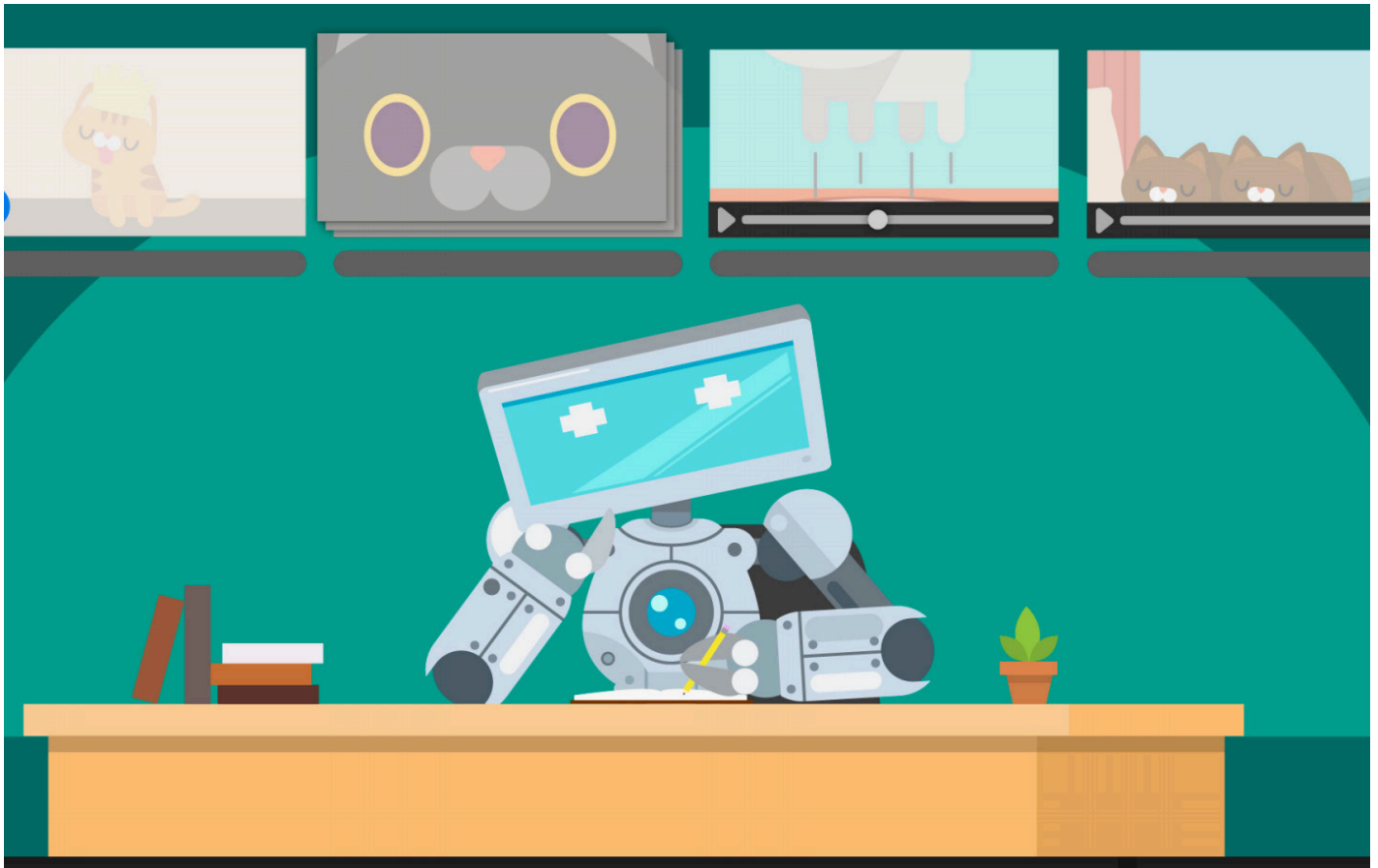


Machine Learning Activity: Deep Composer

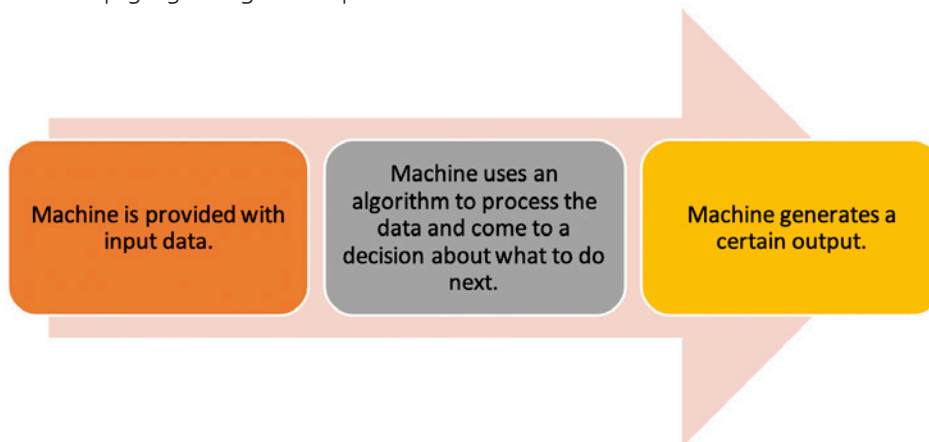


INSTRUCTIONS



Introduction

Have you ever wondered what it's like to perform surgery, scuba dive to the bottom of the ocean, or ride the world's tallest roller coaster? Well, now you can! With virtual reality (VR), nothing is off limits. Virtual reality offers a simulated vision to create an immersive 3D environment. While some VR experiences require a headset and controllers, other VR can be experienced simply by using a computer screen.



Machine learning may sound like something from the future, but it's already all around us. Your social media feeds use an algorithm to figure out what you like to watch, whose profiles you want to see first, and what products or services you might buy. Each time you scroll and click, the program is learning more about you and making tweaks to improve your experience and keep you scrolling even longer.

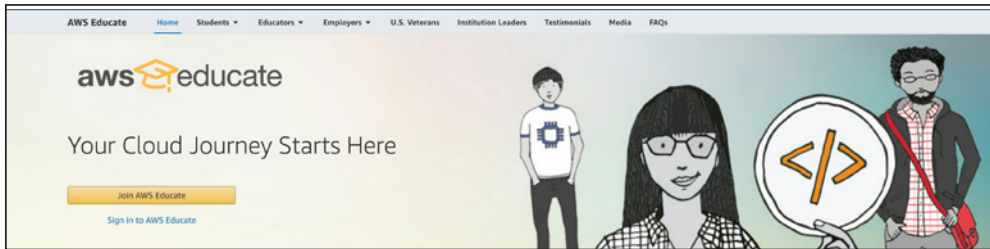
Some games and even tests at school use machine learning to increase or decrease difficulty based on your performance. Machine learning is also used in healthcare to assist doctors in making difficult diagnoses, and can even be used to run a “smart” home by identifying patterns and responding to how people live and use technology at home. Even self-driving vehicles use machine learning to improve how they function. Each time a self-driving vehicle is on the road, it is learning more about its surroundings, how other drivers react, and how to respond in different circumstances.

Machine learning can make our lives faster and easier. Understanding how it works can help you figure out what role machine learning plays in your own life.

Practice Activity

Explore machine learning by using DeepComposer—Amazon's tool for transforming a melody into an original song.

- 1 To begin the demo, please [login to your AWS Educate account](#):



- 2 If you do not have one, [visit the URL](#):

When filling out the application, enter your school name, enter your school-issued or personal email address, and fill in the remaining fields.

This is a screenshot of the 'Step 2/3: Tell us about yourself' application form. The form includes several input fields: 'School or Institution Name' (with a note to not type the name of your school), 'First Name', 'Last Name', 'Email' (with a note to provide a valid current email), 'Graduation Month', 'Graduation Year', 'Birth Month', and 'Birth Year'. There is also a 'Promo Code (optional)' field. A red line from the text above points to the 'School or Institution Name' field. At the bottom of the form, there is a checkbox for 'I'm not a robot' and a 'NEXT' button. A disclaimer at the bottom states: 'Please note that any personal information you provide will be treated in accordance with the AWS Educate Terms and Conditions and AWS Privacy Notice'.

- 3 Accept the Terms and Conditions

This screenshot shows a grey box with the text 'You must scroll through the entire Terms and Conditions before accepting or declining.' Below this text are two buttons: 'I Agree' (highlighted with a red line from the text above) and 'Decline'. At the bottom right of the box is a 'NEXT' button.

- 4 Open the link sent to your email to verify your email address.



5

You will be redirected to a page confirming your application has been submitted and is under review. Applications are reviewed within 24 to 48 hours.

Your email has been verified!
We'll review your application shortly. Check your email for status updates as we process your application.

6

After your application is approved, you will receive a confirmation email. Follow the link to **Set Password**.

aws  educate

Welcome to the AWS Educate Community

Set Your Password

Your Login Credential

New Password

Verify New Password

[Set Password](#)

The password you enter here will be used for access to the AWS Educate Community. It is always more secure to not use the same password that you use on other sites.

Please ensure your password meets the following requirements:

- i. Password must be at least 8 characters long
- ii. Password must contain at least one letter
- iii. Password must contain at least one number
- iv. Password cannot equal or contain your user name
- v. Password must contain at least one of the following characters ! # \$ % - _ = + < >

7

Now you have access to the AWS Educate portal.

Click **AWS Account** to create your free AWS starter account.

aws  educate

[Badges](#) [My Backpack](#) [Advanced Learning](#) [AWS Account](#) [Logout](#)

KaMarie Newton, your cloud journey awaits!

You're well on your way to career awesomeness. Let's get started!

Cloud Explorer Badge

A great place to start! Explore concepts like algorithms, programming, and cybersecurity through real-world examples.



Cloud Inventor Badge

Dive a little deeper! Expand your knowledge with more in-depth challenges on the explorer topics and learn how to use technology to invent the future.



Cloud Builder Badge

Time to create! Learn about the AWS console, services, and start building in the cloud.



8

Click **Create Starter Account**.


I'd like to use an AWS Educate Starter Account

Choose an AWS Educate Starter Account to get access to an AWS account with a preset limit on your spend on AWS services. An AWS Educate Starter Account is run and managed by a third party (Vocareum, Inc.) and the Starter Account runs in Vocareum's environment on AWS. Starter Accounts are subject to a separate agreement between you and Vocareum under separate terms and conditions.


The AWS Educate Starter Account provides access to most but not all AWS services. Students at an AWS Educate member institution will receive up to \$75 (USD) of AWS credit per year in their AWS Educate Starter Account, and students at non-member institution will receive up to \$30 (USD) of AWS credit per year.

You don't need a credit card to use a Starter Account because AWS promotional credits are already available in the account. When your usage of AWS services exceeds the balance on the account, the account is closed and any running services or other resources on the account are lost.

[Create Starter Account](#)

9

Review your account information including credits and expiration date.



AWS Educate Starter Account

Your cloud journey has only just begun. Use your AWS Educate Starter Account to access the AWS Console and resources, and start building in the cloud!

[AWS Educate Starter Account](#)

Your account has an estimated **30 credits** remaining and access will end on **Nov 3, 2021**.

Note: Clicking this button will take you to a third party site managed by Vocareum, Inc. ("Third Party Servicer"). In addition to the AWS Educate terms of service, your use of the AWS Educate Starter Account is governed by the Third Party Servicer's terms, including its Privacy Policy. AWS assumes no responsibility or liability and makes no representations or warranties regarding services provided by a Third Party Servicer.

10

Accept the **Terms and Conditions**.

You may not assign or transfer these Terms, by operation of law or otherwise, without Vocareum's prior written consent. Any attempt by you to assign or transfer these Terms, without such consent, will be null. Vocareum may freely assign or transfer these Terms without restriction. Subject to the foregoing, these Terms will bind and inure to the benefit of the parties, their successors and permitted assigns.

Any notices or other communications provided by Vocareum under these Terms, including those regarding modifications to these Terms, will be given: (i) via email; or (ii) by posting to the Services. For notices made by e-mail, the date of receipt will be deemed the date on which such notice is transmitted.

Vocareum's failure to enforce any right or provision of these Terms will not be considered a waiver of such right or provision. The waiver of any such right or provision will be effective only if in writing and signed by a duly authorized representative of Vocareum. Except as expressly set forth in these Terms, the exercise by either party of any of its remedies under these Terms will be without prejudice to its other remedies under these Terms or otherwise.

Contact Information
If you have any questions about these Terms or the Services, please contact Vocareum at info@vocareum.com.

[I Agree](#)

11

Click on the **AWS Console**.

Welcome to your AWS Educate Account

AWS Educate provides you with access to a wide variety of AWS Services for you to get your hands on and build on AWS! To get started, click on the AWS Console button to log in to your AWS console.

Please read the FAQ below to help you get started on your Starter Account.

- What are the list of services supported?
- What regions are supported with Starter Accounts or Classroom Accounts?
- I can't start any resources. What happened?
- Can I create users within my Starter or Classroom Account for others to access?

Your AWS Account Status

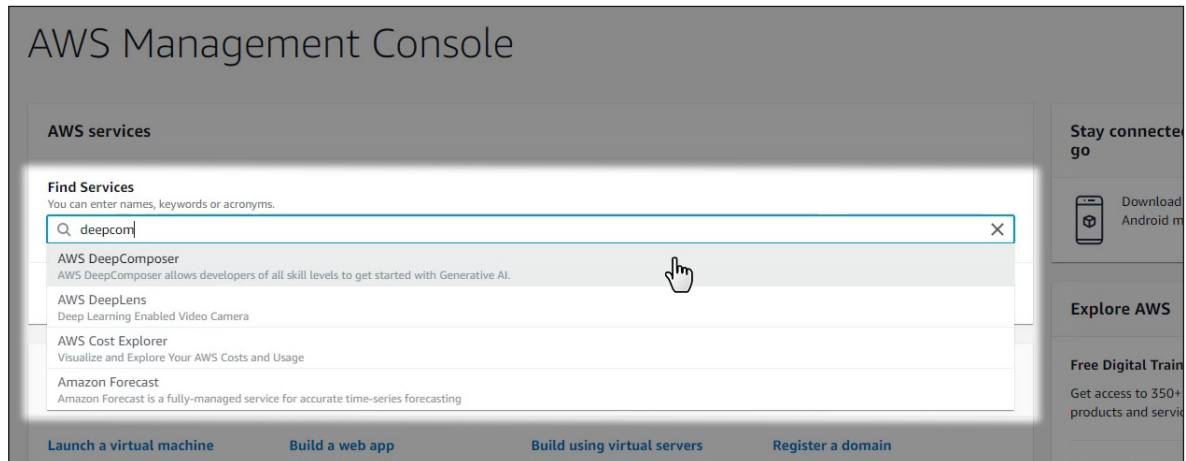
	Active full access ()
	\$30 remaining credits (estimated)
	2:60 session time

[Account Details](#) [AWS Console](#)

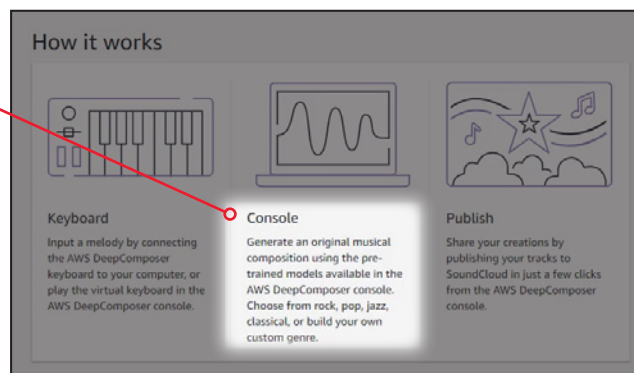
Please use AWS Educate Account responsibly. Remember to shut down your instances when not in use to make the best use of your credits. And, don't forget to logout once you are done with your work!

NOTE: CloudFront service is temporarily unavailable.

- 12 Type **DeepComposer** in the search box and click on Amazon DeepComposer to open the program.



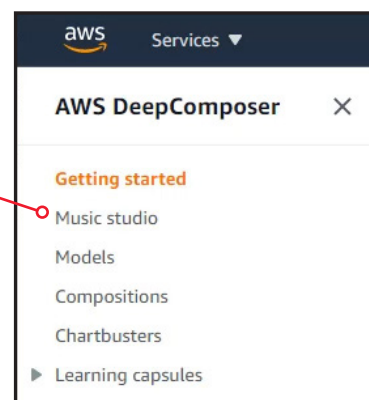
- 13 We will be using the Console for this activity and a virtual keyboard program.



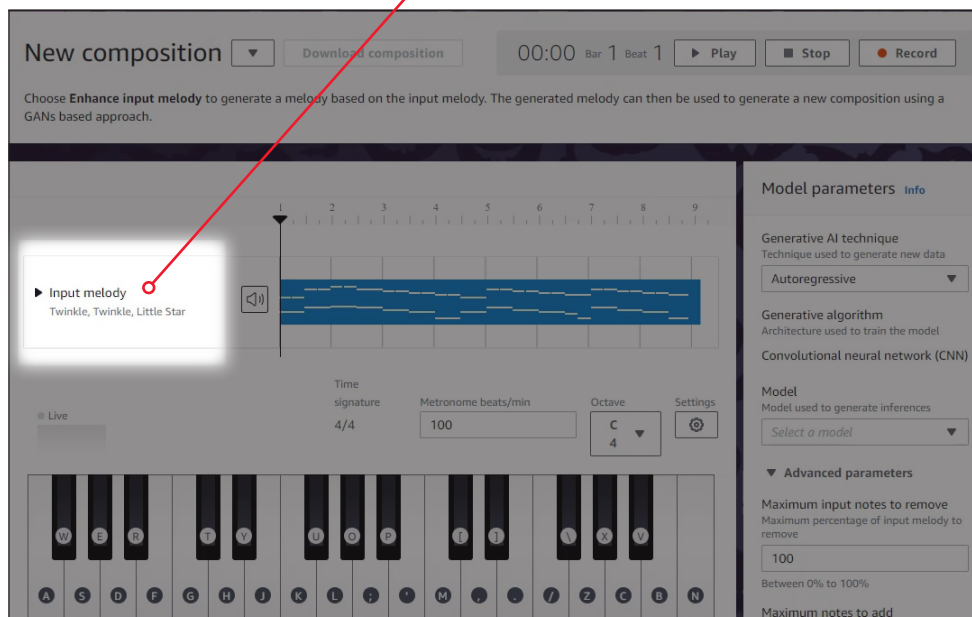
- 14 Click on **Get started** up at the top of your screen.



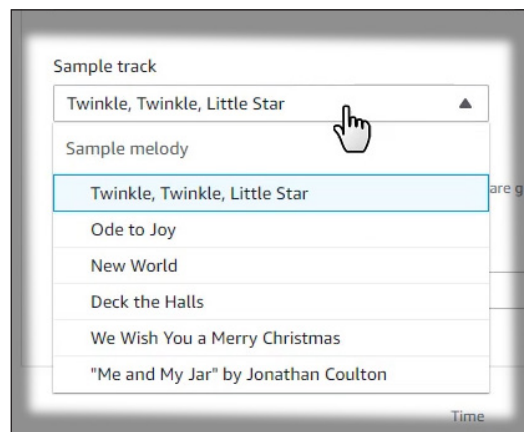
- 15 Then click on **Music studio** on the left side of your screen.



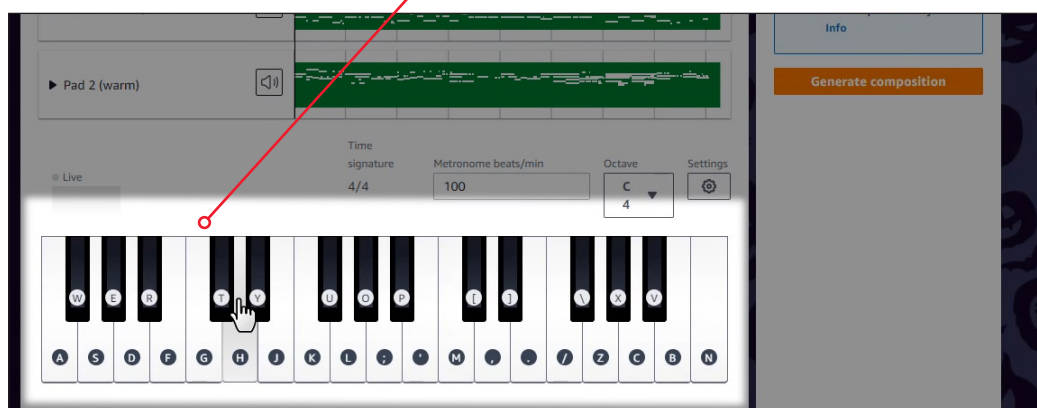
- 16 See the sample melody listed: “Twinkle, Twinkle, Little Star”?



- 17 If you click on the arrow next to the words **Input melody** and then the drop down under **Sample track**, you can see other samples. Choose any melody to explore.



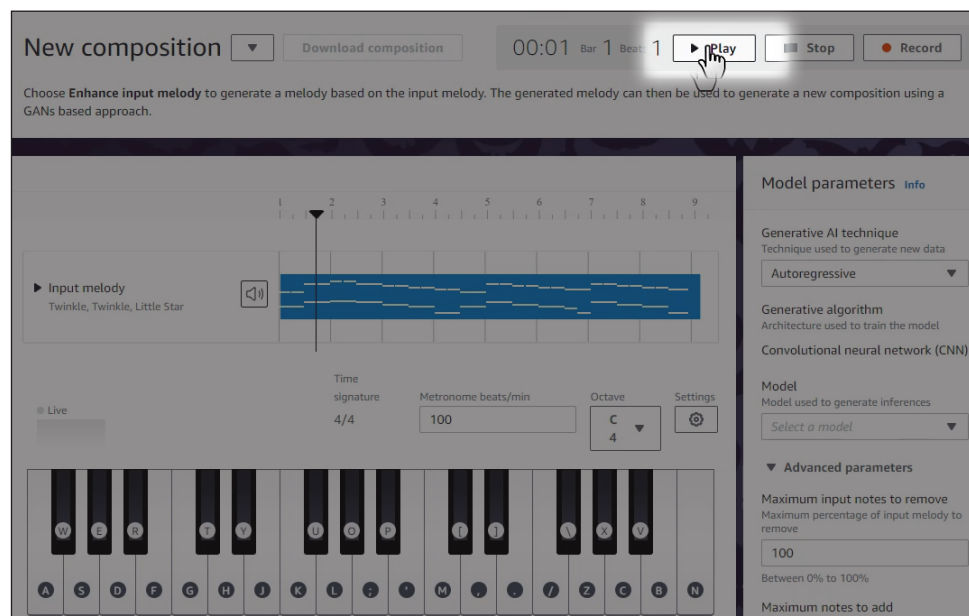
- 18 You can see the virtual keyboard at the bottom of your screen. Click on a few keys to hear how it sounds.



19

Click the **Play** button at the top right corner of your screen to hear how this **New Composition** sounds with the sample **Input Melody** that you choose from the drop down list.

By the way, this new composition is just the sample input melody you choose right now; it does not include the notes you played on the virtual keyboard. You can save that for later!



20

Now explore the Machine Learning Models.

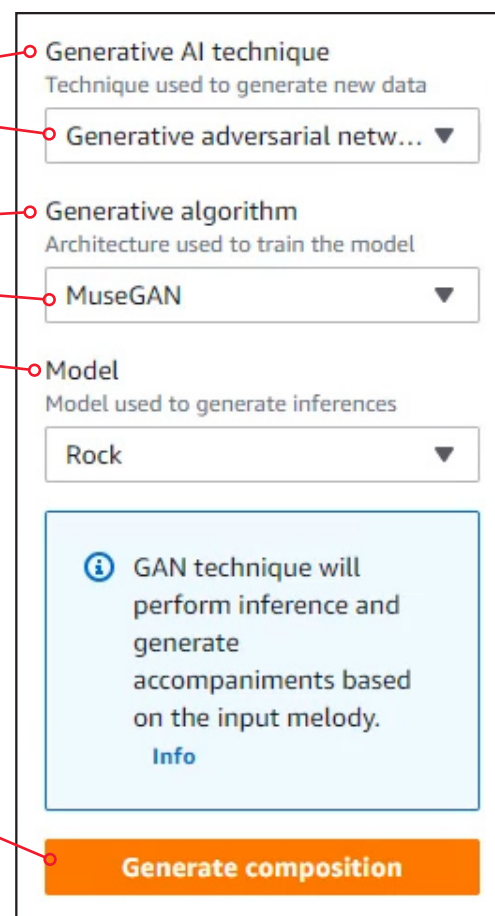
Choose one of the **Generative AI techniques** and then select an algorithm and a model from the drop down menus as well.

You **MUST** choose one of the **Generative AI techniques** to be able to access the **Generative algorithm** and the **Model**.

Choose one from each category to experiment!

MuseGAN was built specifically for generating music and has components for each instrument as well as the overall song. This one is able to capture the unique characteristics of each instrument and how they harmonize with each other to generate the overall song.

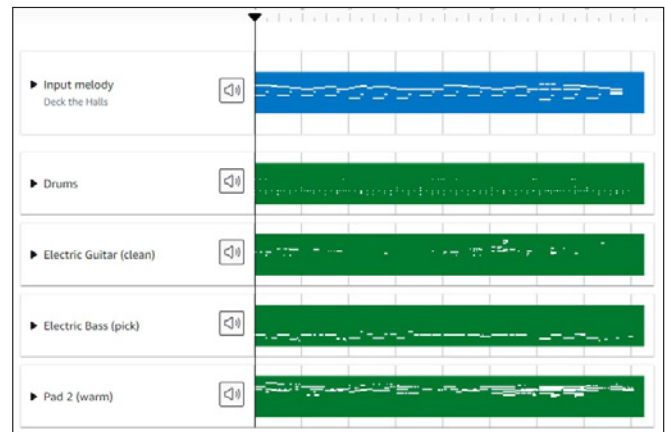
Click **Generate composition** to hear your first musical creation!



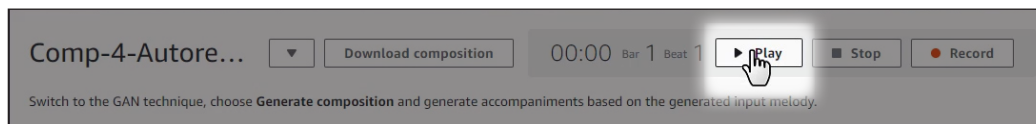
- 21 Once the machine has used your choices to generate a new composition, you will see the new composition appear on your screen. This new music is based on the sample input you provided and the Generative AI technique and Generative algorithm you choose for the machine model to use.

Interesting fact: Generative Adversarial Networks (GANs) are a kind of machine learning that uses two competing networks. (They are adversaries!)

One generates realistic-seeming content and the other tries to distinguish this realistic-seeming content from real content (in this case, music). This is how the machine learns!



- 22 Click **Play** again to see what you and the Machine Learning model have created together.



- 23 Try making a remix by choosing a different **Generative AI** technique and **Generative** algorithm. Notice that the available models change based on the generative algorithm that you choose.

Generative AI technique
Technique used to generate new data

Autoregressive ▼

Generative algorithm
Architecture used to train the model

Convolutional neural network (CNN)

Model
Model used to generate inferences

AutoregressiveCNN Bach ▼

- 24 Now explore some of the **Advanced parameters**.

Change the maximum number of input notes that can be removed from the melody or change the maximum number of notes that can be added.

Try increasing the **Creative risk** number. Note that the higher the number the more “experimental” the creation will sound.

▼ Advanced parameters

Maximum input notes to remove
Maximum percentage of input melody to remove

75

Between 0% to 100%

Maximum notes to add
Maximum number of notes added to the input melody

50

Between 0 and 100

Sampling iterations
Number of actions the model takes

66

Between 0 and 100

Creative risk
As risk increases, compositions will become more experimental

4

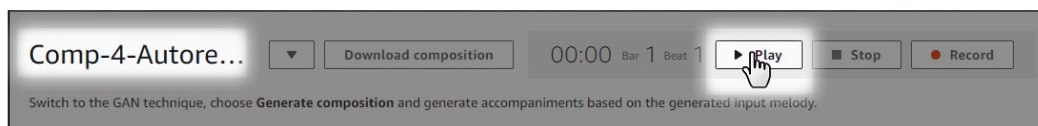
Between 0.5 and 6

- 25 Notice that the model uses its previous output as the input for this next iteration.

ⓘ This model can improve its previous outputs by using them as input melodies. Try enhancing the input melody multiple times. This model does not generate accompaniments. [Info](#)

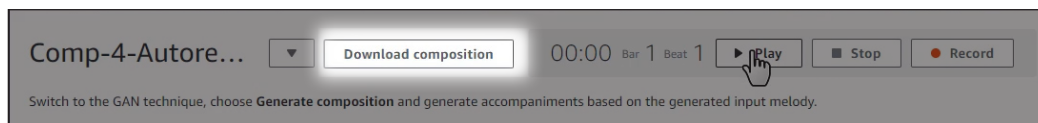
Enhance input melody

- 26 Click **Play** again to see what you and the Machine Learning model have created together.
Can you hear the original input melody in there? Notice the difference?



- 27 If you really like what you and the machine model have come up with, then be sure to click **Download composition**.

Your new creative composition downloads and saves as a .midi file. If time allows, see if you can make another musical creation with the input and machine learning model and parameters that you choose!



Extension Activities

To learn more about machine learning, explore these activities and ideas:

- ☐ Take your DeepComposer song and create another new melody in a completely different genre or style of music.
- ☐ Work with Alexa to start building Alexa skills. Use Amazon's [Alexa Skills Kit](#) to get started.
- ☐ Research machine learning to look for examples in your daily life. Can you find a surprising use for machine learning?

Parent Tips

Your child is learning about machine learning. Machine learning is one branch of artificial intelligence (AI). AI seeks to use computer programming to simulate the way that humans think. Machine learning is all around us. Support your child by asking her to share her project with you, and try one or more of the ideas below:

- ☐ Ask your child to tell you examples of machine learning that you may not have even noticed.
- ☐ Explore programs of study that can help your child prepare for a career related to machine learning. What types of courses or programs would be important to take?
- ☐ Identify careers that require knowledge of machine learning. Consider options on both sides of machine learning, including programming and working with machine learning tools.