



AWS
re:Invent

AIM 223 - R

AWS DeepComposer: Get started with generative AI

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Sr. Software Dev. Engineer
Amazon Web Services

Richard Lee

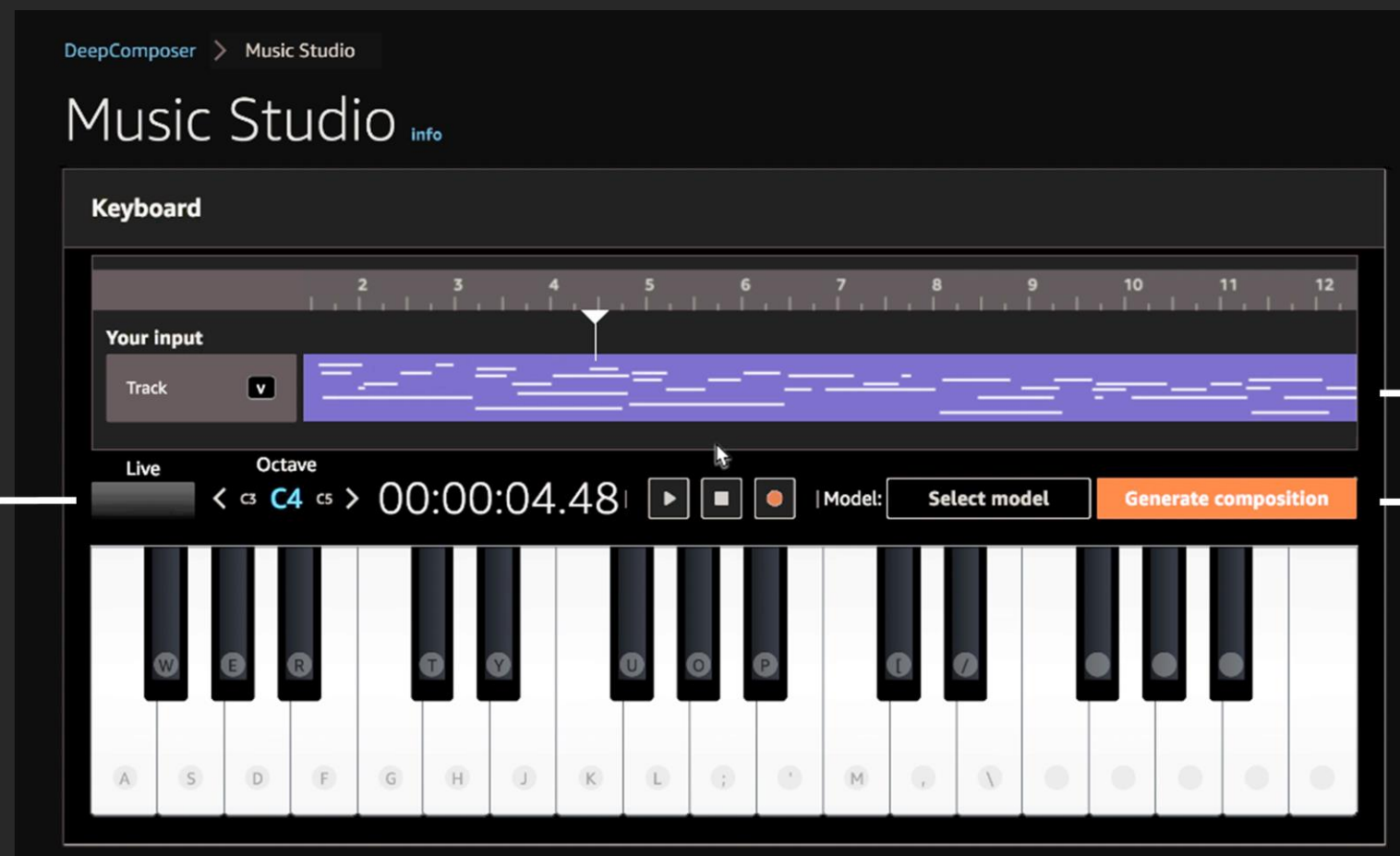
Product Manager Technical
Amazon Web Services

AWS DeepComposer

The world's first machine learning-enabled musical keyboard for developers







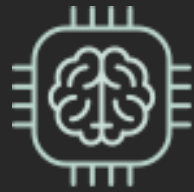
Playback info &
transport controls

Virtual keyboard

Input melody

Model selector

Agenda

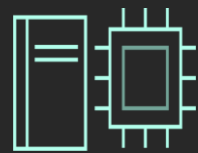


1. ML on AWS (10 minutes)



2. Introduction to ML and Generative AI (20 minutes)

3. Lab 1- Music composition with AWS DeepComposer models (35 minutes)

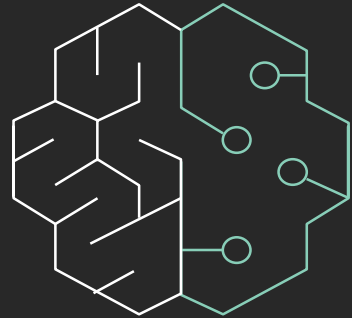


4. Lab 2- Training models with AWS DeepComposer (55 minutes)

Our mission at AWS

Put machine learning in the
hands of every developer

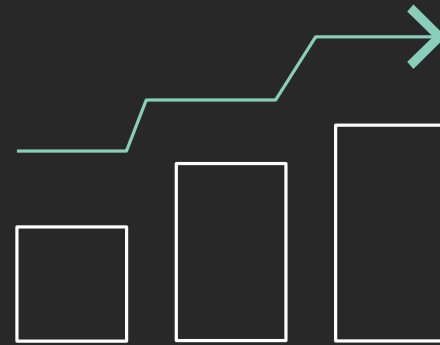
Why AWS for ML



Broadest and deepest set of AI and ML services

200 new features and services launched this last year alone

Unmatched flexibility



Accelerate your adoption of ML with SageMaker

70% cost reduction in data-labeling

10x faster performance

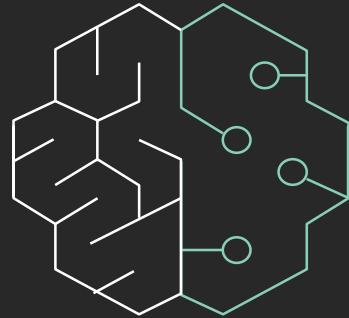
75% lower inference cost



Built on the most comprehensive cloud platform

AWS Named as a Leader in Gartner's Infrastructure as a Service (IaaS) Magic Quadrant for the 9th Consecutive Year

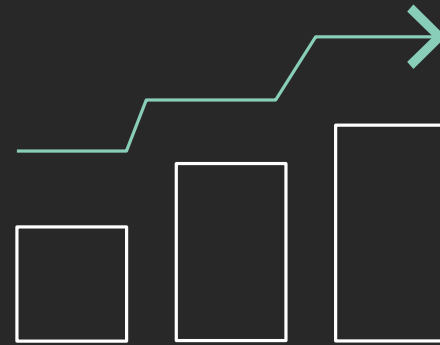
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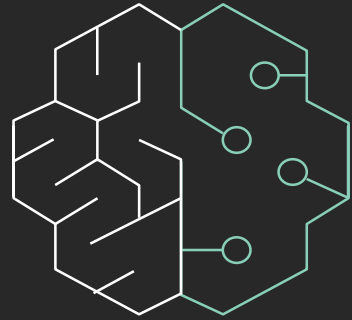
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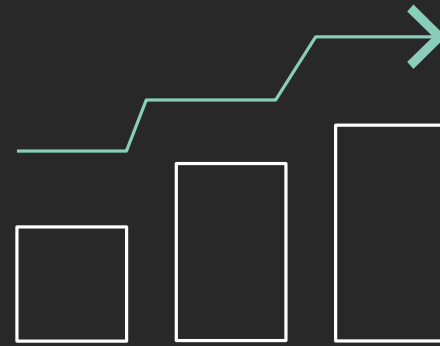
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Built on the most comprehensive cloud platform

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More machine learning happens on AWS than anywhere else

More than ten thousand customers | 2x the customer references | 85% of TensorFlow projects in the cloud happen on AWS



The AWS ML Stack

Broadest and deepest set of capabilities















AI Services

VISION			SPEECH		LANGUAGE		CHATBOTS	FORECASTING	RECOMMENDATIONS
 AMAZON REKOGNITION IMAGE	 AMAZON REKOGNITION VIDEO	 AMAZON TEXTRACT	 AMAZON POLLY	 AMAZON TRANSCRIBE	 AMAZON TRANSLATE	 AMAZON COMPREHEND & COMPREHEND MEDICAL	 AMAZON LEX	 AMAZON FORECAST	 AMAZON PERSONALIZE

ML Services

 Amazon SageMaker								
	Ground Truth	Notebooks	Algorithms + Marketplace	Reinforcement Learning	Training	Optimization	Deployment	Hosting

ML Frameworks + Infrastructure

FRAMEWORKS	INTERFACES	INFRASTRUCTURE								
 TensorFlow  mxnet  PYTORCH	 GLUON  Keras	 EC2 P3 & P3DN	 EC2 G4 EC2 C5	 FPGAS	 DL CONTAINERS & AMIs	 ELASTIC CONTAINER SERVICE	 ELASTIC KUBERNETES SERVICE	 AWS IOT GREENGRASS	 ELASTIC INFERENCE	 INFERTIA

Enabling the next ML developers

ML Educational Devices

AWS DeepLens
Deep Learning

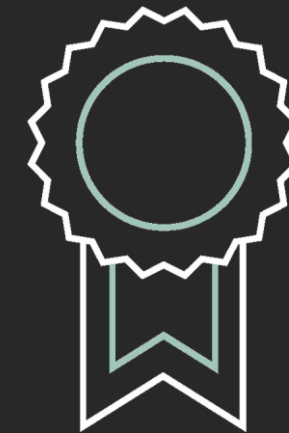


AWS DeepRacer
Reinforcement Learning



AWS DeepComposer
Generative AI

Training & Certification



AWS ML Training and
Certification

UDACITY

coursera

edX

Partnerships with
MOOCs

Enabling the next ML developers

ML Educational Devices

AWS DeepLens
Deep Learning



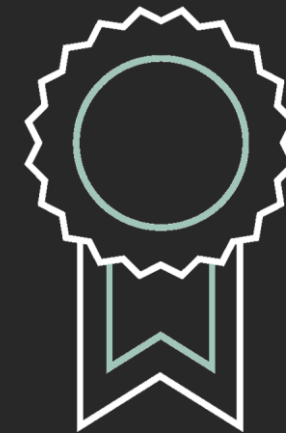
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Partnerships with
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Let's hear from one of the developers



Build your AI with AWS and Intel

AWS and Intel deliver the most comprehensive set of resources, tools, training, and services together



Introduction to ML and Generative AI

Types of ML techniques

Supervised learning

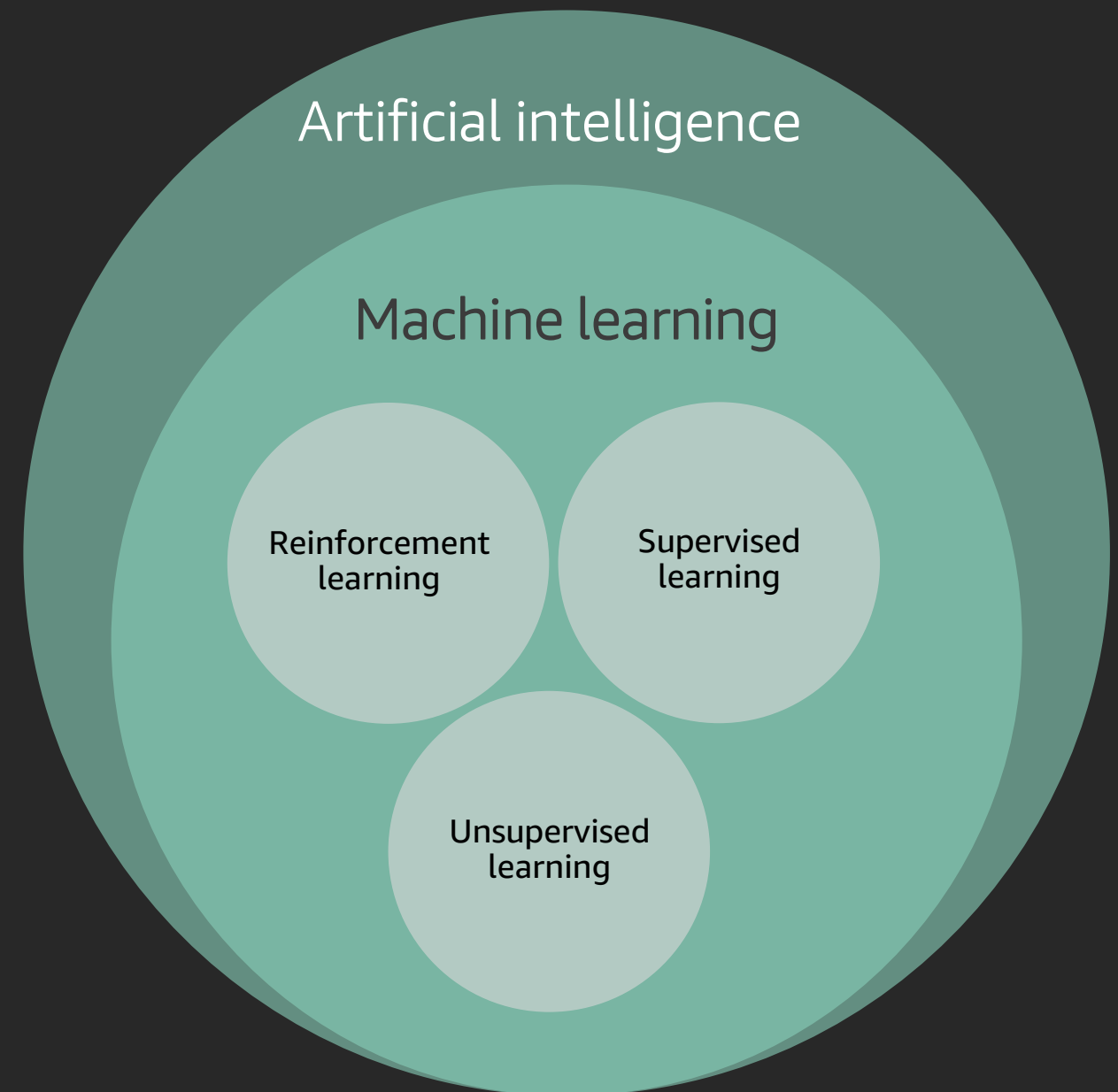
- Every training example has a corresponding label

Unsupervised learning

- No labels for training data
- Most Generative AI is unsupervised learning

Reinforcement learning

- Learns through consequences of action in specific environment



Types of ML techniques

Supervised learning

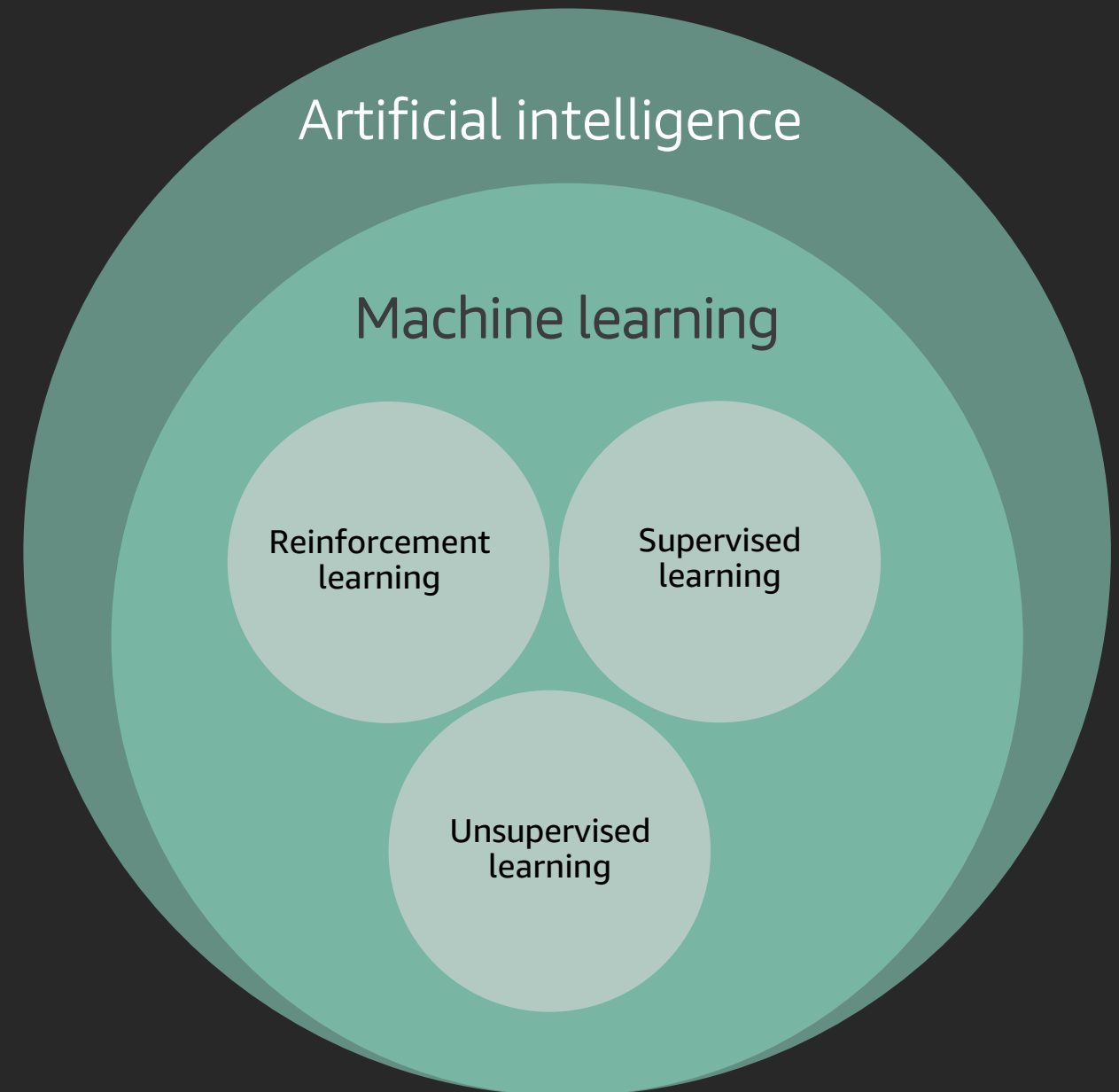
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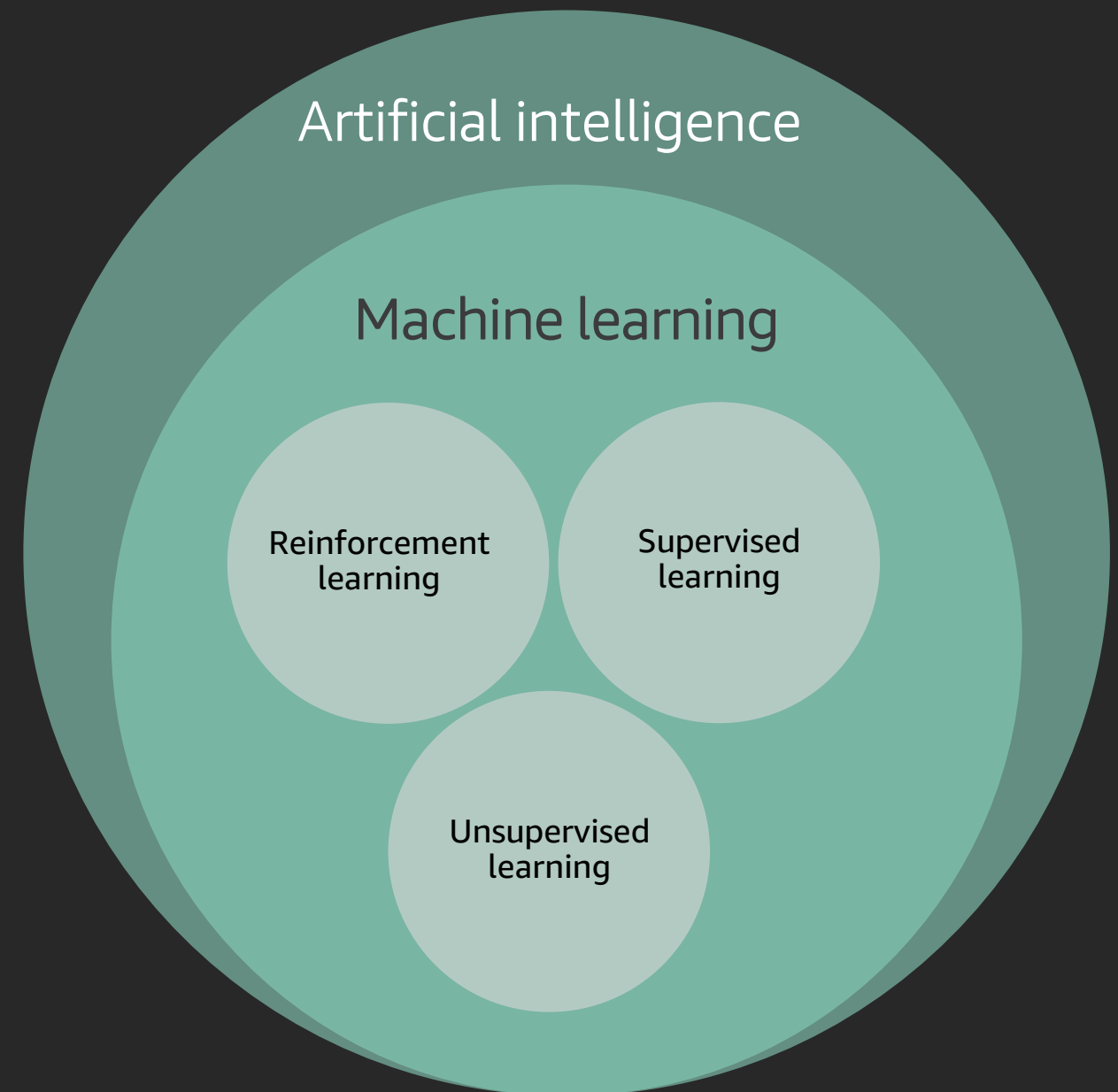
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Generative AI

One of the most promising advances in AI
in the past decade

MIT Technology Review

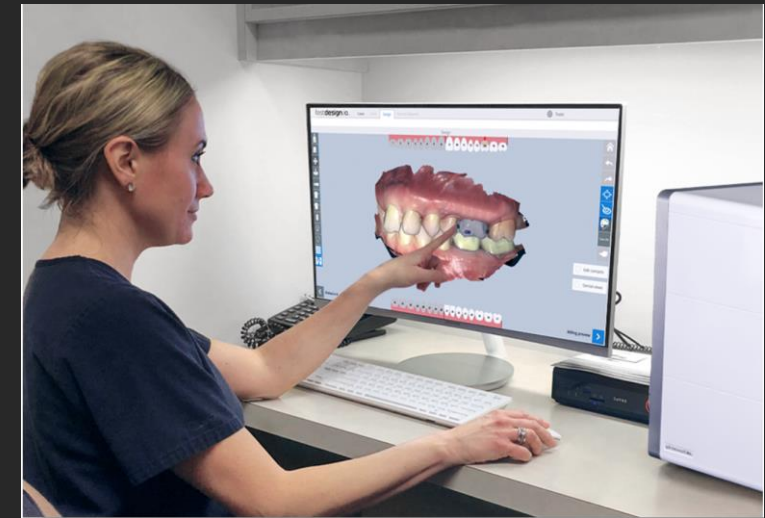
Practical uses of Generative AI



Autodesk – Airbus



Autodesk – NASA JPL



Gildewell Laboratories

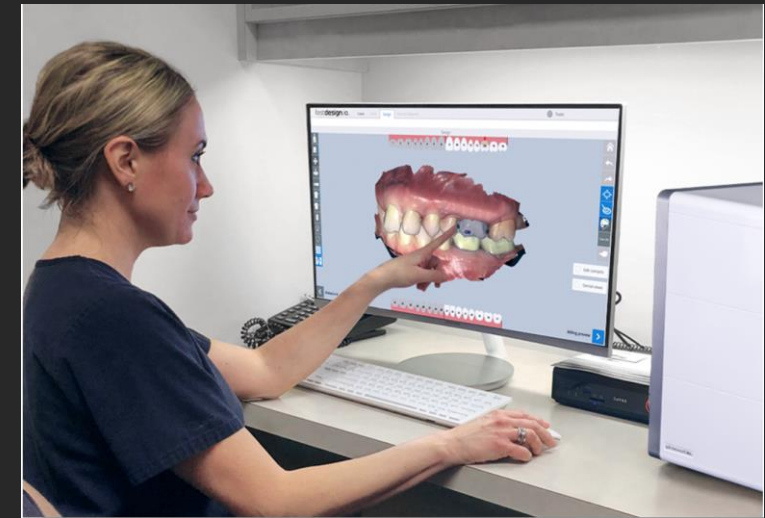
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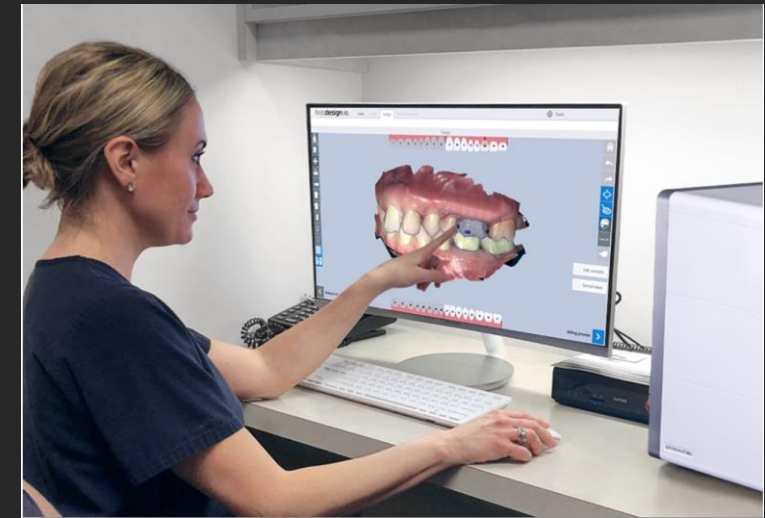
Practical uses of Generative AI



Autodesk – Airbus



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Gildewell Laboratories

Generative Adversarial Network (GAN)



Generative Model



Discriminator

Generative Adversarial Network (GAN)



Generative Model



Discriminator

Generative Adversarial Network (GAN)



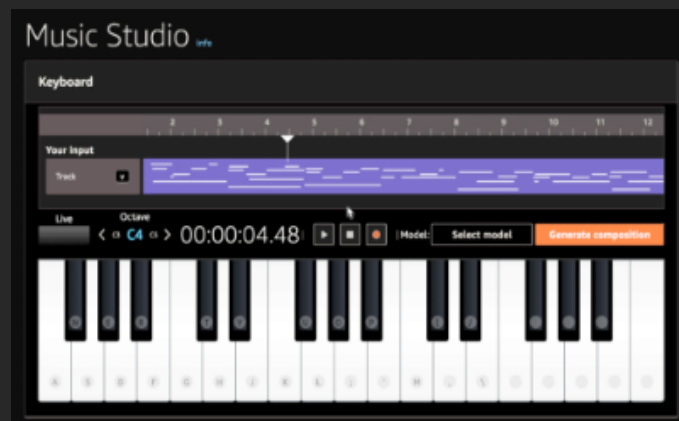
Generative Model



Discriminator

Creative Meets Generative

1



Input a melody by connecting
the AWS DeepComposer
keyboard

2



Choose from jazz, rock, pop,
classical, or build your own
custom genre model in
Amazon SageMaker

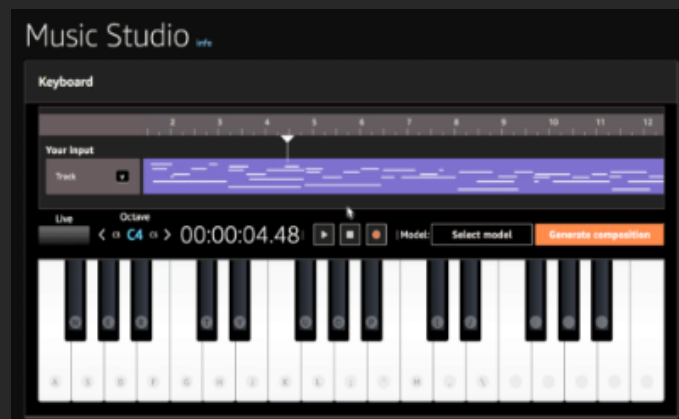
3



Publish your tracks to SoundCloud
from the console; export MIDI files
to your favorite DAW

Creative Meets Generative

1



Input a melody by connecting the AWS DeepComposer keyboard

2



Choose from jazz, rock, pop, classical, or build your own custom genre model in Amazon SageMaker

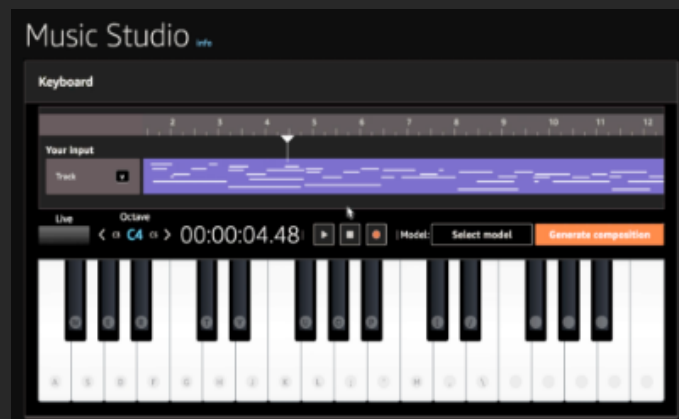
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Choose from jazz, rock, pop,
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Amazon SageMaker

3



Publish your tracks to SoundCloud
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Knowledge Check

<https://kahoot.it/>

Lab 1 - Compose music with AWS DeepComposer models

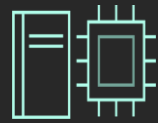
Self-Paced Lab Instructions



1. Find the instruction manual on GitHub:
<https://github.com/aws-samples/aws-deepcomposer-samples>



2. Select Lab 1



3. 35 minutes

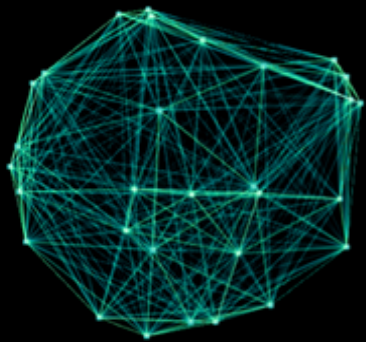
Input melody:

Output melody:

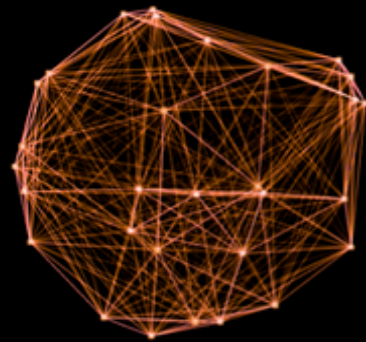
How to access the console

- Find the link to access AWS DeepComposer console in Lab1
<https://github.com/aws-samples/aws-deepcomposer-samples>
- We've created a special AWS account for AWS DeepComposer labs. Please find the printouts on your desk.
- This account will be active until Friday, December 6, 2019, 11:59:59 Pacific Time (GMT-7). So, please grab the printouts before you leave!

Model Training and Output




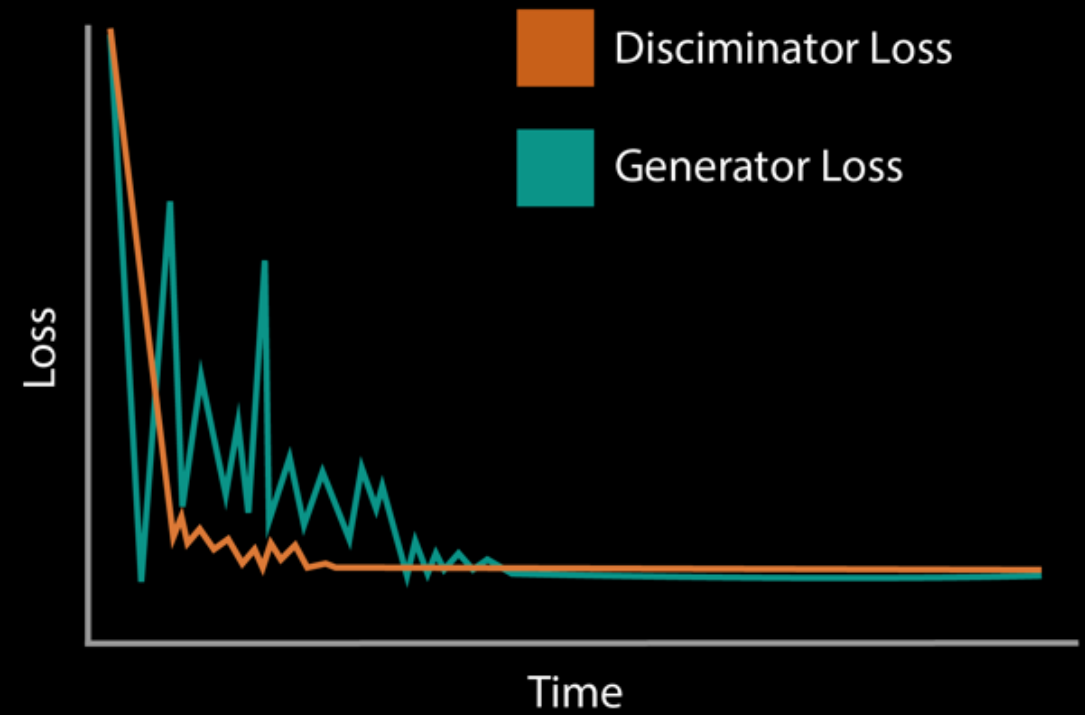
Generative Model



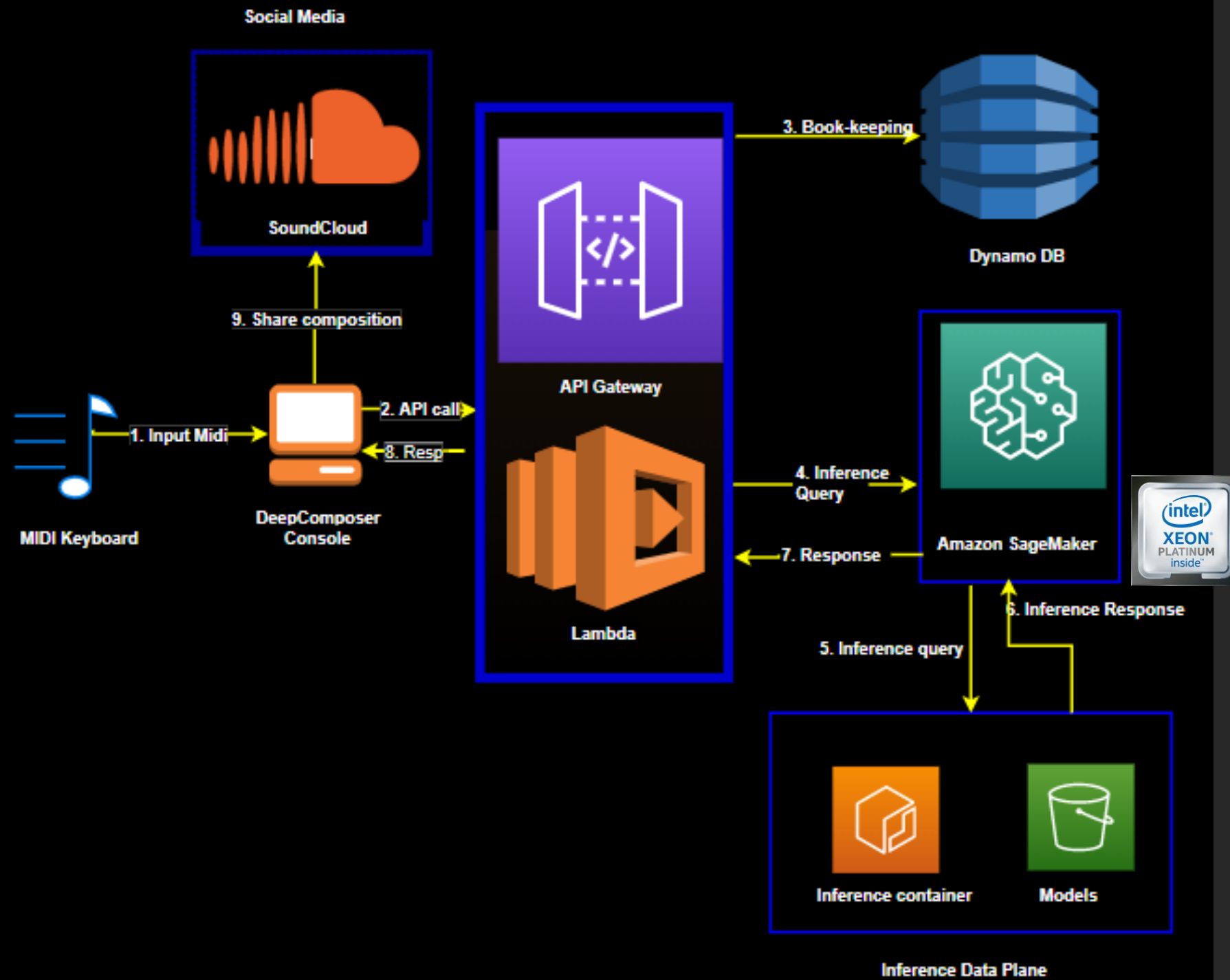
Discriminator

Epoch 3000 

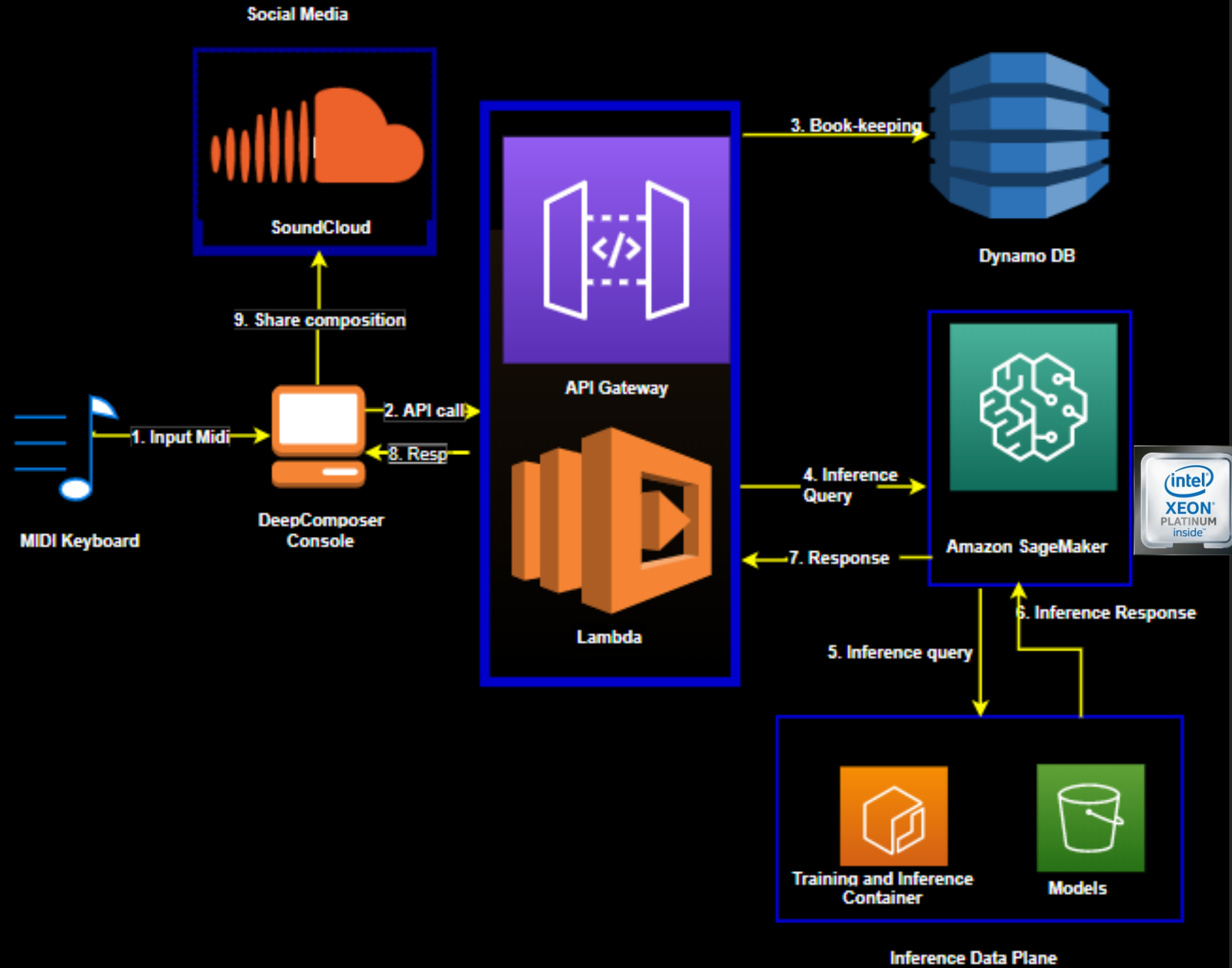
Epoch 60,000 



Lab 1 – Under the hood



Lab 1 – Under the hood

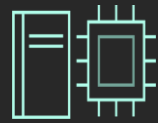


Knowledge Check

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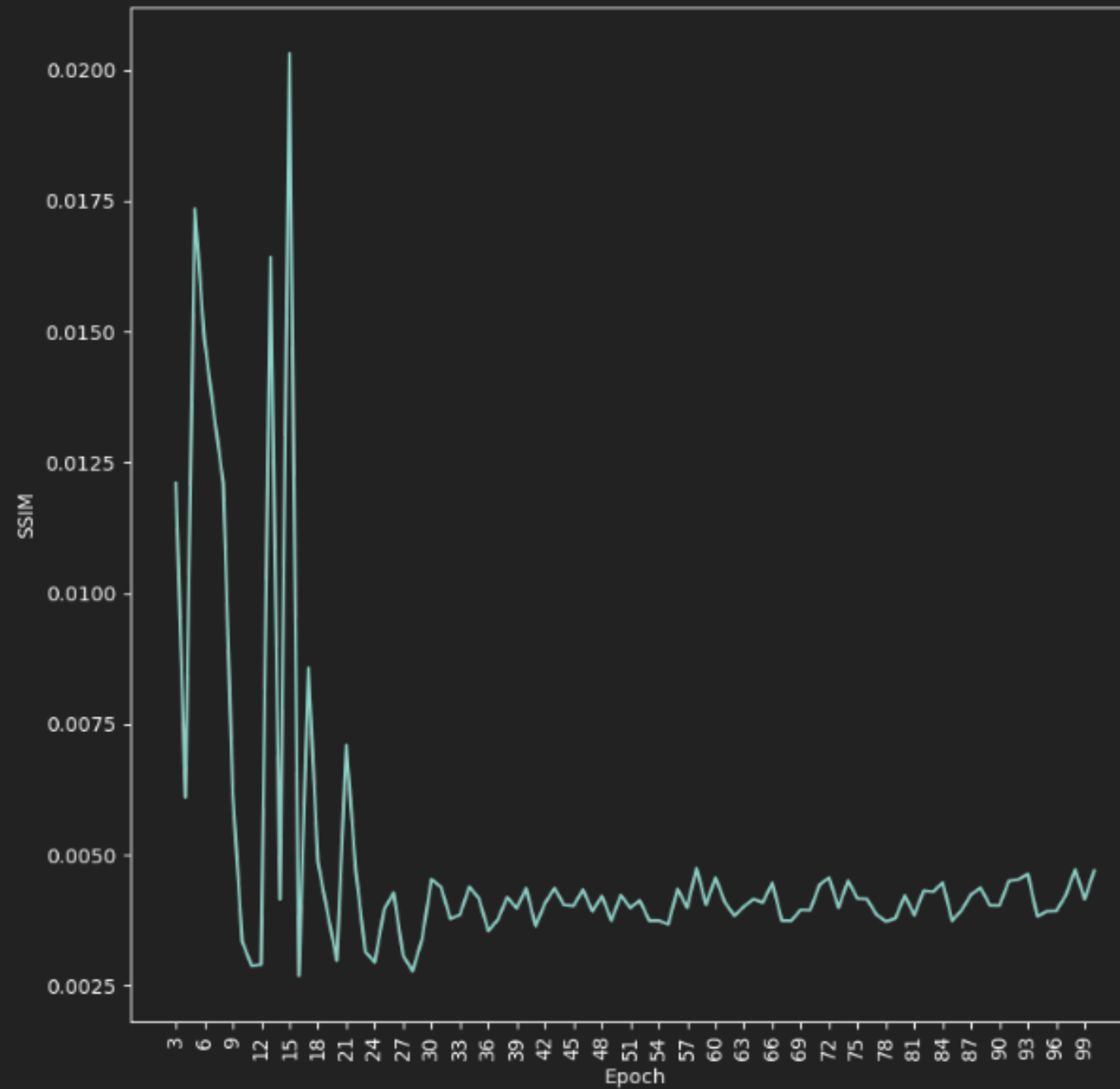
Lab 2 - Train a custom GAN model

Self-Paced Lab Instructions



1. Find the instruction manual on GitHub:
<https://github.com/aws-samples/aws-deepcomposer-samples>
2. Select Lab 2
3. 50 minutes

Understanding Lab 2



Epoch 3,000



Epoch 10,300



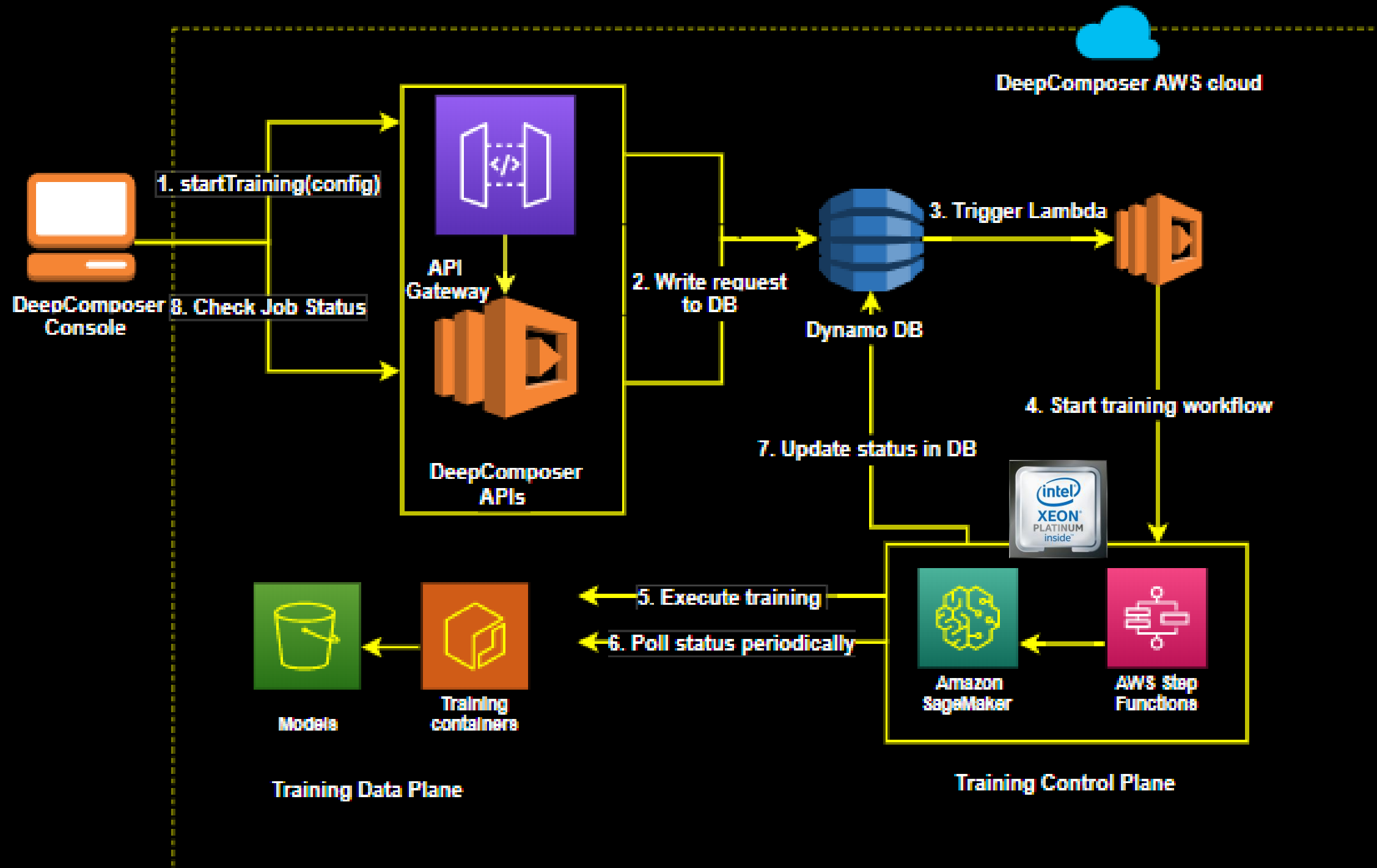
Epoch 20,500



Epoch 60,000



Training architecture



Challenges in training

1. Clean datasets are hard to obtain
2. GANs take time to converge during training
3. Complexity in defining subjective metrics for music creation
4. Complexity in defining quantitative metrics for music creation

Knowledge Check

<https://kahoot.it/>

Conclusion

What you learned today

- What are Generative AI algorithms?
- What are GANs
- GAN architecture and training process
- Generated a composition from an input melody – Lab1
- How AWS DeepComposer inference works
- Built a GAN model in Amazon SageMaker notebook – Lab2
- How AWS DeepComposer performs model training for building custom models

Get your free device

- Attendees who have attended the AWS DeepComposer workshop are eligible to receive a AWS DeepComposer device
- Giveaways can be picked up at the SWAG desk located in Venetian, Level 2, Hall C



Device Shipping

AWS

DeepComposer

If you do not wish to carry your AWS DeepComposer with you to your final destination, please fill in this card and take it to the **VENETIAN FedEx Business Center** to have it shipped, on us!

Please note: Redeemable at VENETIAN FedEx Business Center only. Covers complementary US Ground and International Economy shipping. International shipping subject to local country restrictions regulating the shipping and receipt of certain items. Redeemable at Venetian, Level 2, FedEx Business Center only. Please write legibly in order to avoid complications in device delivery.

Recipient's Name:		Country:
Ship To Address:		
City, State, Zip:		
Phone Number:	Email:	

Learn More

AWS DeepComposer - Sign up for preview

<https://aws.amazon.com/deepcomposer/>

Learn ML with AWS

<https://aws.amazon.com/machine-learning/learn/>



Questions?

Thank you!



Please complete the session
survey in the mobile app.