School - 47.86%
Office - 42.91%
Doctor - 40.12%

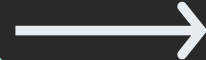
40%

...
Hospital - 35.05%
X-Ray - 32.23%
Painting - 23.11%

Accept results over threshold/drop results below



ML model



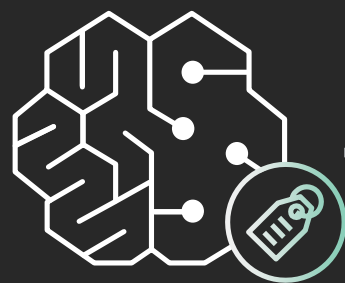
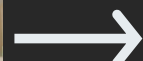
Person - 99.70%
Computer - 99.43%
Monitor - 95.09%
...
School - 47.86%
Office - 42.91%
Doctor - 40.12%

Confidence
Threshold

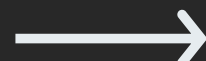


Person - 99.70%
Computer - 99.43%
Monitor - 95.09%

Reviewing with human in the loop

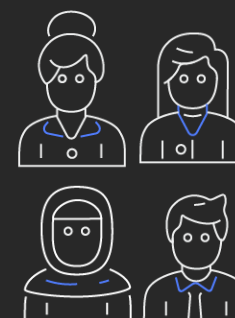
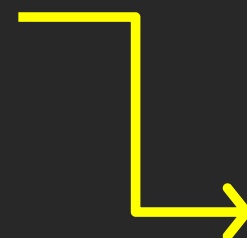


ML model



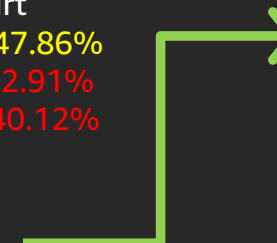
Person - 99.70%
Computer - 99.43%
Monitor - 95.09%
...
School - 47.86%
Office - 42.91%
Doctor - 40.12%

Confidence
threshold



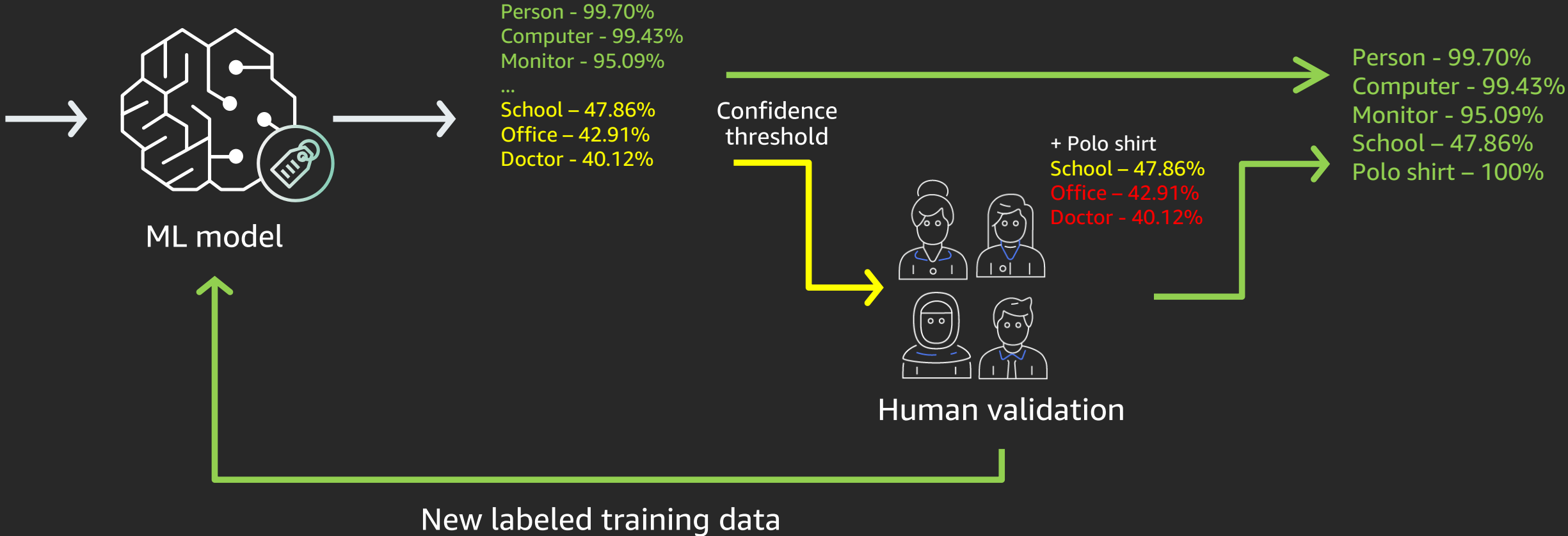
Human validation

+ Polo shirt
School - 47.86%
Office - 42.91%
Doctor - 40.12%

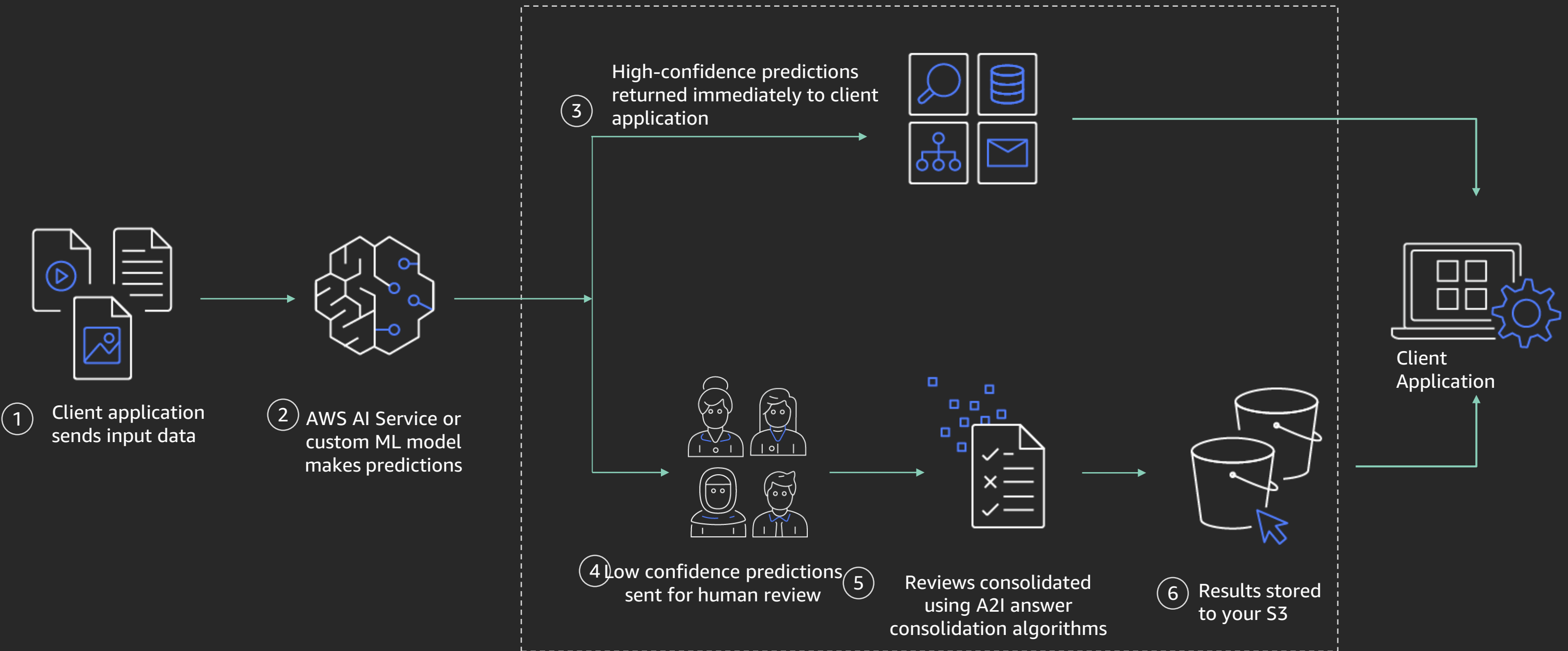


Person - 99.70%
Computer - 99.43%
Monitor - 95.09%
School - 47.86%
Polo shirt - 100%

Reviewing with human in the loop



How Amazon Augmented AI works



Integration with Amazon Rekognition and Amazon Textract

Step 1: Define Human Review Workflow



- When to trigger human review
- Who should review
- What should humans see

Step 2: Use A2I Workflow in your API calls



- Call A2I directly from Rekognition and Textract APIs
- Get to know in real time if human review was needed

Pre built Task UI

Instructions

[View full instructions](#)

[View tool guide](#)

Review the image and select all appropriate categories for the image.

If none of the category is presented in the image, choose the last option **None of the above**.

Nudity
Visuals depicting nude male or female person or persons


Graphic Male Nudity
Visuals depicting full frontal male nudity, often close ups

Sexual Activity
Visuals depicting various types of explicit sexual activities and pornography

Illustrated Nudity Or Sexual Activity
Visuals depicting animated or drawn sexual activity, nudity or pornography

Adult Toys
Visuals depicting adult toys, often in a marketing context

Review the image and select all appropriate categories for the image.



Choose all categories you see in the image

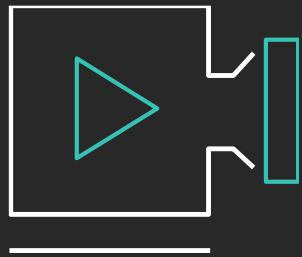
Nudity	1
Female Swimwear	2
None of the above	N

Zoom in Zoom out Move Fit image

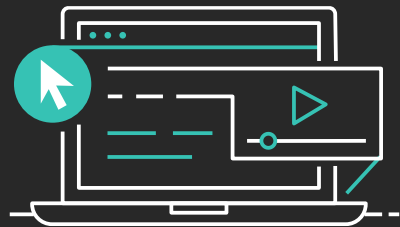
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Thank you!



Please complete the session survey in the mobile app.

Transcription review demo

