AI Bootcamp

The Future of AI

Module 22 Day 3

Class Objectives

By the end of class, you will be able to:

1. Describe how generative AI tools utilize transformer technology.
2. Explain how AI is affecting the global economy.
3. Summarize the active areas of AI research and hypothesize how AI could be applied in the future.

Instructor **Demonstration**

Overview of Generative AI Developments

Reinforcement learning

ChatGPT is trained by using a method called reinforcement learning. This training method involves three steps:

01

Supervised fine tuning: A pre-trained LLM is fine-tuned using additional labeled training data.

02

Mimicking human preferences: The model uses outputs ranked by human judges to train a new reward model on a new dataset.

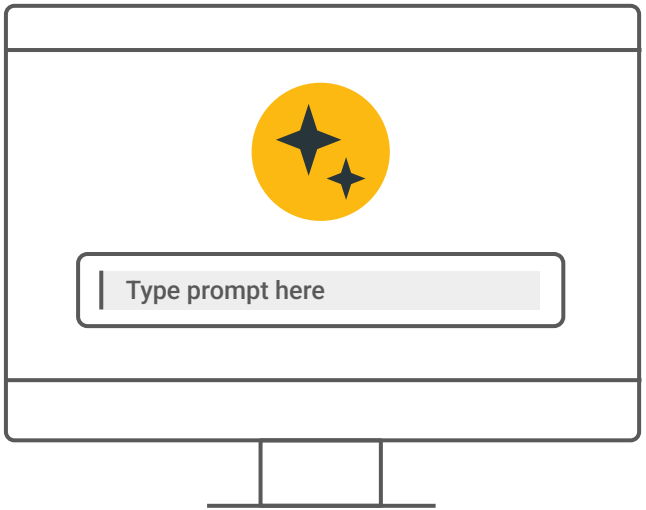
03

Proximal Policy Optimization: The reward model selects the best responses from the fine-tuned model based on what it learned about human preferences in its training data.

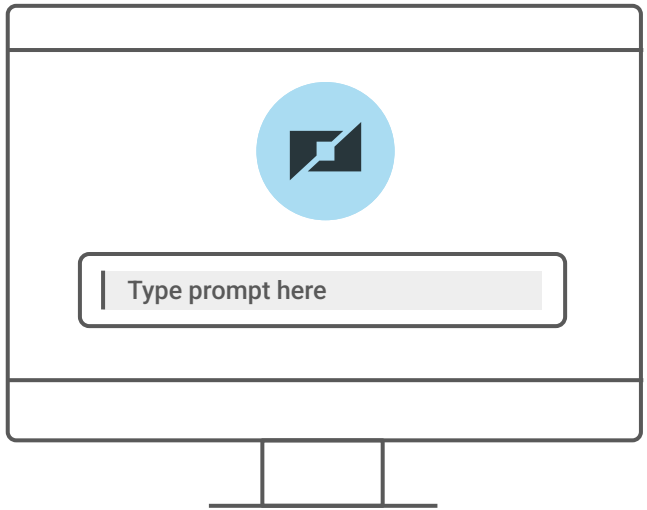
By learning what a human observer prefers and sees as conversational, reinforcement learning models generate responses that seem more conversational to humans.

Additional text-generating systems

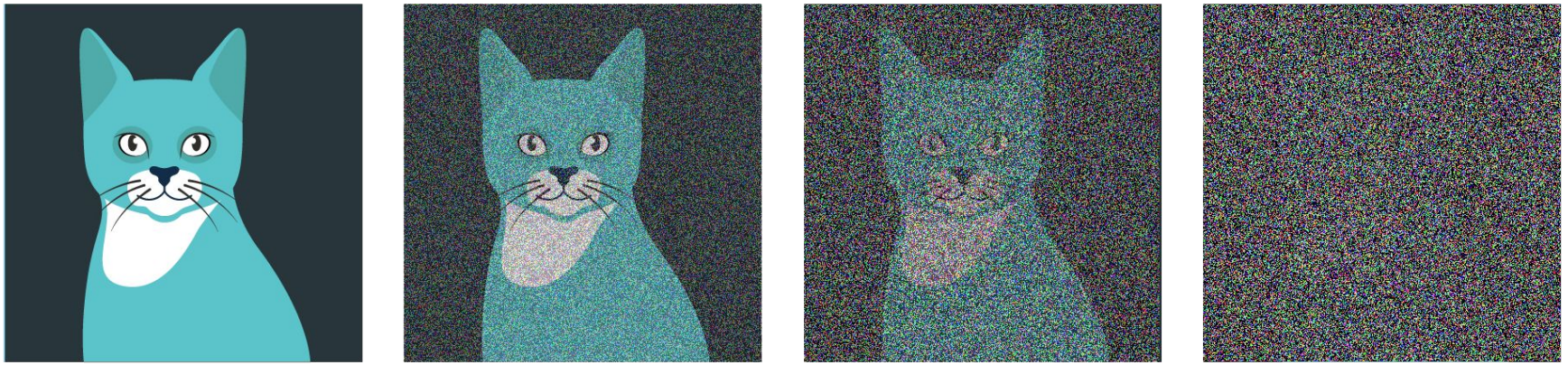
Google's **Bard**



Microsoft **Copilot**



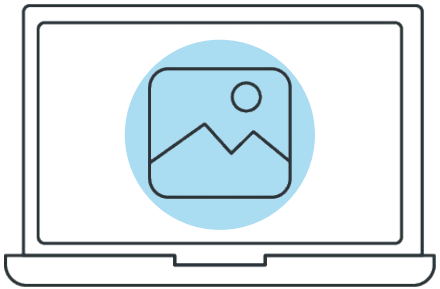
How stable diffusion uses noise



Additional image generation tools

OpenAI’s DALL-E 2

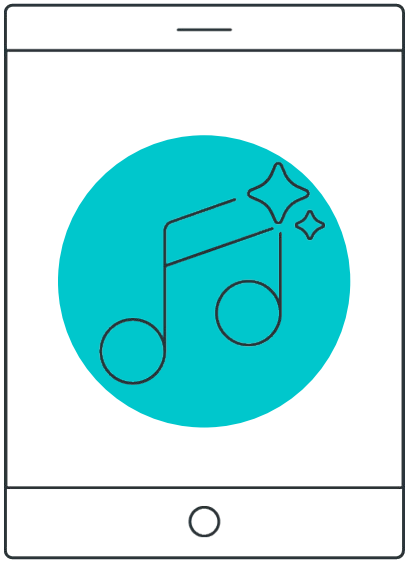
Photoshop Generative Fill



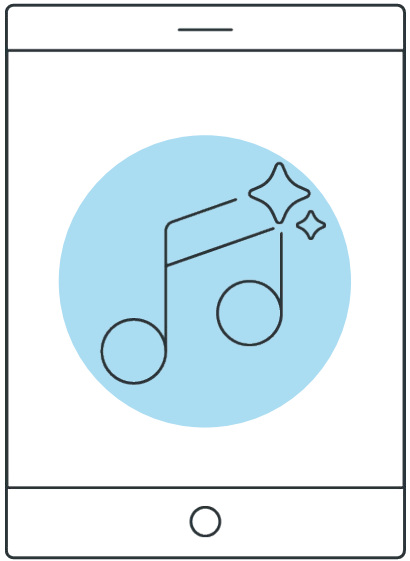
Canva - Magic Media

Art Breeder

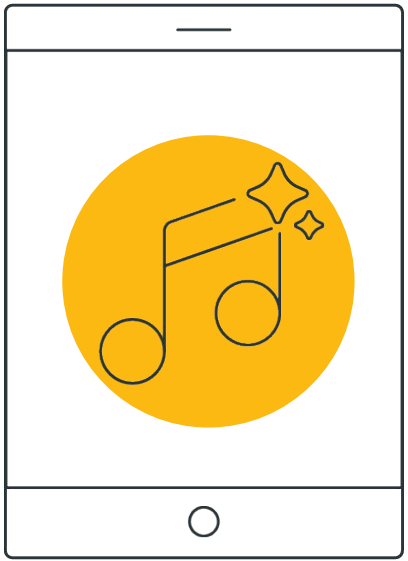
Additional music generation systems



Aimi



MusicFX



Dream Track

Poisoned images

Image samples poisoned using Nightshade

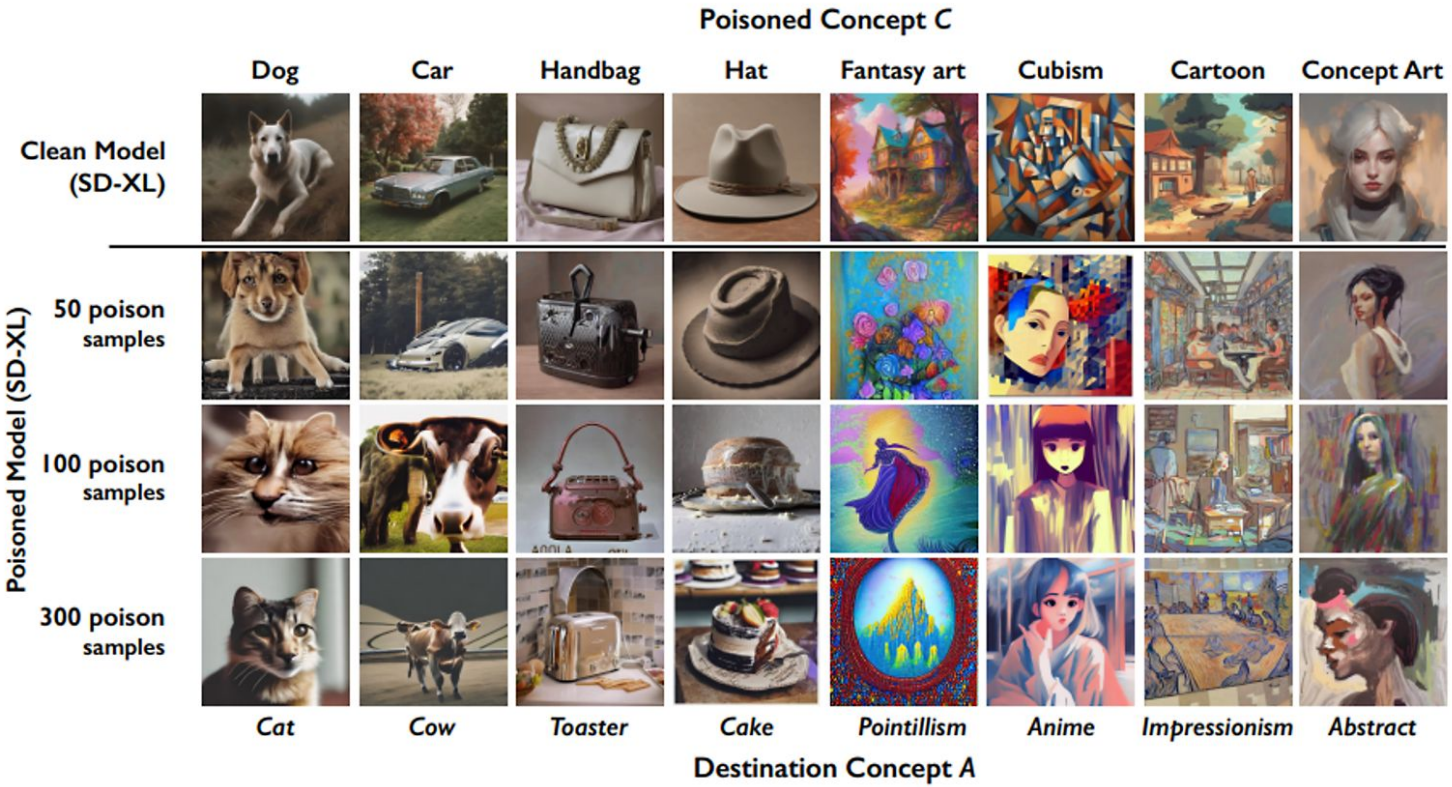


Image credit: Shan et.al., 2023

Activity:

Generative AI

In this activity, you will choose a generative AI tool and generate an image or piece of music using the best practices from the **Prompt Engineering** lesson earlier in the week.

Suggested Time:
20 Minutes

Time’s up!

Let’s review

Questions?

Instructor **Demonstration**

AI Beyond the Computer

Autonomous vehicles

01

Autonomous cars have self-driving features.

02

Many industries including public transportation and long distance shipping could be disrupted by self-driving cars.

03

Self-driving cars must be able to react to other vehicles, objects, adverse weather, pedestrians, and more.

Autonomous vehicles

Computer vision

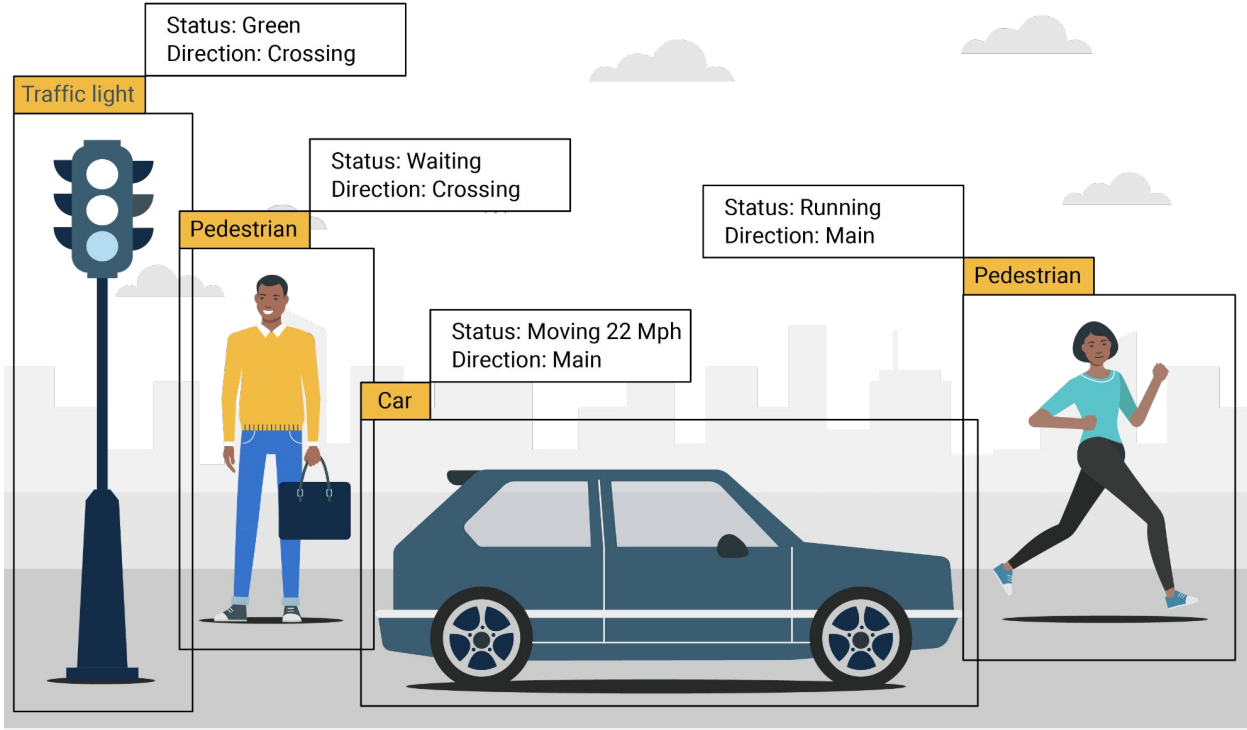
Computer vision or object detection allows computerized systems to “see” by analyzing images and identifying features in those images.

Self-driving cars use computer vision to perceive their surroundings.

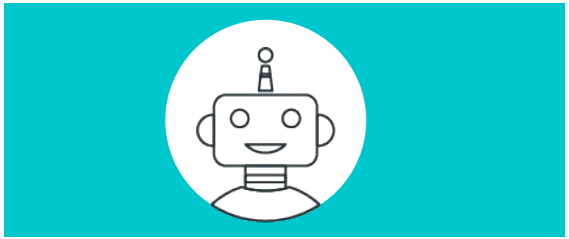
Autonomous vehicles

How computer vision works

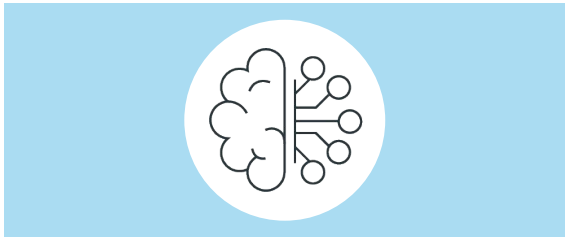
1. Process live images.
2. Break the images down into pixels and groupings.
3. Label the various components.
4. Make predictions about what is most likely to be found in the relevant image.



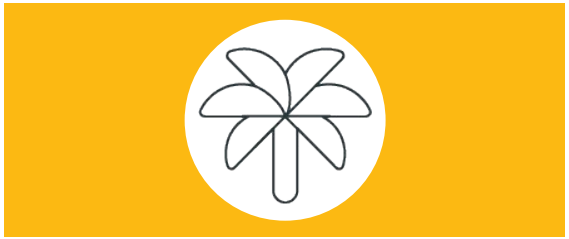
Robots



Robots rely on computer vision to interact with the world around them.



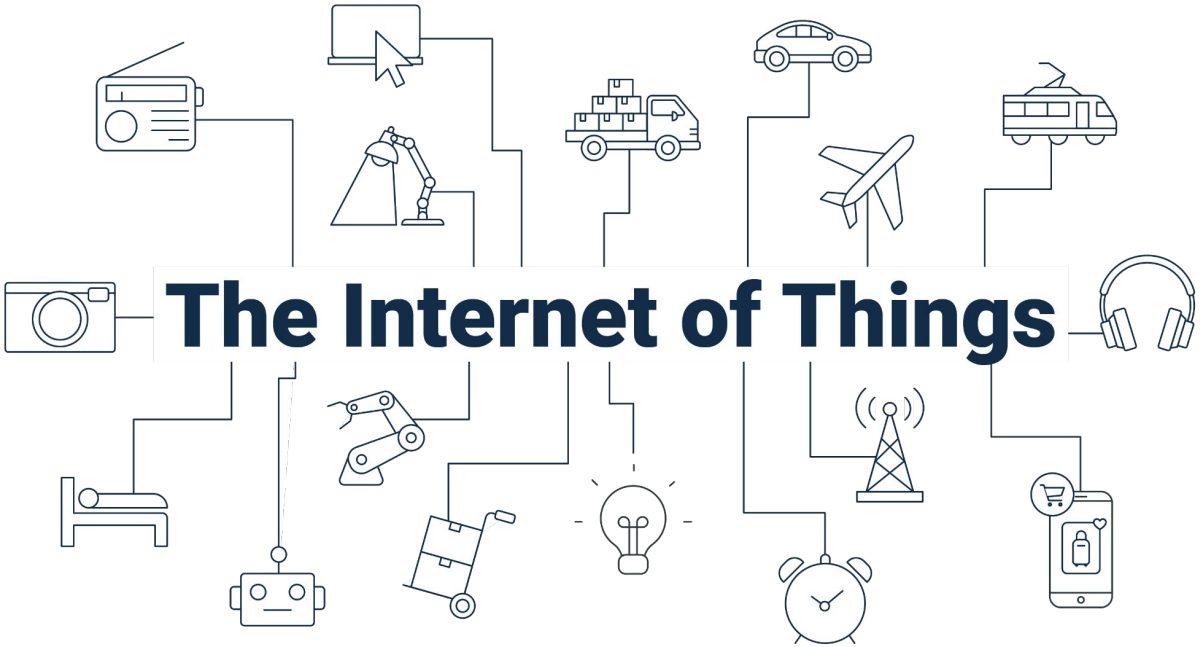
LLMs help robots interpret human instructions so that they can play and carry out the tasks they are assigned. They are also able to provide verbal feedback to their operators.



In early March 2023, Google demonstrated a general-use robot equipped with their PaLM-E visual-language model. The robot showed that it was capable of interpreting an instruction to go fetch snacks from a kitchen and an understanding that being asked to bring something to clean a spill would require it to find a sponge.

Internet of Things

The **Internet of Things** (IoT) refers to a network of connected devices of any kind equipped with the necessary technologies that allow for data collection and processing, including sensors, controllers, processors, and software.



Internet of Things

Generative adversarial networks (GANs)

TinyML is a category of machine learning applications that run on low-power devices, dealing with smaller amounts of data and smaller scale algorithms.

Applications include:

- Detecting activation phrases for digital assistants or smart technology.
- Predictive maintenance and warning of wear and future machinery breakdowns.

Internet of Things

Generative adversarial networks (GANs)

1. GANs describe a training strategy for ML models that use two models to improve results while minimizing the need for human input.

2. Each GAN is made up of a generative model and a discriminator model.

3. The discriminator is a model that identifies whether a given input example is real or generated by the aforementioned generative model.

4. These two models are effectively in competition: The discriminator is trying to “catch” the generator on its mistakes while the generator is training to trick the discriminator.

Mobile AI

Although AI may seem like cutting-edge technology, the truth is that it is already in use in our daily lives. If you own a smartphone, you are already using AI on your mobile device.

For instance:

01

Embedded AI models improve cameras.

02

Security systems use face recognition technology to unlock your devices.

03

Autocomplete predicts the next word you are most likely to use.

AI and the future of work

1. AI's ability to mimic human skills such as image creation, writing, and decision-making is followed by concerns that people's jobs will be at risk in the boom of AI application still to come.

2. US-based employers reported AI as the reason for 6% of layoffs in 2023 (Challenger, Gray & Christmas, Inc., 2023).

3. Analysts contend that AI's impact on the job market will be similar to other technological advances, which automated some skills and forced workers to learn how to use the technology or transition their skills to other roles.

4. With AI automation set to increase production and revenue while reducing labor costs, some experts consider the greatest threat a wider inequality gap rather than job loss.

Break

15 mins

Activity:

Economic Disruption

In this activity, you will reflect on how AI is disrupting various economic sectors and impacting employment.

Suggested Time:
20 Minutes

Time’s up!

Let’s review

Economic Disruption Activity

1. What impact is AI predicted to have on the worldwide job market? Cite specific metrics from the article.
2. How is the rate of impact of AI expected to change over time?
3. What are some of the positive impacts that AI is predicted to have on the economy?
4. What steps are some governments taking to ease the pain of labor-market upheaval?

Questions?

Instructor **Demonstration**

Additional Areas of Active Research

Areas of active research

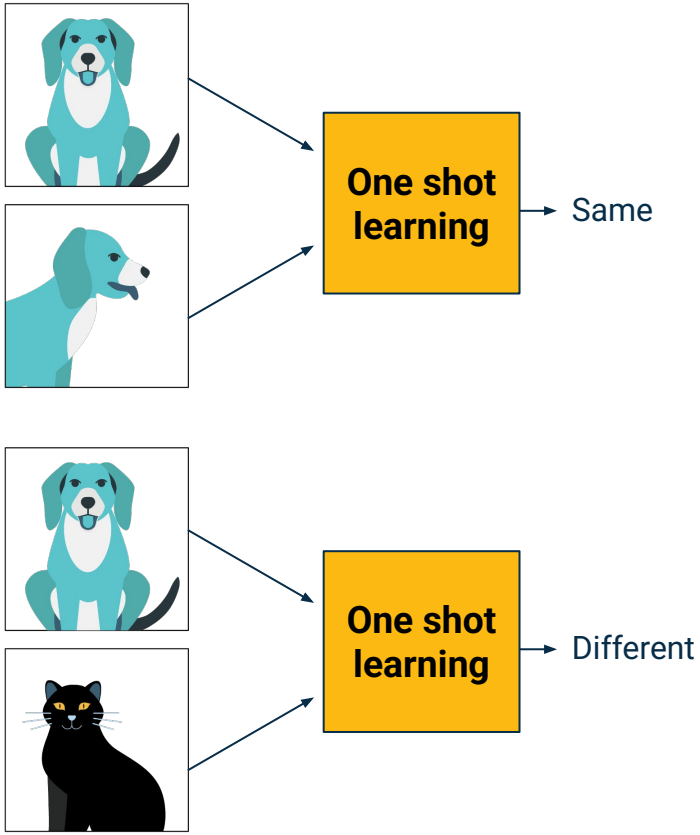
One-shot learning

1. One-shot learning is a machine learning technique that can help identify the similarity and difference between two novel images, such as comparing a passport photo to the face of its holder

2. One-shot learning uses a model known as the Siamese neural network (SNN). The SNN takes an input image and processes it by measuring how closely the features of two images resemble each other.

3. It is trained to do this by using a triplet loss function, where three images are provided: an anchor, a positive, and a negative. The anchor and positive are chosen to have a close similarity, for example, two similarly framed images of the same person. The negative should be close but nevertheless different.

4. The model is then trained to recognize the similarity between the anchor and the positive while recognizing the difference between the anchor and the negative.



Areas of active research

Zero- and few-shot learning

01

Few-shot learning techniques are used where there are multiple but limited amounts of labeled data available for training.

02

Zero-shot in situations where there is no labeled data whatsoever. The latter relies purely on drawing from prior experience to compare new novel examples.

03

One-shot learning has an obvious advantage over traditional machine learning algorithms as those would need to be trained on many pictures of the same person, which isn't practically feasible facial recognition.

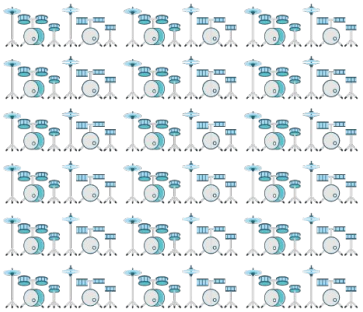
Areas of active research

Neuro Radiance Field (NeRF)

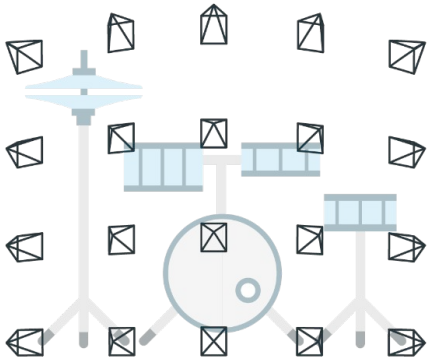
A new innovation called Neuro Radiance Field (NeRF), developed by the hardware and software company Nvidia, significantly speeds up the process of 3D modeling.

NeRF trains an AI model on a relatively small number of images in order to predict and generate a complex 3D environment that closely resembles the real-world environment that the pictures represent.

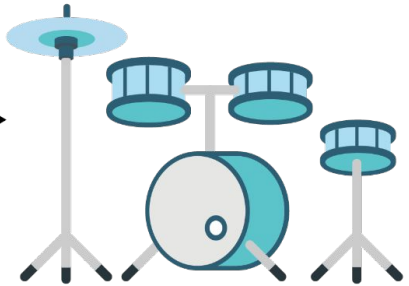
Input images



Optimize NeRF



Render new views



Areas of active research

Algorithm speed and computational resource management

1. Improving AI algorithms to work faster enhances their performance and enables their application in areas that require quick, complex decision-making. These enhancements also lead to more efficient use of time and power.

2. AI algorithms, using pattern recognition abilities and optimization through machine learning, can be used to improve speed and reduce computational resource requirements.

3. For example, Nvidia used AI reinforcement learning to improve the design of their chips, a trend Google has also followed by using its large language model PaLM to suggest improvements to optimize itself.

4. Similarly, new reinforcement learning models like BCOOLER have successfully reduced energy consumption, proving that AI systems can optimize energy usage.

Activity:

Research Emerging Technologies

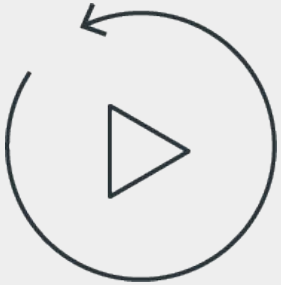
In this activity, you will have an opportunity to dive deeper into an area of active research that you are interested in learning more about.

Suggested Time:
20 Minutes

Time’s up!

Let’s review

Questions?



Let’s **recap**

Recap

After today's lesson you are able to:

1. Describe how generative AI tools utilize transformer technology.
2. Explain how AI is affecting the global economy.
3. Summarize the active areas of AI research and hypothesize how AI could be applied in the future.

Questions?

The End