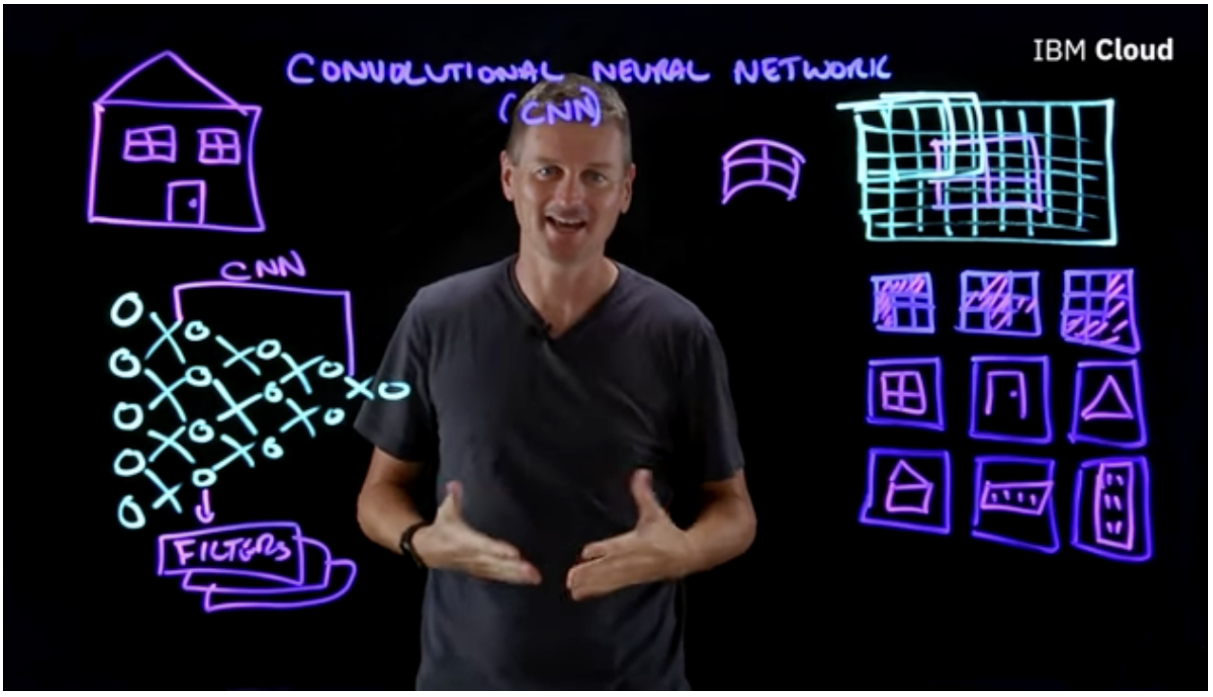
IBM course AI(mod4)

AI classifies images

Convolutional neural networks [CNN]



An AI system uses a convolutional neural network (CNN) to analyze images

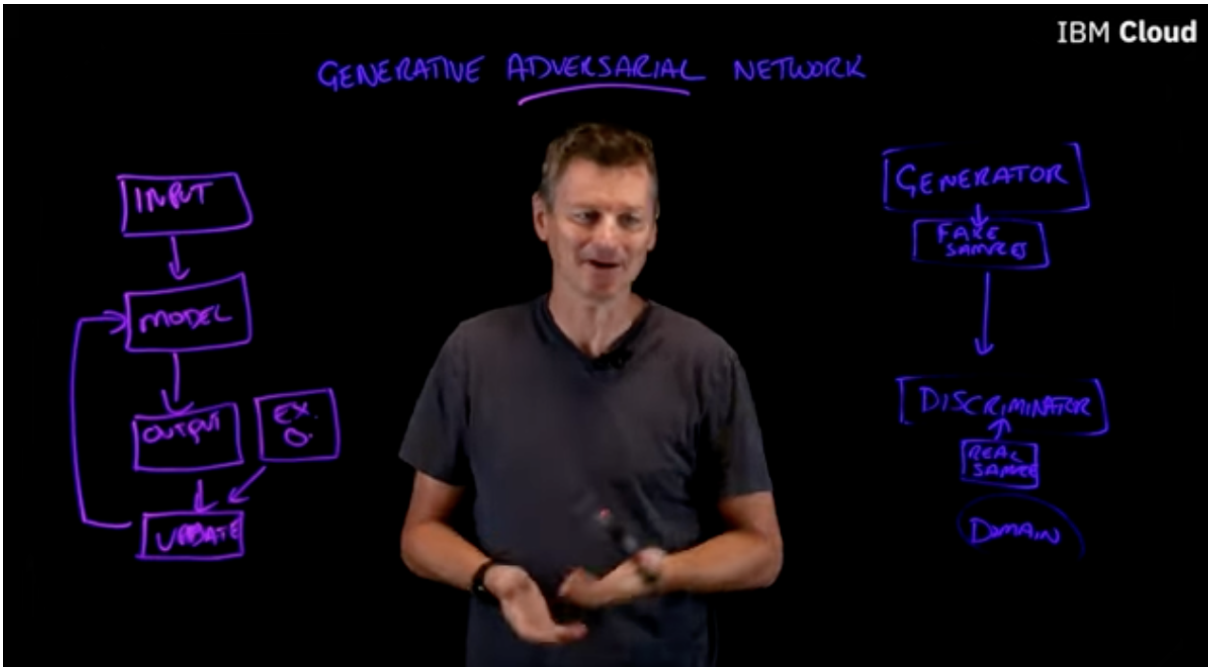
Digital photos and videos build images with millions of pixels—tiny dots that, taken together, give the human eye the illusion of a two-dimensional image. Each pixel has one of several million brightness and color levels that can be expressed in numbers. A computer (including the camera in a cellphone) can look at each of those pixels and input or output its numbers, either recording (input) or displaying (output) an image. But it's one thing to display an image and another, much more complicated thing to analyze it.

The problem is caused by those millions of pixels with their color and brightness levels. They add up to numbers so large that they would overwhelm most AI systems. (Research scientists say that too much data can "flood" a system.) To get around this, research scientists have devised a clever way to analyze only small parts of an image at a time. This process, called a **convolutional neural network**, or **CNN**, makes it possible for visual recognition systems to identify things in an image, as in facial recognition.

Martin Keen, an IBM Master Inventor, understands how a convolutional neural network brings image analysis down to a practical scale.

> **To summarize**
>
> In a **CNN**, two small groups of pixels that overlap each other are compared mathematically to get a value. AI can use thousands of these small comparisons to identify individual parts of an image, then compare them to images in its corpus. From this, AI can put together an overall identification, without being overwhelmed.

Generative adversarial networks



A visual recognition system can use a generative adversarial network (GAN) to create new drawings and photos

Recall that an AI system can analyze a photo using a neural network to identify a photo. But what about AI systems themselves that create imaginary photos?

You might have heard of computer-generated “deep fakes”: computer-generated images that look like they were taken from real life. You might have also seen drawings or handwritings created by AI “artists”. How does a system do this? One way is by pitting two convolutional neural networks (CNNs) against each other in a “contest” called a **generative adversarial network**, or **GAN**. In effect, the CNNs battle each other until one of them becomes pretty good at creating art.

Martin Keen returns to explain the surprising way a generative adversarial network does this.

> ### To summarize
>
> A **GAN** battle ends with an image that’s ready to be shown to a human. Sometimes, the human might laugh and think the resulting image is ridiculous. But other times, the human, like the CNN acting as judge and teacher, won’t be able to tell the difference. At that point, the deep fake is a success!

Question

Reflection: What do you think?

Think about AI computer vision in your life. Take a moment to list at least one way that computer vision impacts you personally.

> In today's world, computers control nearly every aspect of life. As a computer science student, my education is entirely online, and this digital dependency extends to daily activities like shopping, transportation, and entertainment. Computers are the backbone of modern existence, and as a student, I'm immersed in this digital revolution, shaping its future.