Introduction to Deep Learning
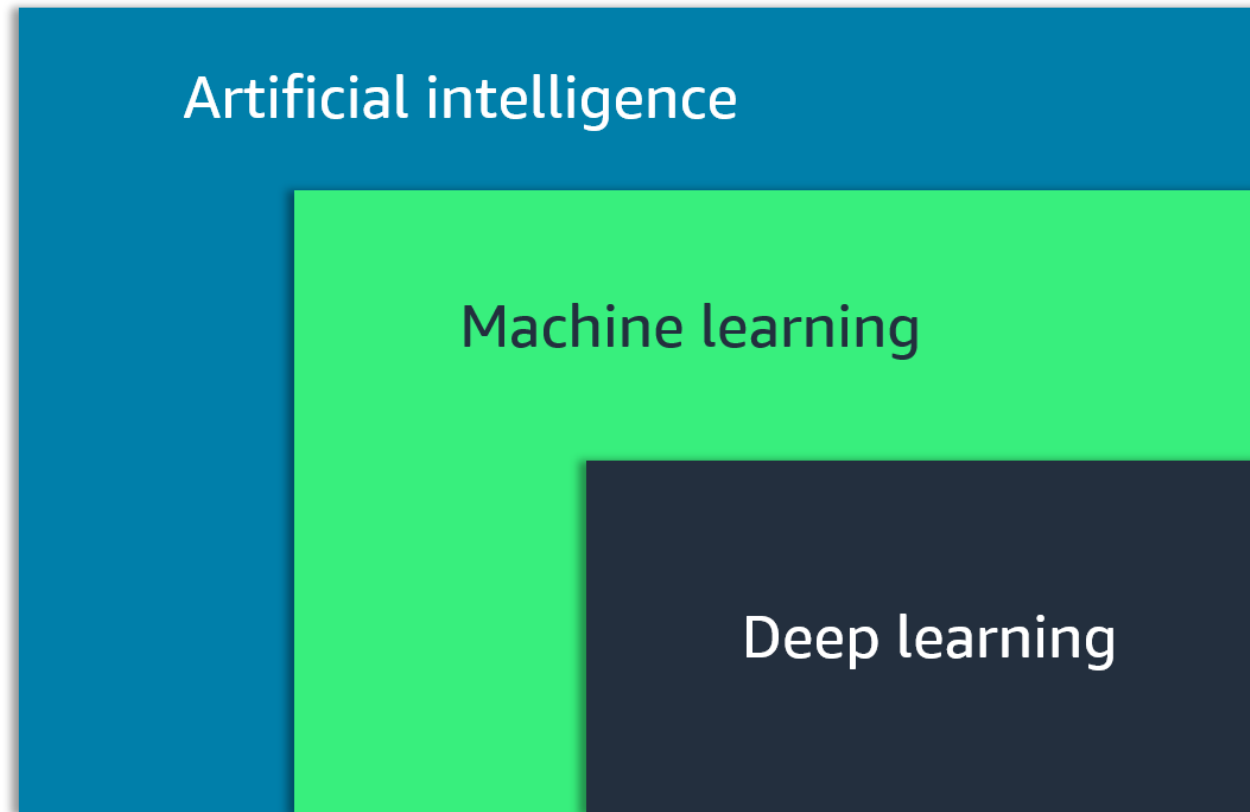
Outline

- What is deep learning?
- Artificial neural networks
- Neural network architecture
- Deep learning frameworks
- Types of neural networks

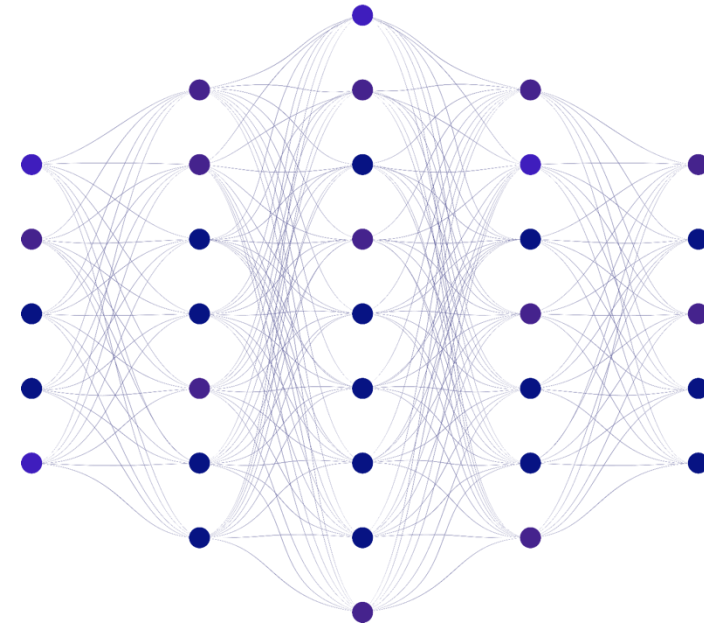# Artificial intelligence, machine learning, and deep learning
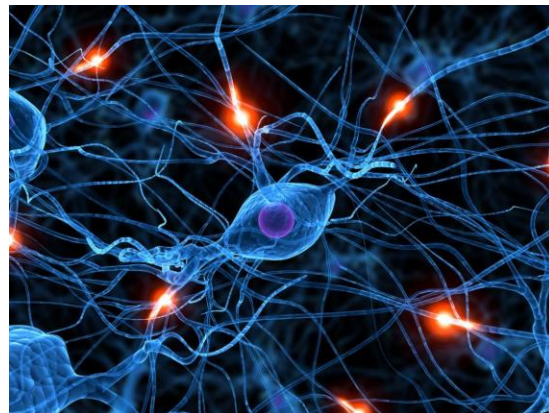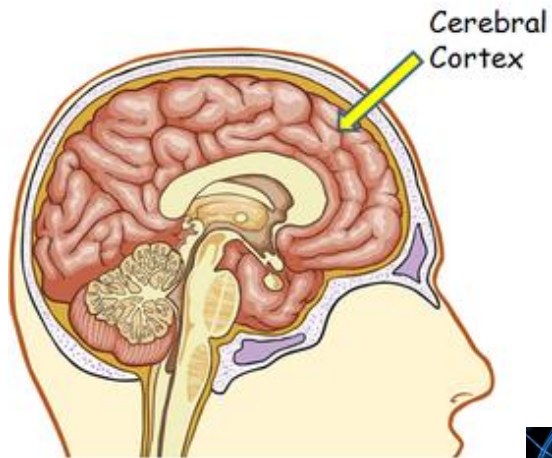

Source: Amazon Web Services

Deep learning

Artificial Neural Network

Source: Amazon Web Services

# How Human Brain Works

Cerebral Cortex

- Neurons in cerebral cortex are connected via axons

- A neuron 'fires' to the neurons it is connected to, when enough of its input signals are activated

- Very simple at the individual neuron level, bit layers of neurons connected in this way can yield learning behavior

- This actually works, not only in human's brain but also in computers

Source: https://brainmadesimple.com/cerebral-cortex-and-lobes-of-the-brain/
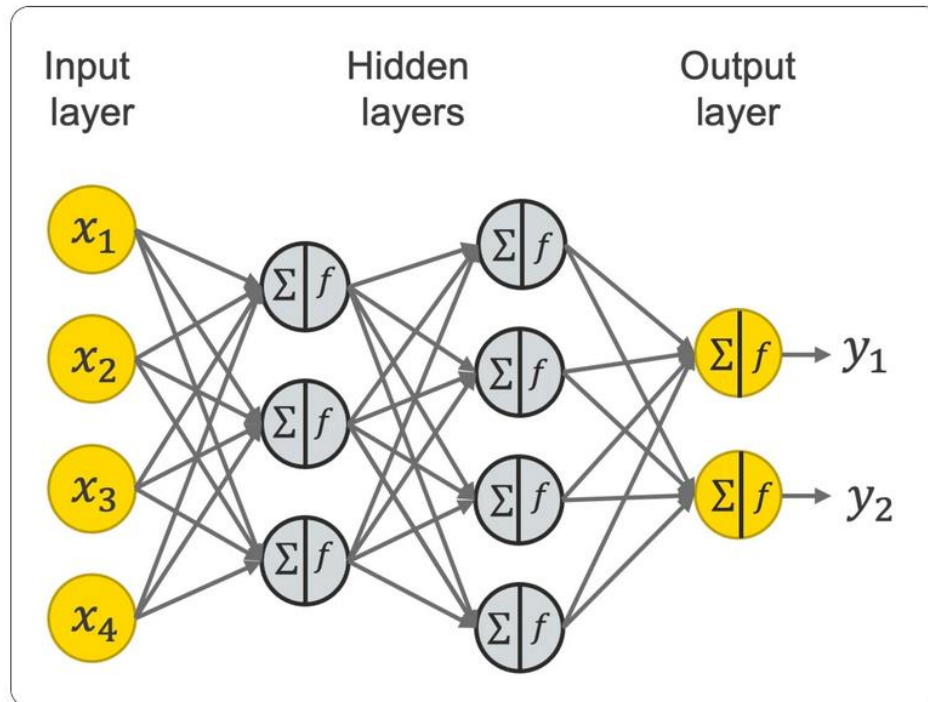
Neurons In Human Brain
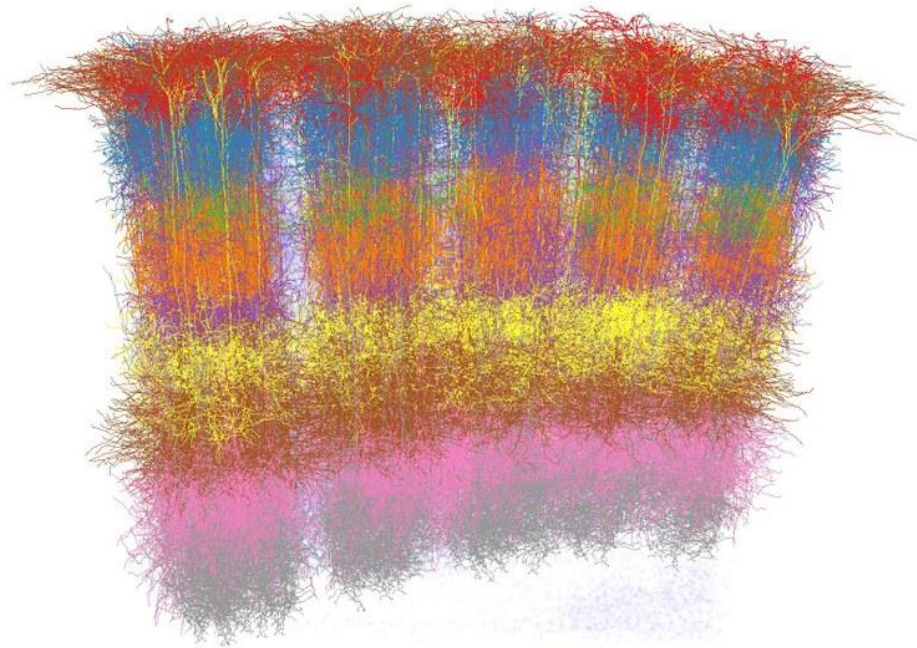
- Neurons in cerebral cortex are arranged into many stacks, or "columns" that process information in parallel

- "mini-columns" of around 100 neurons are organized into larger "hyper-columns". There are 100 million mini-columns in your cortex

- This is a similar architecture to how GPU in a computer works

Source: https://www.thekurzweillibrary.com/neuroscientists-find-cortical-columns-in-brain-not-uniform-challenging-large-scale-simulation-models
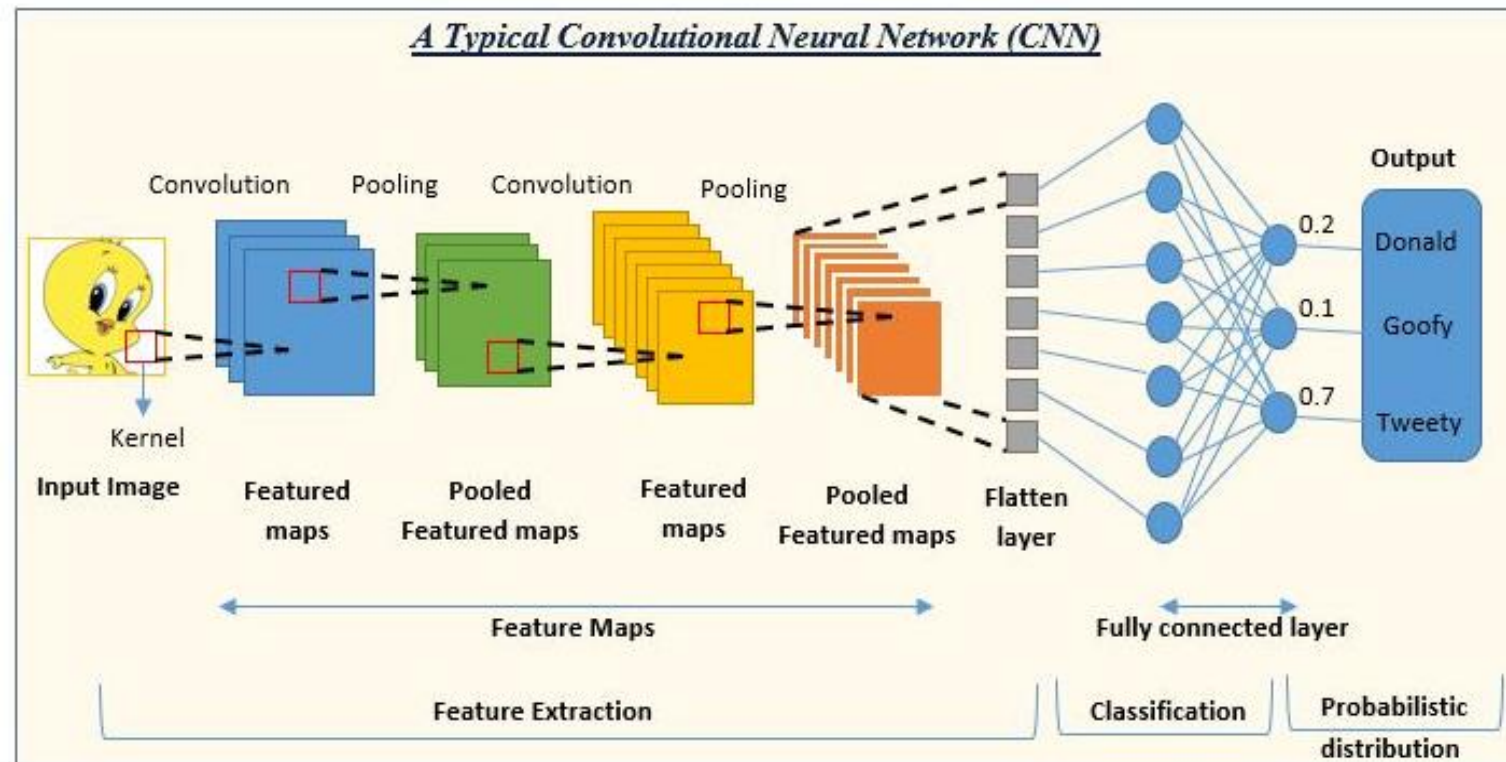
Deep Neural Networks

Source: https://www.knime.com/blog/a-friendly-introduction-to-deep-neural-networks

- Take weighted inputs from the input layer
- Apply some activation functions to that weight
- Passes the result to the next layer
- Output layer produces the output

Neural Networks Architecture

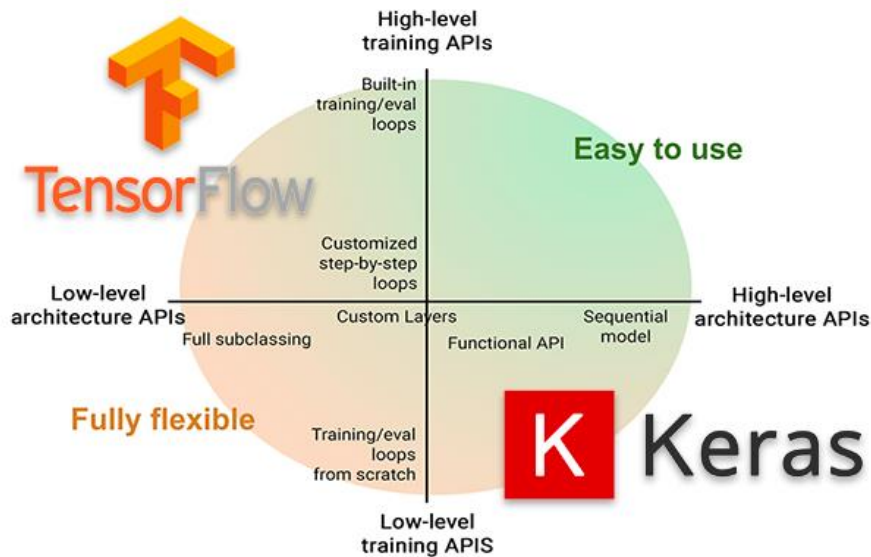A Typical Convolutional Neural Network (CNN)

Deep Learning Frameworks

GPU is capable of parallelizing a lot of artificial neurons.

Tensorflow / Keras


```
model = Sequential()

model.add(Dense(64, activation='relu', input_dim=20))
model.add(Droptout(0.5))
model.add(Dense(64, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(10, activation='softmax'))
model.compile(loss='categorical_crossentropy',
              optimizer='adam',
              metrics='accuracy']
```

Source: https://www.analyticsvidhya.com/blog/2021/11/training-neural-network-with-keras-and-basics-of-deep-learning/

Types of Neural Networks

- Feedforward Neural Network

- Convolutional Neural Networks (CNN)

    - Image classification, natural language processing (text classification)

- Recurrent Neural Networks (RNN)

    - Deal with sequences in time

    - e.g., predict stock prices over time, machine translation