# Chapter 2
# Deep Learning Using Keras

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## ABSTRACT

*A branch of artificial intelligence (AI) known as deep learning consists of statistical analysis algorithms known as artificial neural networks (ANN) inspired by the structure and function of the brain. The accuracy of predicting a task has tremendously improved with the implementation of deep neural networks, which in turn incorporate deep layers into the model allowing the system to learn complex data. This chapter intends to give a straightforward manual for the complexities of Google's Keras framework that is easy to understand. The basic steps for the installation of Anaconda, CUDA, along with deep learning libraries, specifically Keras and Tensorflow, are discussed. A practical approach towards solving deep learning problems in order to identify objects in CIFAR 10 dataset is explained in detail. This will help the audience in understanding deep learning through substantial practical examples to perceive algorithms instead of theory discussions.*

## KERAS

Keras is an open source machine-learning library written in python and developed by a Google engineer named François Chollet for quickly building deep learning models by only writing few lines of code. It is a high-level API that runs on top of Tensorflow, Theano, and CNTK and wraps up extensive complex numerical computation to perform activities like objects identification, image labeling, sentiment analysis, automated car driving etc. keras provides a convenient solution to deep learning problems by replacing

hundreds of lines of conventional code with only few lines of codes. It removes the effort of building a complex network that could be challenging to build through conventional approaches that might take hours or days to hand code in Python or other languages. Both industry and research community has a stronger adoption of keras API as compared to other deep learning libraries. tf.keras module is the official frontend of TensorFlow, which is the most popular API among other deep learning libraries. Keras is used in Netflix, Yelp, Uber, Square, Instacart, Zocdoc, and many others. In addition, it takes 2nd place in terms of research article published by preprint arXiv.org and is adopted by researchers at large scientific organizations such as NASA and CERN.

*Figure 1. Deep learning framework power scores 2018 (Chollet, 2015)*
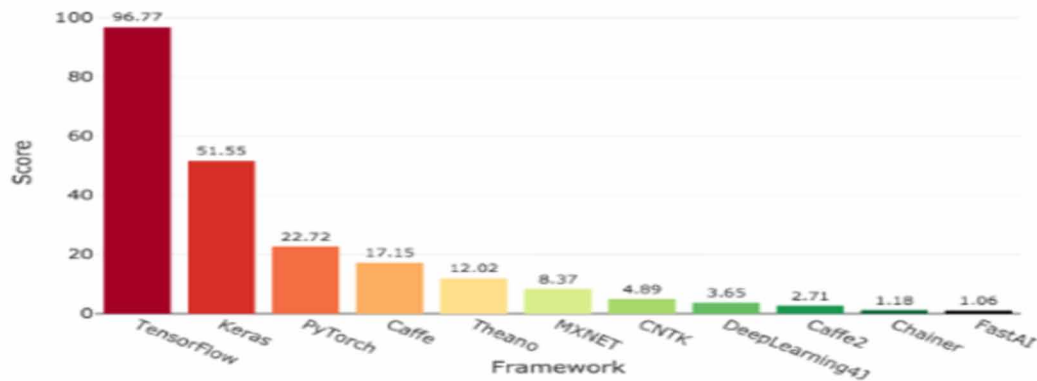


## ARTIFICIAL INTELLIGENCE VS MACHINE LEARNING VS DEEP LEARNING

Artificial Intelligence is a far-reaching research domain, wherein the basic idea revolves around devices and machines exhibiting cognitive capabilities such as interaction with the environment, computer vision, handwriting and speech recognition, problem analysis and solving, comprehensive learning, perception and various other imperative applications (Russell and Norvig, 2016). Artificial Intelligence aims at imparting human intelligence and instincts to a computer, and a perfect blend of mathematics, statistics, and science makes this practicable.

A sub-branch of AI, Machine Learning (ML) focuses on imparting these capabilities contemporaneously, by teaching the computers, instead of training and programming them for specific tasks (Bishop, 2006). ML serves the purpose by creating algorithms, using which the computers can then make predictions for similar tasks and situations. The machines are provided with data and its desired output and thus are trained on these examples for future unseen data and problems. This is termed as supervised learning. Under unsupervised learning, only the input data is provided to the machine and it is expected to develop an output by itself, without supervision.

There is another learning field called reinforcement learning, where the machine interacts with its surroundings and trains itself seeing how the environment reacts to the machine's actions. The science behind this cognitive learning; computer vision revolves around artificial neural networks. The algorithms are inspired by the human brain that learns using large amounts of data sets so as to clone the

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