# Deep Learning:

i). Artificial Neural Network (ANN): a collection of simple, trainable mathematical units that collectively learn complex functions.

ii). Deep Neural Network (DNN):.

Advantages of Deep Learning:

i). Robust: ① No need to design the features ahead of time, features are automatically learned to be optimal for the task at hand.

② Robustness to natural variations in the data is automatically learned.

ii). Generalization: The same neural network approach can be used for many different applications and data types.

iii). Scalable: performance improves with more data, method is massively parallelizeable.

Convolutional Neural Network (CNN): → image.

Recurrent Neural Network (RNN): → Natural language text understanding.

GPU and Deep Learning:

with GPU, it delivers: i). Same or better prediction accuracy.
ii). Faster results.
iii). Smaller footprint.
iv). Lower power
v). Lower cost.

The mathematics that underpins DL training is predominantly linear matrix algebra. Computation of this type of mathematics is highly parallelizable making it a perfect fit for acceleration using GPUs.

How NVIDIA is helping Deep Learning Stack:

i). GPU accelerated Deep Learning frameworks (Caffe, Torch, Theano).

ii). Performance libraries (CuDNN, cuBLAS) - Highly optimized.

iii). CUDA - Best Parallel Programming Toolkit.

iv). GPU - world's best DL Hardware

Theano: Math Expression Compiler, using Python interface.

Caffe: Deep Learning framework, interface: command line, Python, Matlab.

CNNs have a structure which loosely resembles the structure the human visual cortex where lower levels of model hierarchy are focused on small and local visual details, such as oriented line segments, which aggregate together into higher levels of the model which correspond to complex human concepts, such as faces and animals.

Deep Learning Frameworks: Caffe, Theano, Torch.

They all share the common benefits of providing highly optimized GPUs enabled code specific to the computations required for training DNNs whilst providing access to that code through simple command line or scripting language interfaces such as python.

1). Caffe: fast due to it's highly optimized C/CUDA backend which integrates GPU acceleration.

Defining and building many different types of DNN is possible without ever writing a line of code.

Training a DNN in caffe requires three things:

① A network definition file specifying the neural network architecture;

② A solver definition file specifying the training parameters and

③ A. Dataset

2). Theano. (Python Deep Learning library).

i). Theano provides a highly expressive way of defining and training DNNs as it is built as a general symbolic math library and offers automatic function differentiation

ii). fast with a CUDA backend that enables GPU acceleration.

Select Theano if

i). look for a highly expressive DL framework.

ii). to develop a wider range of DL applications than just CNNs for imagery, by defining new layer types, training algorithms, and objective functions without leaving python.

3). Torch: a scientific computing framework based on Programming Language Lua.

Advantages: ① Run-time speed

② Easy to use multi-GPU for training.

RNNs introduce a self-connection to the hidden nodes, this allows the network to remember its previous states and subsequently learn significant predictive patterns in the input data.

Nvidia GPU. Python 2.7. Linux/Mac.