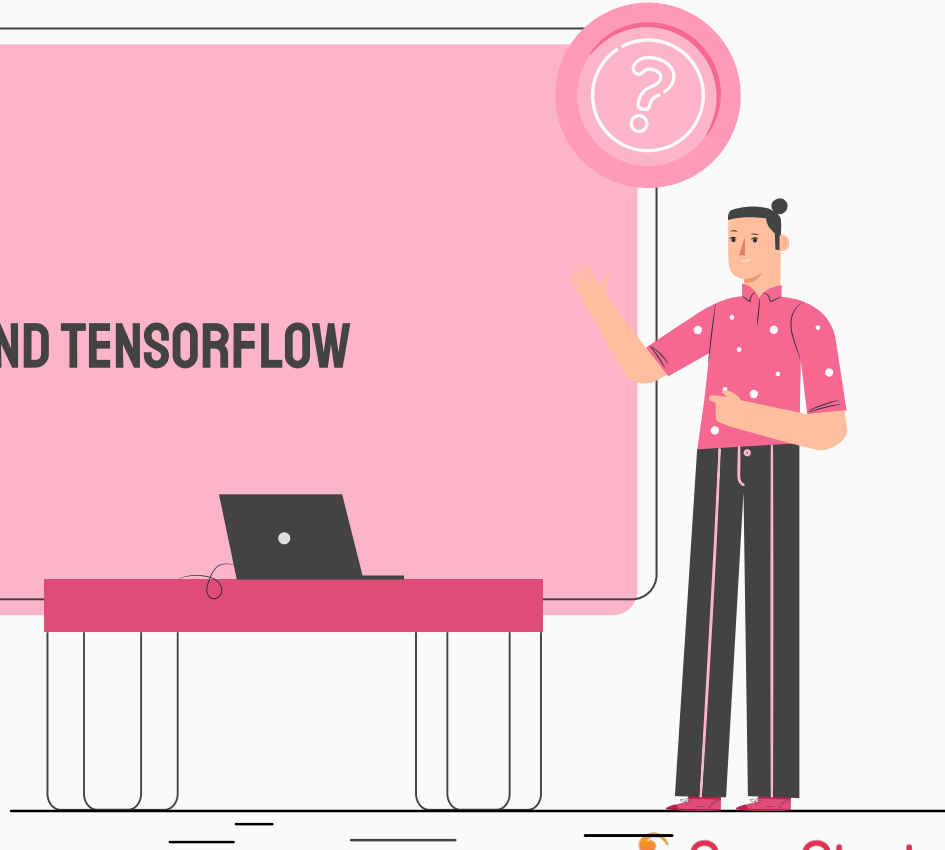
DEEP LEARNING AND TENSORFLOW



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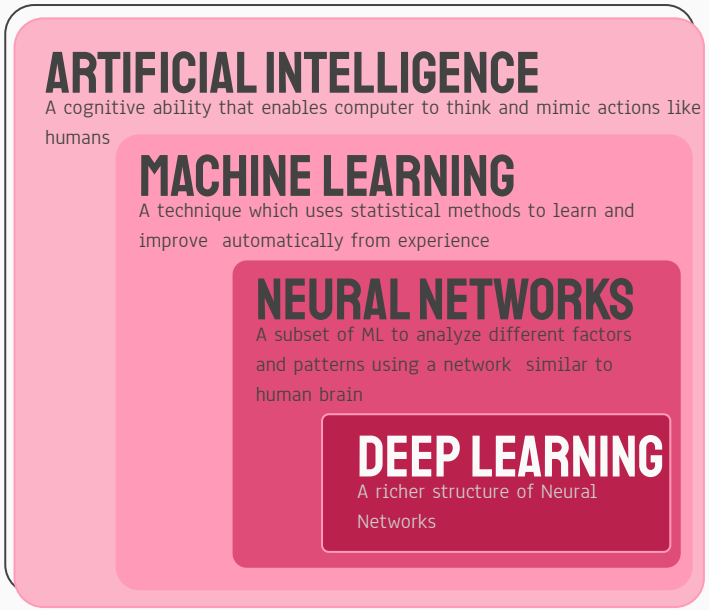
DEEP LEARNING



Deep Learning is a subfield of machine learning.

The algorithms are inspired by the structure and function of **human brain** in processing **data** and creating patterns for use in **decision making**.

In reality, deep learning is quite far away from the complexity of human decision making.

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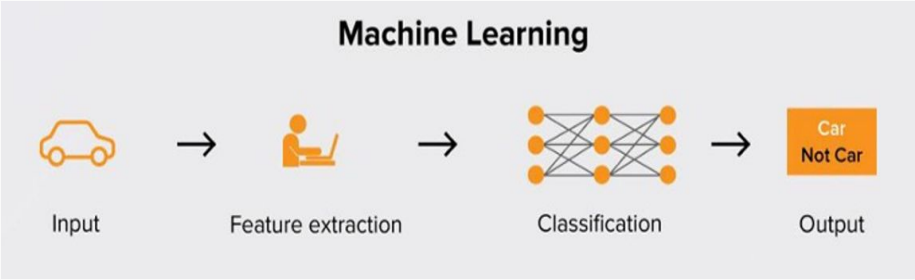
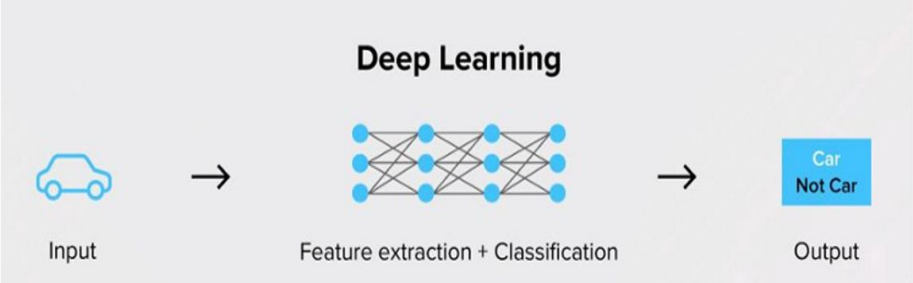
TRADITIONAL ML VS DEEP LEARNING



Traditional images classification:
hand-designed feature extraction algorithms such as Bag-of-Words, HOG followed by a machine learning classifier such as SVM.



Deep Learning classification:
Deep learning approach of stacking layers that automatically learn more intricate, abstract, and discriminating features and at the end work as a classifier.

Figure source

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DEEP LEARNING: WHY NOW?

AVAILABILITY OF DATA

Publicly available online databases

Data storage service in cloud infrastructure

IMPROVED ALGORITHMS

Open-source libraries, tools, API and pre-trained architecture

Collaborative project and framework

Large research community all over the world

Industrial investment on AI research

IMPROVED TECHNOLOGY

Increased memory capacity
Low power consumption
Availability of GPU card
Cost efficient training infrastructure
Cloud computing infrastructure such as Amazon Web Service, Microsoft Azure, Google cloud and IBM Cloud.

SOME APPLICATIONS OF DEEP LEARNING

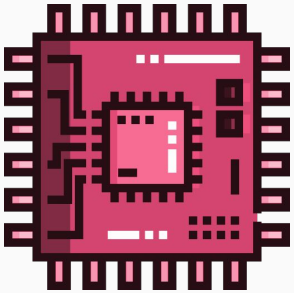
COMPUTER VISION (CV)

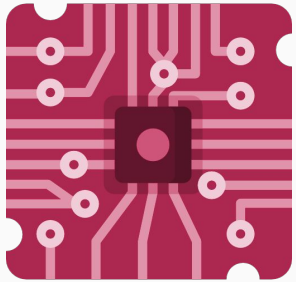
Face recognition and Identification
Pose Estimation using Computer Vision
Image transformation using GANS
Medical Image analysis
Automatic Number plate identification
Automated Driving car
Robotics and Automation
Monitoring and tracking through video

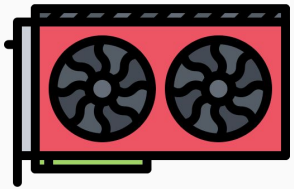
NATURAL LANGUAGE PROCESSING (NLP)

Speech Recognition
Chatbots & Virtual Assistants
Auto-Corrector
Language Translator
Voice Assistants such as Google Assistant, Apple Siri, Amazon Alexa,
Email Filtering into primary, social, and promotions or Spam no Spam
Text analysis and Fraud detection

WHAT IS CPU, GPU AND TPU?







CPU -> CENTRAL PROCESSING UNIT

- It is a general-purpose processor.
- CPU runs the operating system, considered as the brain of the computer.
- Performs all the logics, calculations, and input/output of the computer.

GPU -> GRAPHICAL PROCESSING UNIT

- It is an additional processor to enhance the graphical interface.
- Perform high-end tasks parallely through multithreaded multiprocessor.
- Provides real-time visual interaction in gaming, live streaming, high intensity graphics software, deep learning, rendering 3D animations & video and much more.

TPU -> TENSOR PROCESSING UNIT

- It is a powerful custom-built processors to process neural networks
- Created by Google for TensorFlow library.
- Designed to accelerate the AI calculations and algorithm

CPU, GPU AND TPU

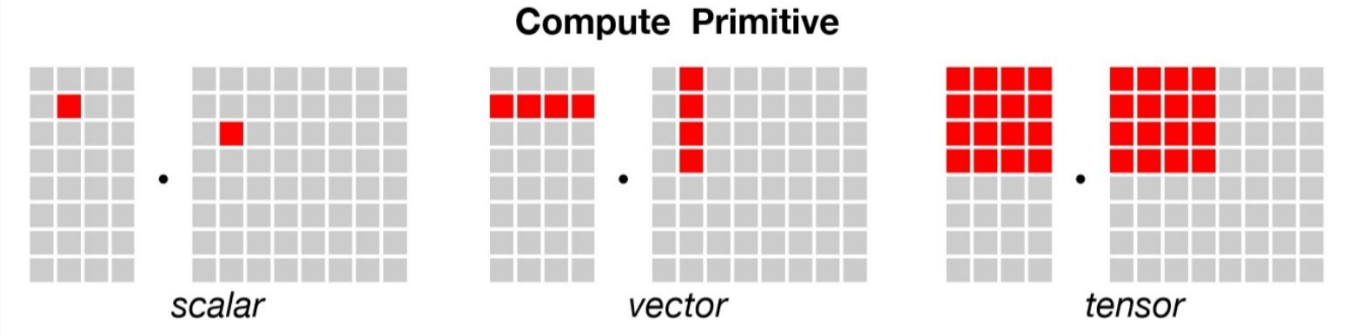
Performance

As a comparison, consider this:

CPU can handle tens of operation per cycle

GPU can handle tens of thousands of operation per cycle

TPU can handle up to 128000 operations per cycle



1. https://cloud.google.com/blog/products/ai-machine-learning/an-in-depth-look-at-googles-first-tensor-processing-unit-tpu
2. https://iq.opengenus.org/cpu-vs-gpu-vs-tpu/

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TENSORFLOW

Open-source library for Machine Learning, Deep Learning.

Developed by **Google Brain Team**, released in November 2015.

Provides both C++ and Python API's.

Easy model **building, execution and debugging.**

Has growing and engaged community.

Read more: https://www.tensorflow.org/

WHY TENSORFLOW?

Support both CPU's and GPU's as computing device.

You can easily train and deploy models in the cloud, on-premise, in the browser, or on-device.

Solves real, everyday ML problems.

Popular among big companies.

airbnb Coca-Cola DeepMind GE Healthcare

Google intel NERSC

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TENSORS

Tensors are multi-dimensional arrays with a uniform type. Tensors contains floats, ints, complex numbers, strings

Tensors have:

Shape: The length (number of elements) of each of the axes of a tensor.
Rank: Number of tensor axes.
Axis or Dimension: A particular dimension of a tensor.
Size: The total number of items in the tensor, the product shape vector.

The shape of Tensors come in scalars, vectors, matrices, and so on-

- Scalar: Rank-0 tensor
- Vector: Rank-1 tensor
- Matrix: Rank-2 tensor
- Cube of Matrices: Rank-3 tensor

A scalar, shape: [ ]	A vector, shape: [3]	A matrix, shape: [3 , 2]
4	2.0 3.0 4.0 3	3 1 2 3 4 5 6 2

https://www.tensorflow.org/guide/tensor

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