Deep Learning


I Am AI

Agenda

Introduction – the context

What is Deep learning

How it is different from ML

Types of Deep learning Algorithms

When to use ML and DL

Understanding text

What is NLP

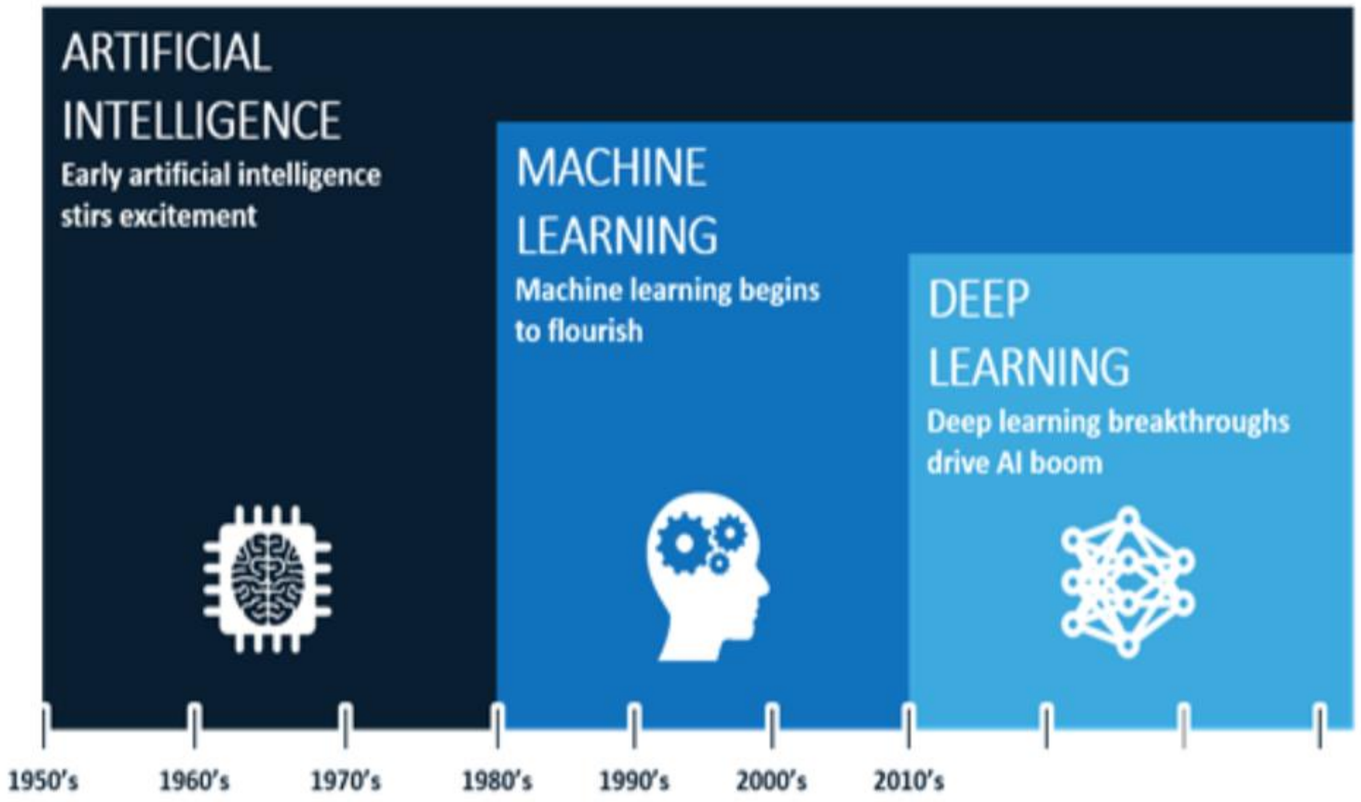
Process

Applications

Hands On

e

AI VS ML VS DL



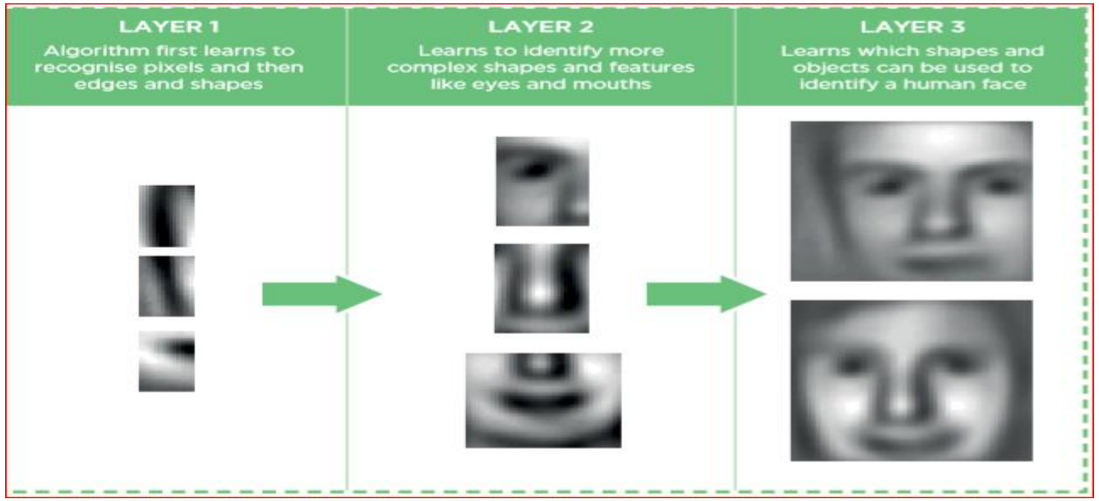
AI: Intelligence demonstrated by machines rather than humans or animals

ML: Giving computers the skills to learn without explicit programming

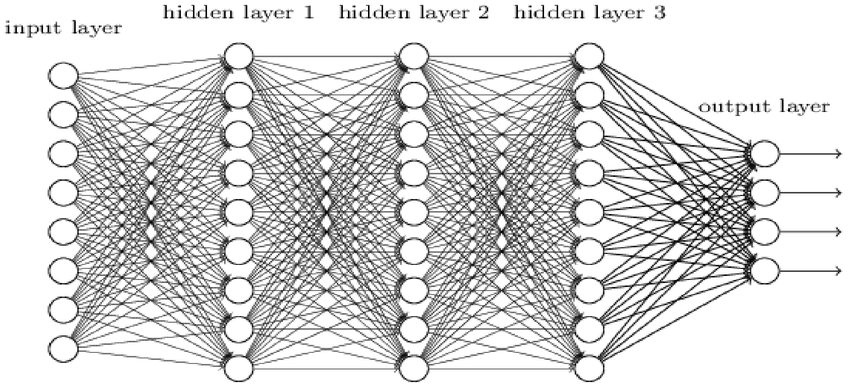
DL: is an ML subset examining algorithms that learn and improve on their own

WHAT IS DEEP LEARNING?

Practically, Deep Learning is a subset of Machine Learning *that achieves great power and flexibility by learning to represent the world as nested hierarchy of concepts, with each concept defined in relation to simpler concepts, and more abstract representations computed in terms of less abstract ones.*



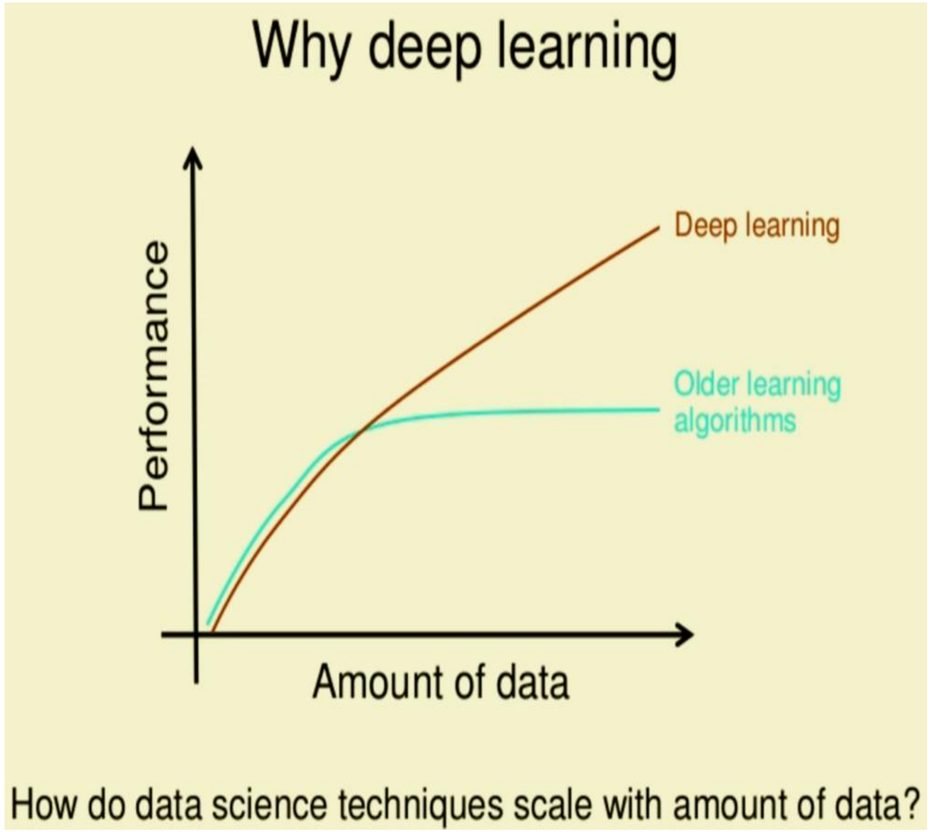
Elaborately, a deep learning technique learn categories incrementally through it's hidden layer architecture, defining low-level categories like letters first then little higher level categories like words and then higher level categories like sentences.



Deep learning is a specific subfield of machine learning: a new take on learning representations from data that puts an emphasis on learning successive layers of increasingly meaningful representations. The deep in deep learning isn't a reference to any kind of deeper understanding achieved by the approach; rather, it stands for this idea of successive layers of representations.

DISTINCTIVE FEATURES OF DEEP LEARNING

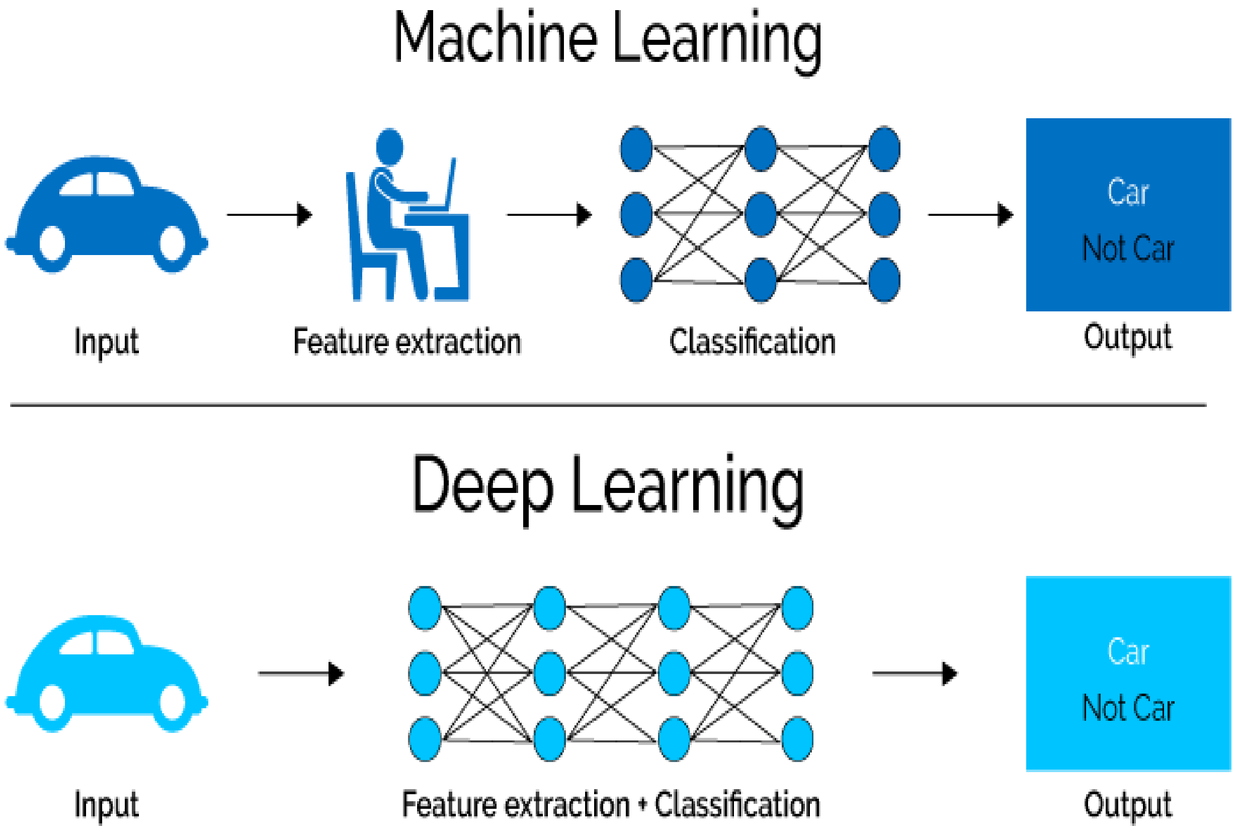
Performance



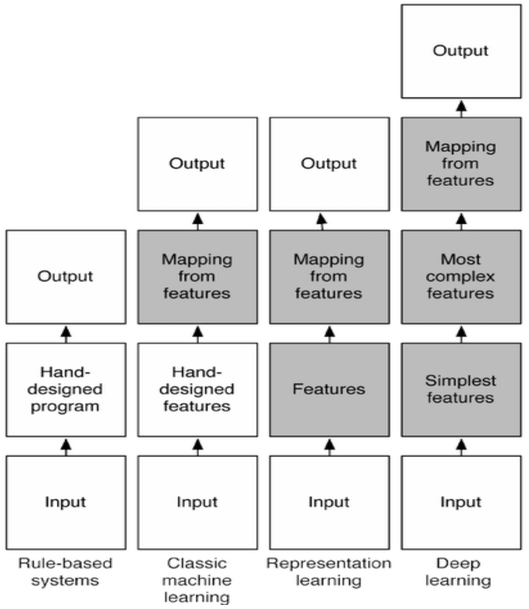
A big advantage with deep learning, and a key part in understanding why it's becoming popular, is that it's powered by massive amounts of data. The "Big Data Era" of technology will provide huge amounts of opportunities for new innovations in deep learning. As per **Andrew Ng**, the chief scientist of China's major search engine Baidu and one of the leaders of the Google Brain Project, "***The analogy to deep learning is that the rocket engine is the deep learning models and the fuel is the huge amounts of data we can feed to these algorithms.***"

Deep Learning requires high-end machines contrary to traditional **Machine learning** algorithms. GPU has become a integral part now to execute any **Deep Learning** algorithm.

ARCHITECTURE



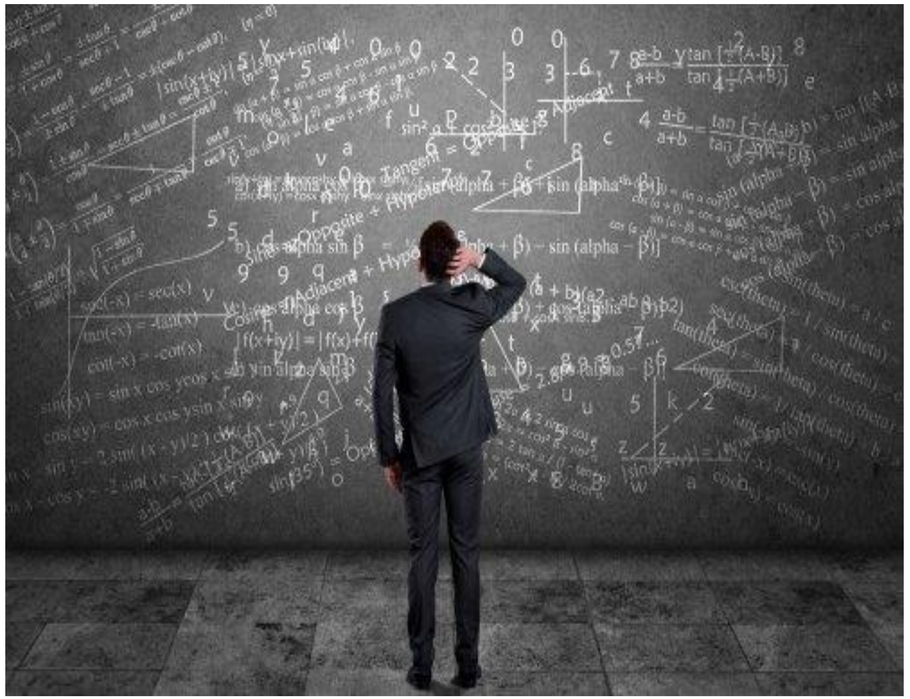
Another major difference between **Deep Learning** and **Machine Learning** technique is the problem solving approach. **Deep Learning** techniques tend to solve the problem end to end, where as **Machine learning** techniques need the problem statements to break down to different parts to be solved first and then their results to be combine at final stage.



TIME

Usually, a Deep Learning algorithm takes a long time to train due to large number of parameters. Popular ResNet algorithm takes about two weeks to train completely from scratch. Where as, traditional Machine Learning algorithms take few seconds to few hours to train. The scenario is completely reverse in testing phase. At test time, Deep Learning algorithm takes much less time to run. Whereas, if you compare it with k-nearest neighbors (a type of machine learning algorithm), test time increases on increasing the size of data.

INTERPRETABILITY



Interpretability is the main issue why many sectors using other Machine Learning techniques over Deep Learning. Let's take an example. Suppose we use deep learning to calculate the relevance score of a document. The performance it gives is quite excellent and is near human performance. But there's is an issue. It does not reveal why it has given that score. Indeed mathematically you can find out which nodes of a deep neural network were activated, but we don't know what there neurons were supposed to model and what these layers of neurons were doing collectively. So we fail to interpret the results. Which is not in case of Machine Learning algorithms like decision trees, logistic regression etc.

DEEP LEARNING

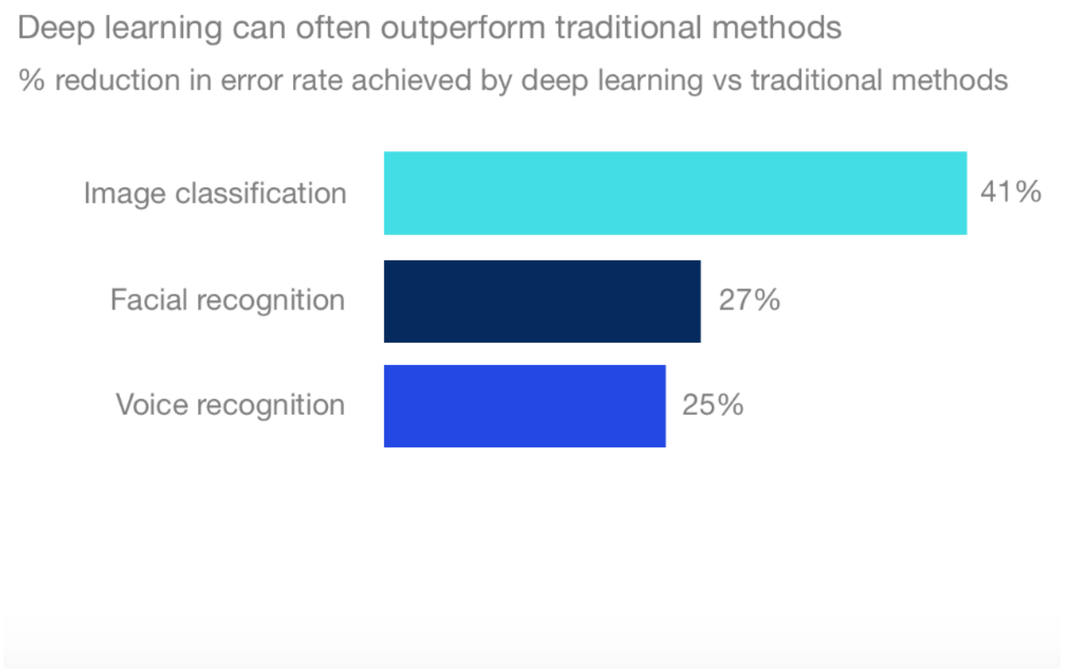
Deep learning is a type of machine learning that can process a wider range of data resources, requires less data preprocessing by humans, and can often produce more accurate results than traditional machine-learning approaches (although it requires a larger amount of data to do so).

In deep learning, interconnected layers of software-based calculators known as "neurons" form a neural network.

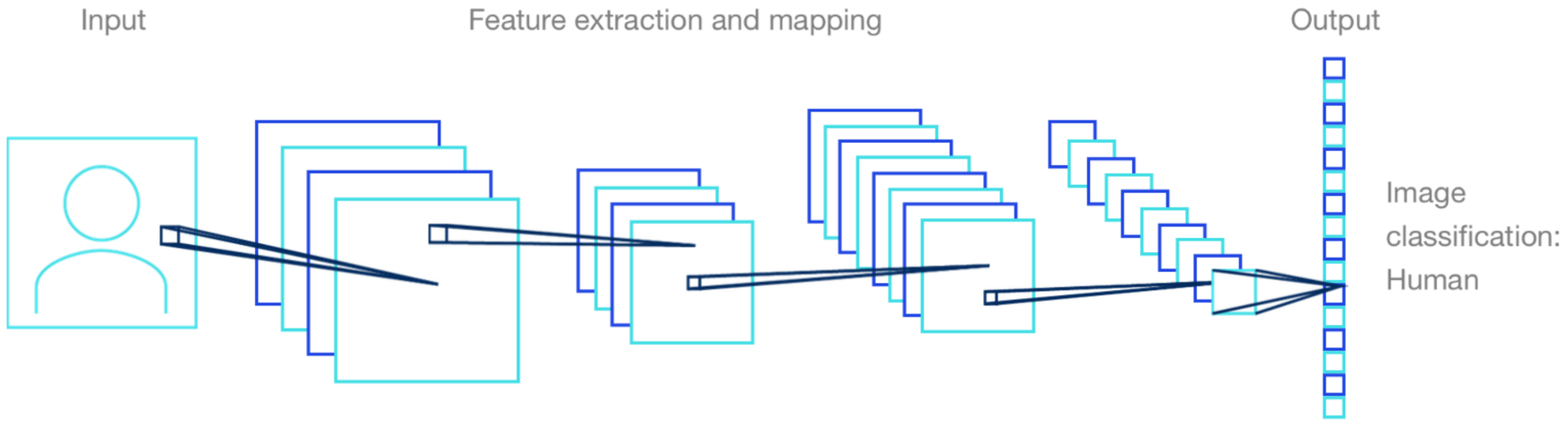
The network can ingest vast amounts of input data and process them through multiple layers that learn increasingly complex features of the data at each layer.

The network can then make a determination about the data, learn if its determination is correct, and use what it has learned to make determinations about new data.

For example, once it learns what an object looks like, it can recognize the object in a new image



CONVOLUTION NEURAL NETWORK



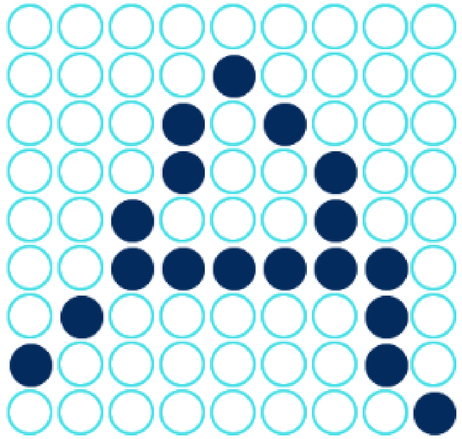
What is it?

A multilayered neural network with a special architecture designed to extract increasingly complex features of the data at each layer to determine the output

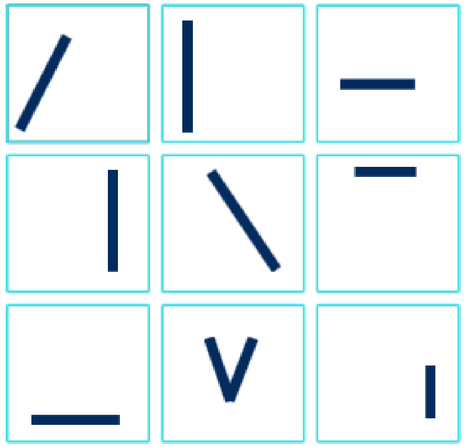
When to use it?

When you have an unstructured data set (eg, images) and you need to infer information from it

CONVOLUTION NEURAL NETWORK



**The convolutional neural network (CNN) receives an image–
for example, of the letter “A”–
that it processes as a collection of pixels**



- In the hidden layers, it identifies unique features–
for example, the individual lines that make up “A”

The CNN can now classify a different image as the letter “A” if it finds in it the unique features previously identified as making up the letter

CONVOLUTION NEURAL NETWORK

Diagnose health diseases from medical scans

Detect a company logo in social media to better understand joint marketing opportunities (eg, pairing of brands in one product)

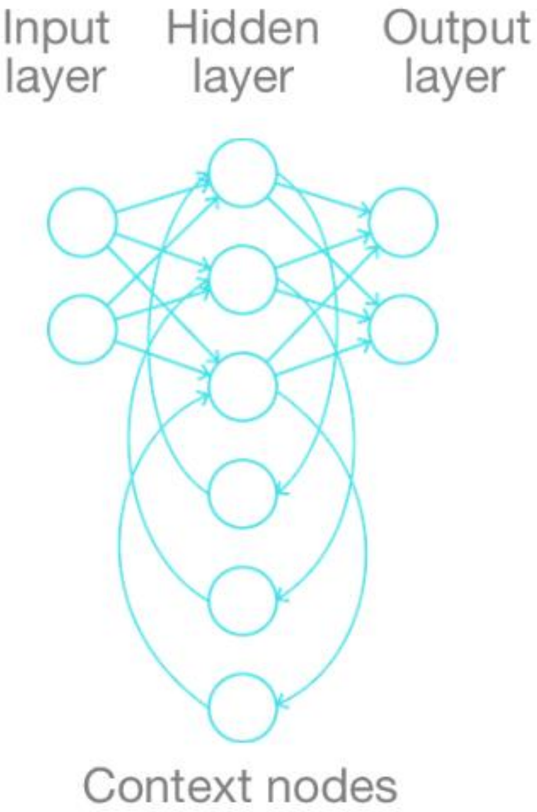
Understand customer brand perception and usage through images

Detect defective products on a production line through images

RECURRENT NEURAL NETWORK

What is it?

A multilayered neural network that can store information in c ontext nodes, allowing it to lea rn data sequences and output a number or another sequence



When to use it?

When you are working with time-series data or sequences (eg, audio re cordings or text)

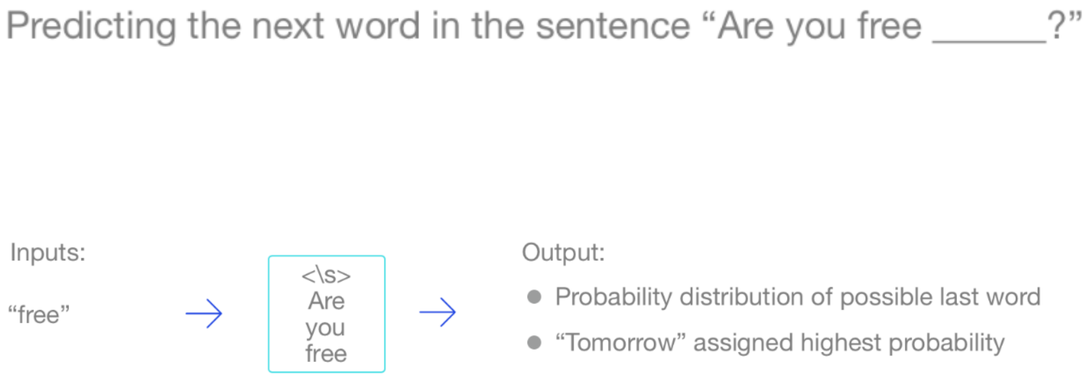
RNNS

Other neural-

network architectures assume all inputs are independent from one another.
But this assumption doesn’t work well for some tasks.

Take, for example, the task of pr edicting the next word in a sente nce–

it’s easier to predict the next wor d if several words that came befo re are known

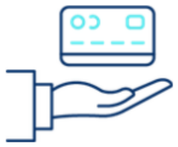


RNNS – USE CASES

Generate analyst reports for securities traders

Provide language translation

Track visual changes to an area after a disaster to assess potential damage claims (in conjunction with CNNs)



Assess the likelihood that a credit-card transaction is fraudulent

Generate captions for images

Power chatbots that can address more nuanced customer needs and inquiries

A mostly complete chart of

Neural Networks

- Backfed Input Cell
- Input Cell
- Noisy Input Cell
- Hidden Cell
- Probablistic Hidden Cell
- Spiking Hidden Cell
- Output Cell
- Match Input Output Cell
- Recurrent Cell
- Memory Cell
- Different Memory Cell
- Kernel
- Convolution or Pool

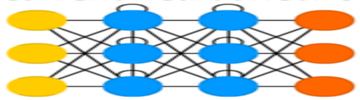
Perceptron (P)

Feed Forward (FF)

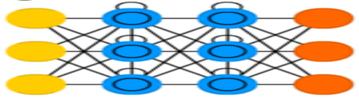
Radial Basis Network (RBF)

Deep Feed Forward (DFF)

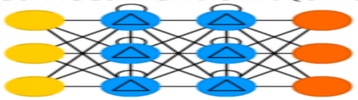
Recurrent Neural Network (RNN)



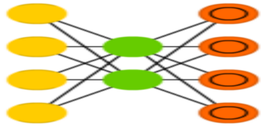
Long / Short Term Memory (LSTM)



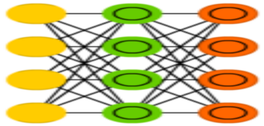
Gated Recurrent Unit (GRU)



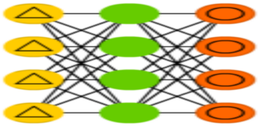
Auto Encoder (AE)



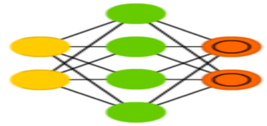
Variational AE (VAE)



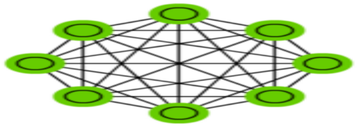
Denoising AE (DAE)



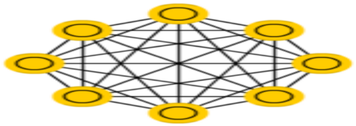
Sparse AE (SAE)



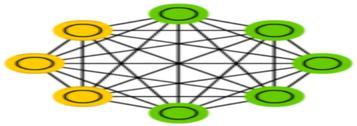
Markov Chain (MC)



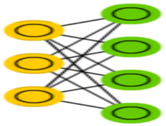
Hopfield Network (HN)



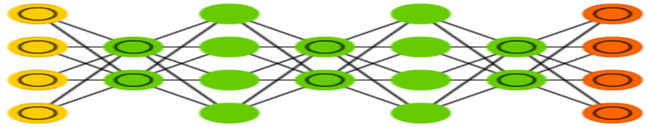
Boltzmann Machine (BM)



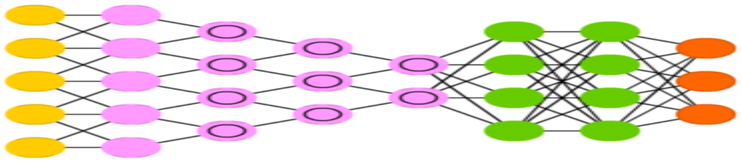
Restricted BM (RBM)



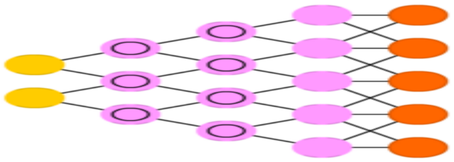
Deep Belief Network (DBN)



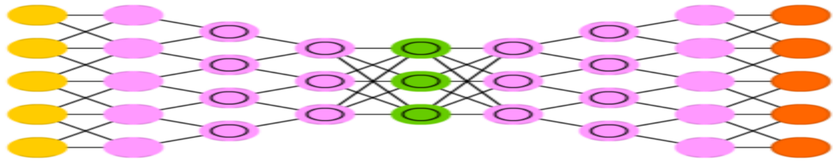
Deep Convolutional Network (DCN)



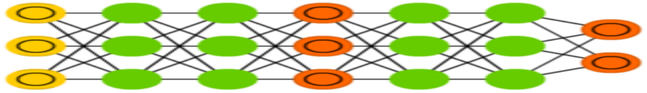
Deconvolutional Network (DN)



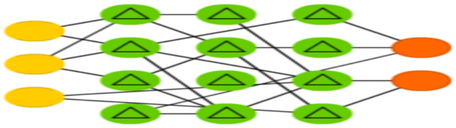
Deep Convolutional Inverse Graphics Network (DCIGN)



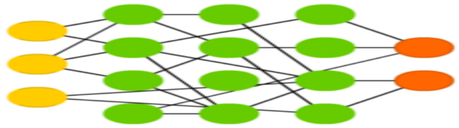
Generative Adversarial Network (GAN)



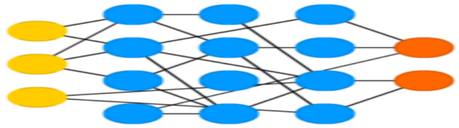
Liquid State Machine (LSM)



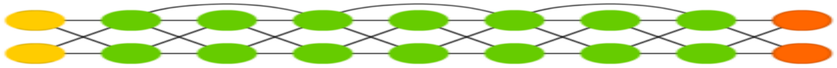
Extreme Learning Machine (ELM)



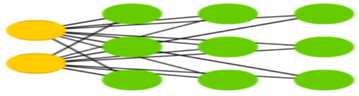
Echo State Network (ESN)



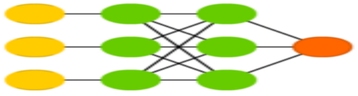
Deep Residual Network (DRN)



Kohonen Network (KN)



Support Vector Machine (SVM)



Neural Turing Machine (NTM)

HOW NN WORKS (ONE LAYER PIC)