Welcome to Deep Learning Online Bootcamp

Day 1 - Deep Learning Overview

dφ

Democratizing Data Science Learning

Learning Objectives

What and why Deep Learning?

Machine Learning vs Deep Learning

Deep Learning Applications

Deep Learning Frameworks

dφ

Democratizing Data Science Learning

Some Cool Deep Learning Applications

Flappy Bird

- ❏ A deep learning agent playing Flappy Bird!
- ❏ The agent is able to play without being told any information about the structure of the game or its rules.
- ❏ It automatically discovers the rules of the game by finding out how well it did each time. This approach is called Deep Reinforcement Learning.
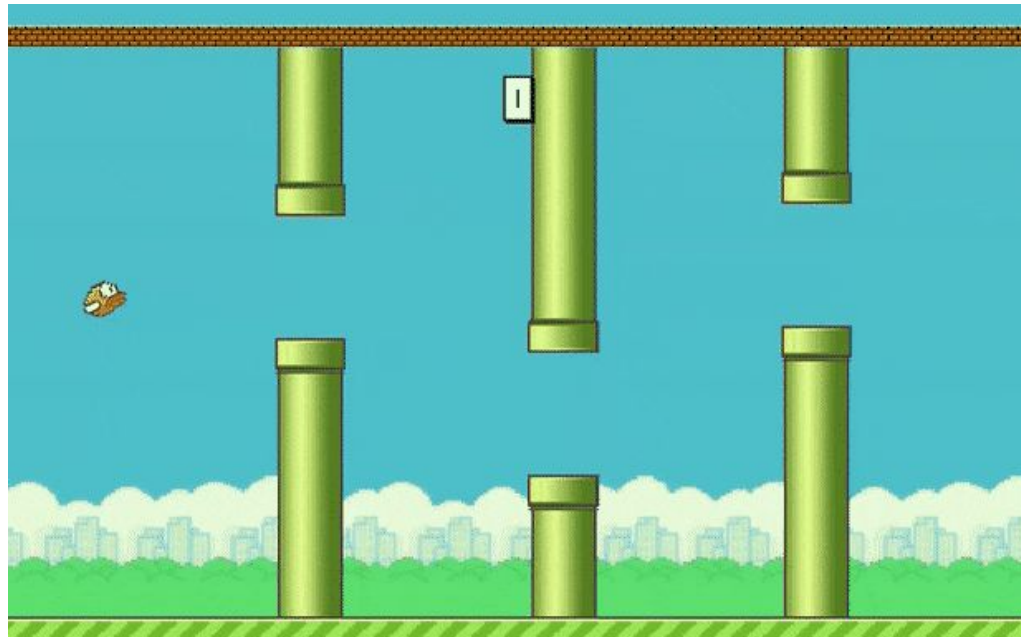
Increasing the pixels of a blurry image

❏ Increase the resolution of a blurry image through deep learning.

LipNet

- ❏ Lip reading performed more accurately than humans.

Why Deep Learning?

Older machine learning algorithms typically plateau (become constant) in performance after they reach a threshold of data.

Deep learning is one-of-a-kind algorithm whose performance continues to improve because more the data fed, the more the classifier is trained, resulting in outperforming the traditional models/ algorithms.

How do data science techniques scale with amount of data?
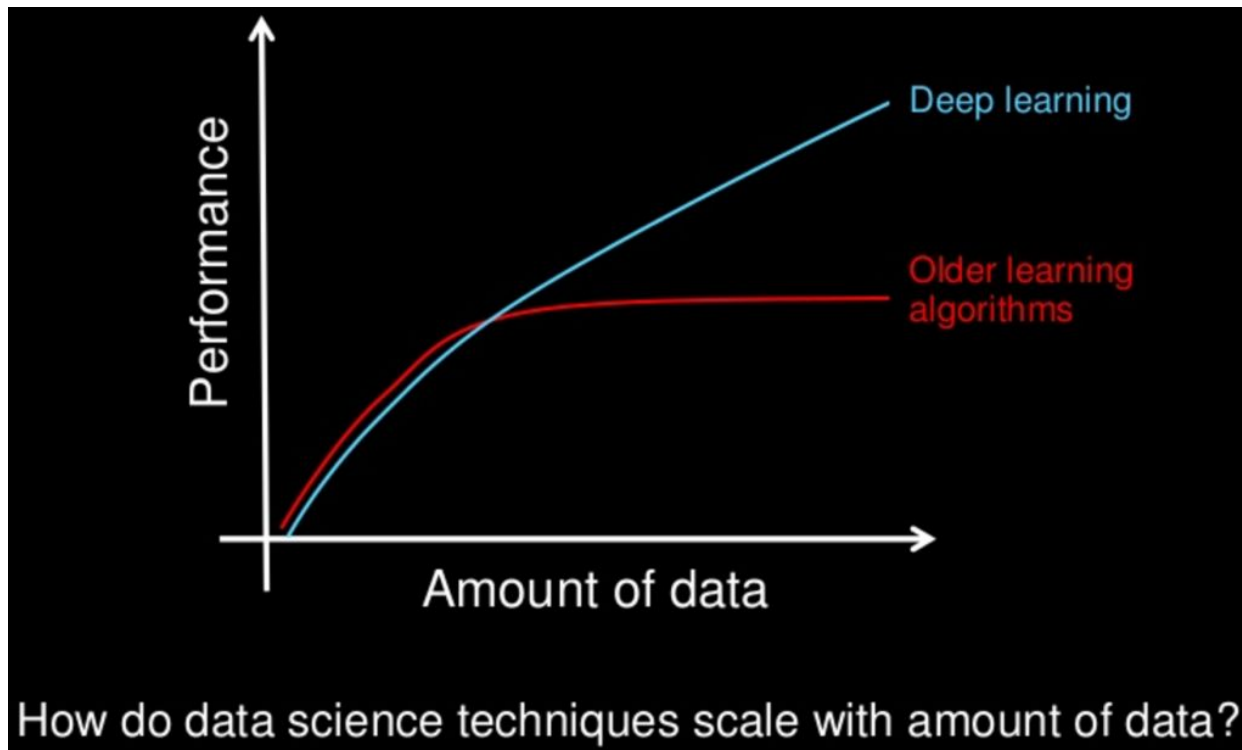
Deep Learning – An Analogy

Look at how a child learns language:

You show an apple to a kid and say "this is an apple". Repeating it for 20 times, a connection in its brain is established and it can now recognize apples. What is important - at the beginning it can not differentiate small details. Small ball in your hand is going to be an apple because it follows the same pattern (small, rounded, red/green). Only an apple is rooted in a little brain.

The child points at an object and says, 'apple.' The child's parent immediately provide feedback: 'Right' or 'No, that's a ball".

Slowly, after enough feedback, the child eventually forms an internal mental model of how to label different objects in the world.

What is Deep Learning?

A Deep Learning algorithm is able to **learn hidden patterns** from the data by itself (without human supervision), **combine them together**, and build much more **efficient decision rules**.

What is Deep Learning?

Now what does learning hidden patterns mean? Taking the same apple example, it means that:

- A deep learning model first identifies the low level features like the edges of an apple
- Then it slowly understands the more complex features like body and stem.
- Finally, it combines all the learnings and learns the shapes, colours and other characteristics that can be used to identify an apple.
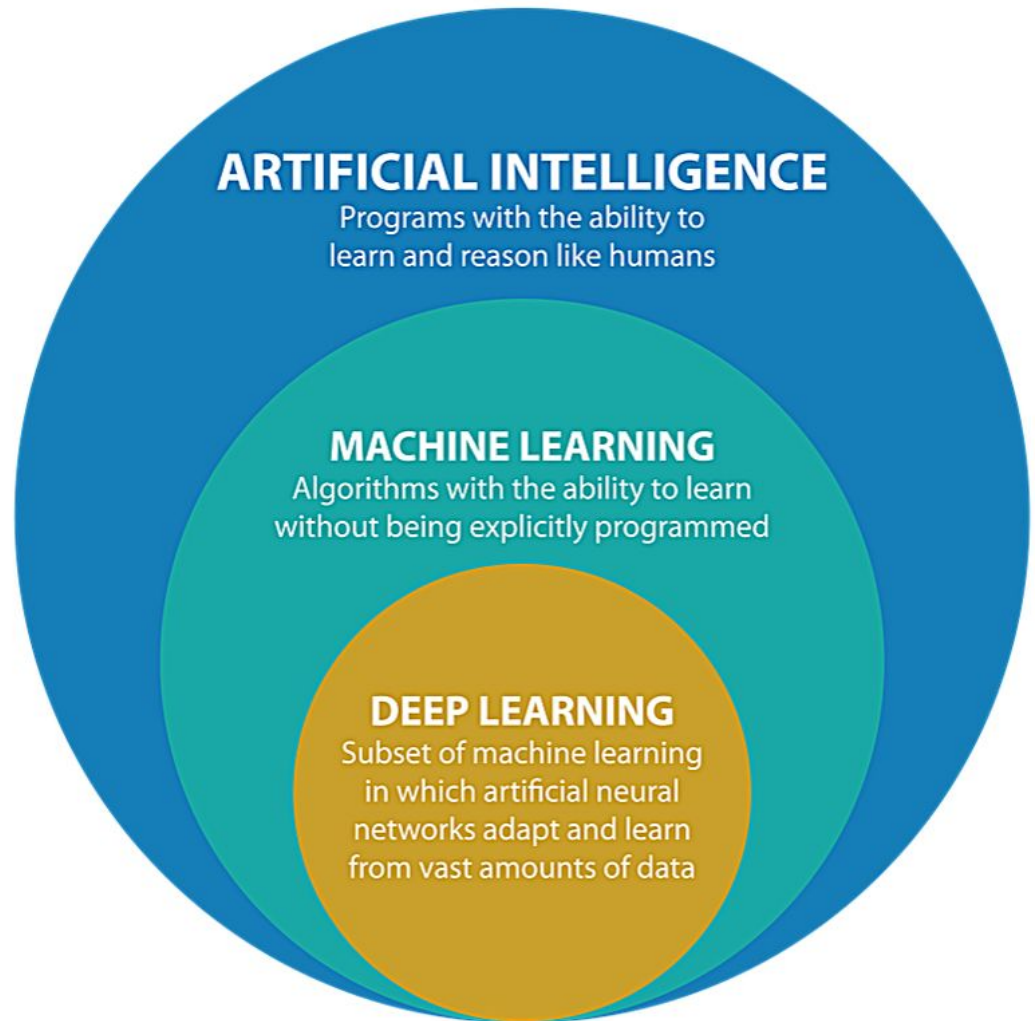
The further you advance into it, the more complex the features it can recognize.

Machine Learning vs Deep Learning

In practical terms, deep learning is just a **subset of machine learning**.

In fact, deep learning technically is machine learning and functions in a similar way (hence why the terms are sometimes loosely interchanged). However, its capabilities are different.

ARTIFICIAL INTELLIGENCE
Programs with the ability to learn and reason like humans

MACHINE LEARNING
Algorithms with the ability to learn without being explicitly programmed

DEEP LEARNING
Subset of machine learning in which artificial neural networks adapt and learn from vast amounts of data

Machine Learning vs Deep Learning

If you've worked with Machine Learning in the past, you might have heard about Feature Extraction. What is it?

Feature Extraction means extracting the useful features of a dataset.

For eg. The stem and body of an apple.

Machine Learning vs Deep Learning

❏ In traditional Machine learning techniques, most of the features need to be identified by an domain expert in order to reduce the complexity of the data and make patterns more visible for learning algorithms to work.

Unfortunately, **feature extraction** is a **separate** and often a **manual component** in machine learning pipeline and it is **time-consuming**.

❏ The biggest advantage of Deep Learning algorithms are that they **try to learn features from data** in an **incremental manner**. As discussed before, the model will first learn the basic constituents/low-level features before moving on to the high level ones i.e it learns on ITS OWN!
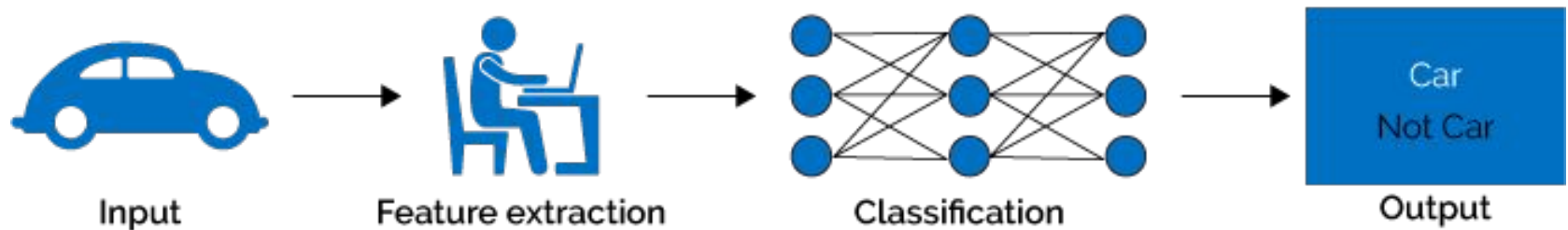
This **eliminates the need of domain expertise and hard core feature extraction.**

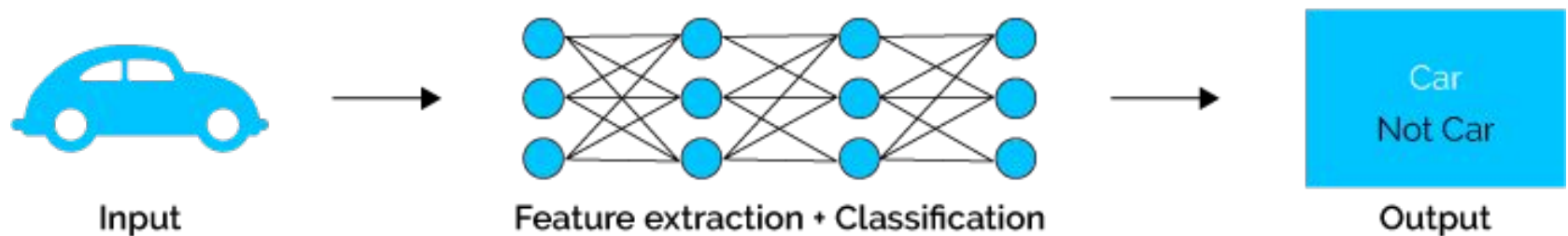Have a look at the next figure to understand this better.
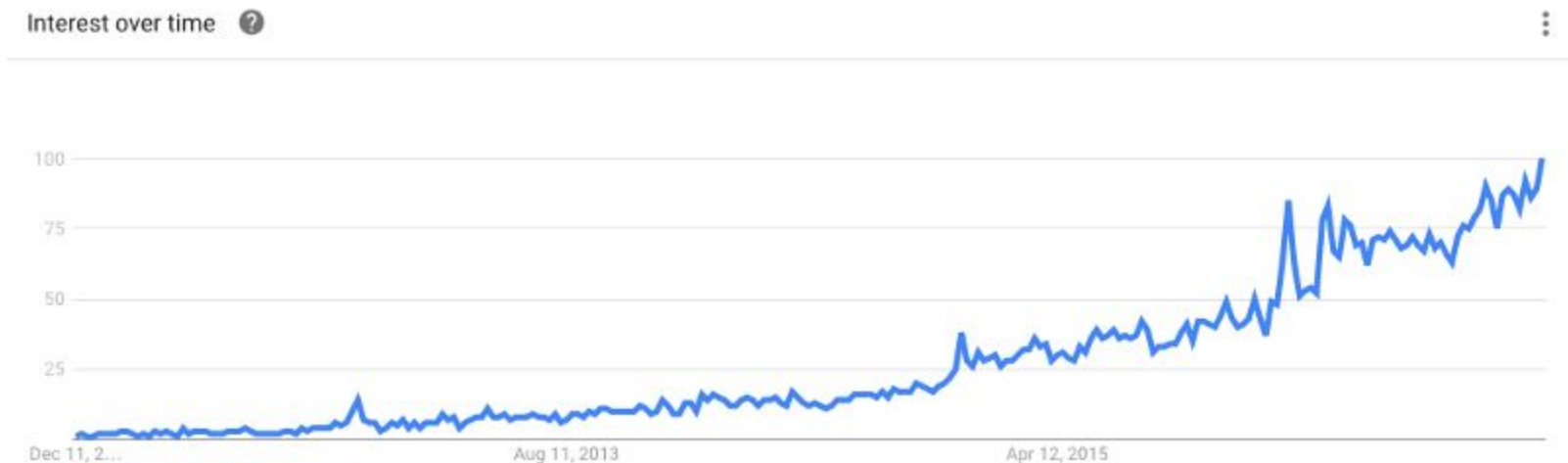
Machine Learning vs Deep Learning

Why is Deep Learning so popular?

In 2012, deep neural networks began to outperform traditional classification algorithms, including machine learning algorithms.
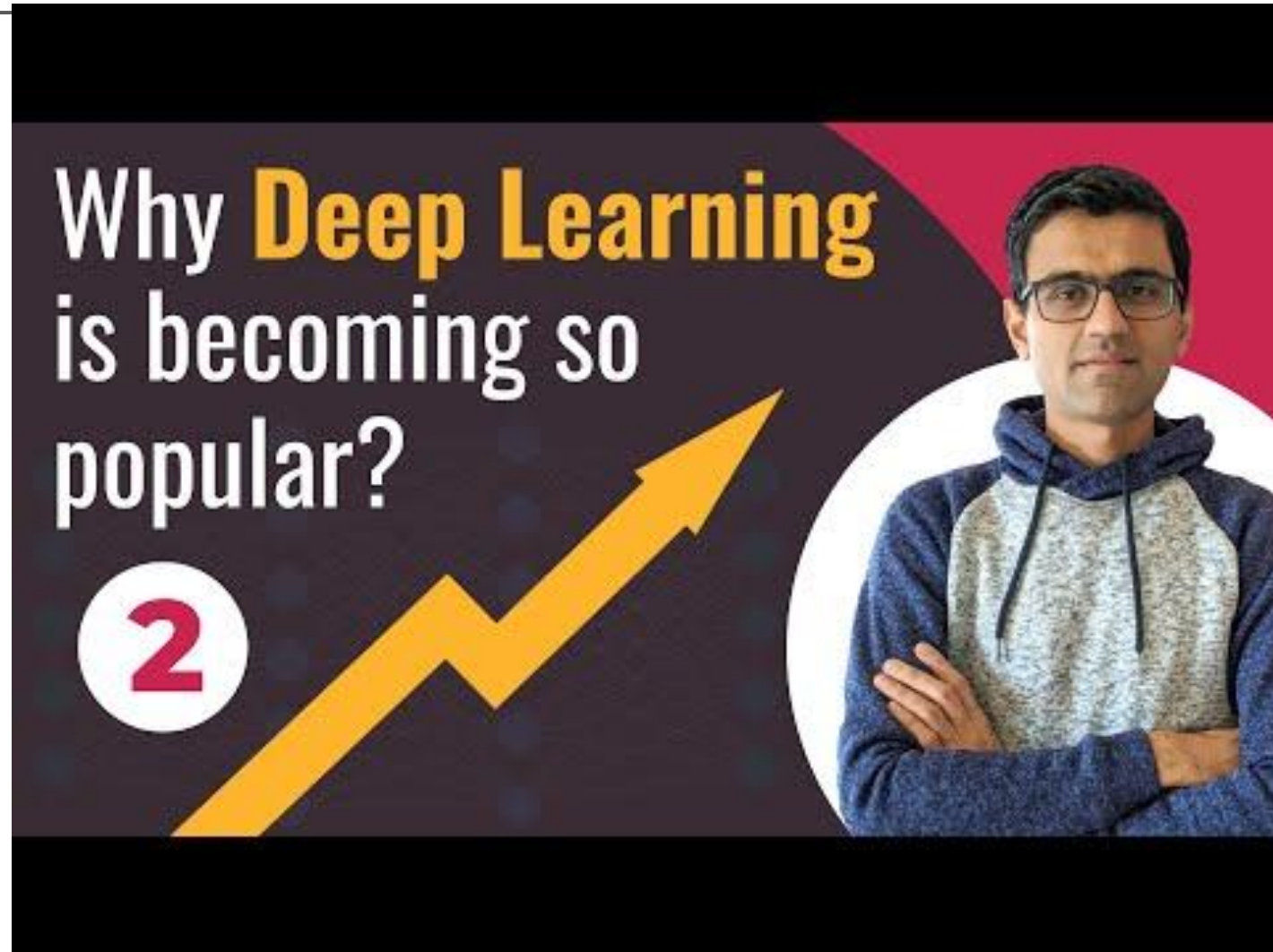
This is largely due to **increased performance of computer processors (CPUs & GPUs)** and **larger storage media for retaining huge training datasets**. Every year since, deep learning has continued to get better, becoming state of the art for solving problems in many different domains. This explosion in deep learning is largely thanks to improvements in hardware and massive labeled data sets that allow deep learning models to improve quickly over time.

Google trend for the keyword "Deep Learning"

Why is Deep Learning so popular?

Deep Learning Applications in daily lives

Social Media

One of the most common applications of Deep Learning is **Automatic Friend Tagging Suggestions** in **Facebook** or any other social media platform.

Facebook uses face detection and Image recognition to automatically find the face of the person which matches it's Database and hence suggests us to tag that person based on **DeepFace**.

We've Suggested Tags for Your Photos

We've automatically grouped together similar pictures and suggested the names of friends who might appear in them. This lets you quickly label your photos and notify friends who are in this album.
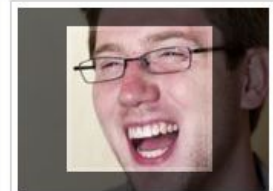
Tag Your Friends

This will quickly label your photos and notify the friends you tag. Learn more

Who is this?

Who is this?

Who is this?

Who is this?

Who is this?

Who is this?

Francis Luu

Virtual Personal Assistants

Have you ever thought about what lies behind the working of **Google Assistant, Siri** or **Alexa**?

As the name suggests, Virtual Personal Assistants assist in finding useful information, when asked via text or voice. All you need to do is ask a simple question like "What is my schedule for tomorrow?" or "Show my upcoming Flights".
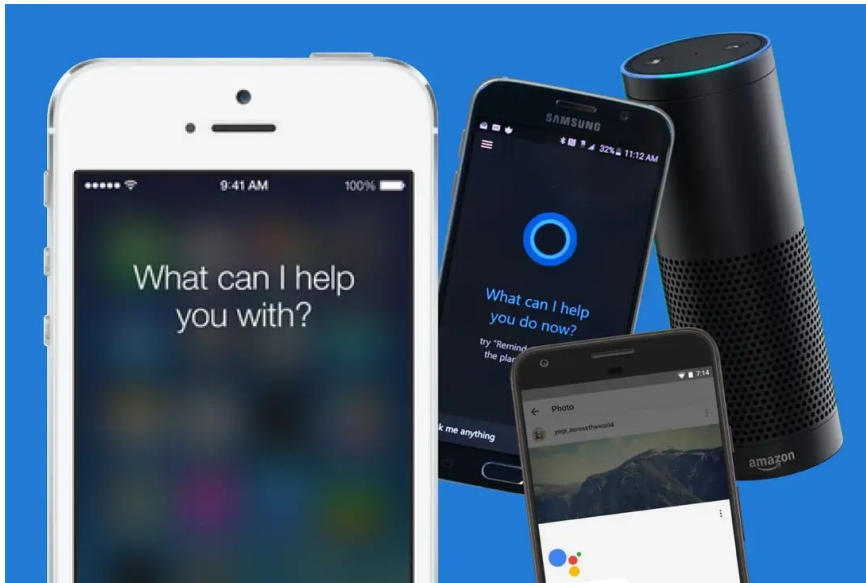

Recently, personal assistants are being used in Chatbots which are being implemented in various food ordering apps, online training websites and also in Commuting apps. It is even used for shopping purposes.

Healthcare

Deep learning provides the healthcare industry with the ability to analyze data at exceptional speeds without compromising on accuracy.

The technology has been applied across several other areas over the years. These include AI-powered chatbots that can identify patterns in patient symptoms, deep learning algorithms designed to identify certain cancers, pathology, and the identification of rare diseases.

Within each of these areas, deep learning plays a fundamental role in providing the medical professional with insights that allow them to identify issues early and provide highly personalized and relevant patient care.
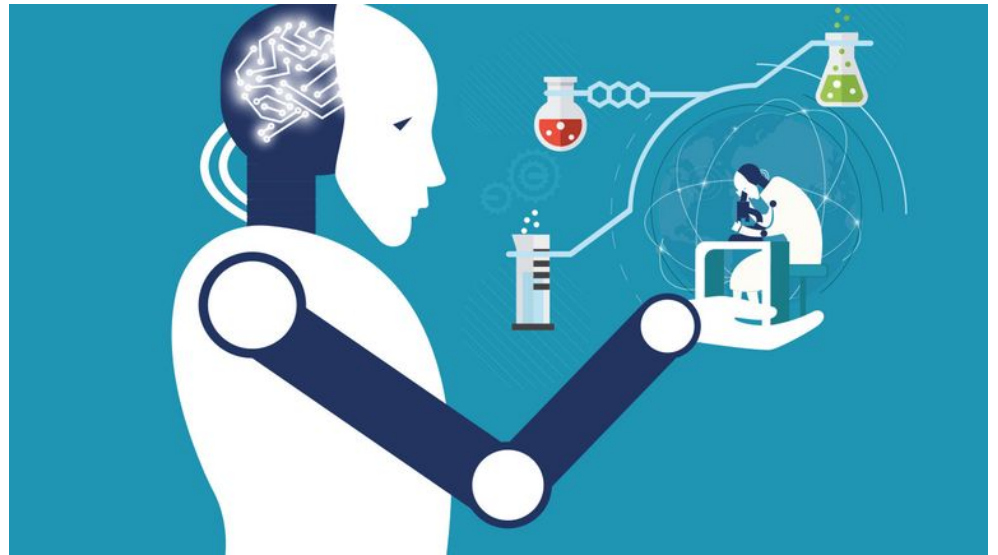
Other Applications

Apart from the ones you just saw, the number of deep learning applications in our daily lives are immense.

Can you think about more such applications?

Add them here:

https://discuss.dphi.tech/t/day-1-introduction-to-deep-learning/685

Deep Learning Frameworks

Deep Learning Frameworks

Both TensorFlow and PyTorch have their advantages as starting platforms to get into neural network programming.

Traditionally, **researchers and Python enthusiasts have preferred PyTorch**, while **TensorFlow has long been the favored option for building large scale deep learning models for use in production**.

However, the latest releases have seen the two libraries converge towards a more similar profile. As long as you stick to either TensorFlow or PyTorch as your deep learning framework, you can do nothing wrong.

Slide Download Link

- You can download the slides here:
  https://docs.google.com/presentation/d/1XdenSAVaiFMdbtCqaG70yEHOdQLVr2ehnbQQPJDRo5E/edit?usp=sharing

That's it for the day. Thank you!

Feel free to post any queries on [Discuss](#)
or in the #help channel on Slack