

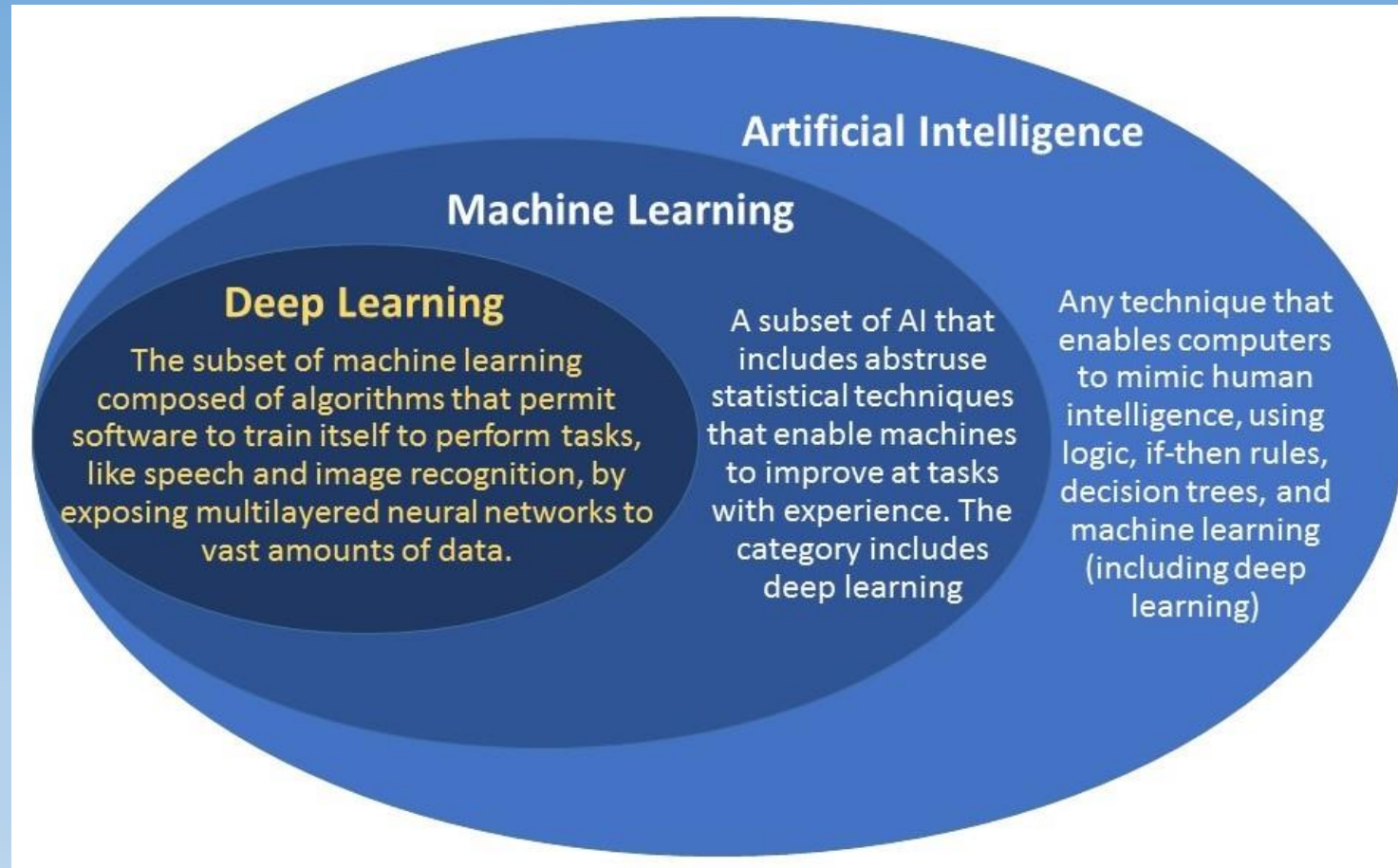


Deep Learning

By

Prof. Dr Ali Hussien Mary

AI-ML-DL

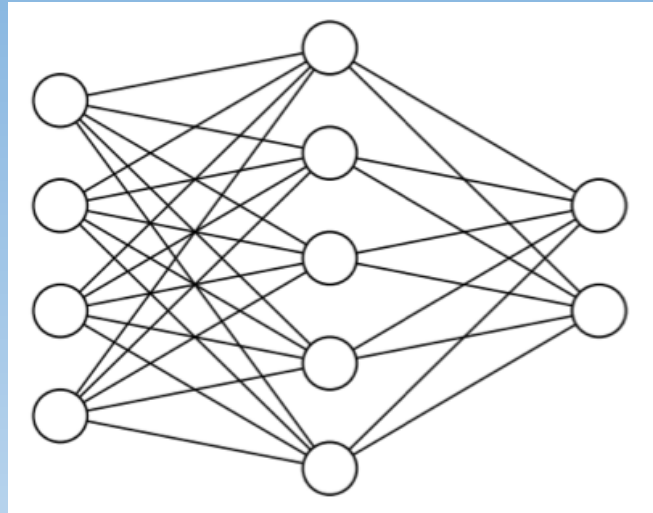
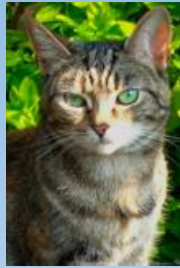


Types of machine learning



Types of machine learning

- 1- **Supervised learning**

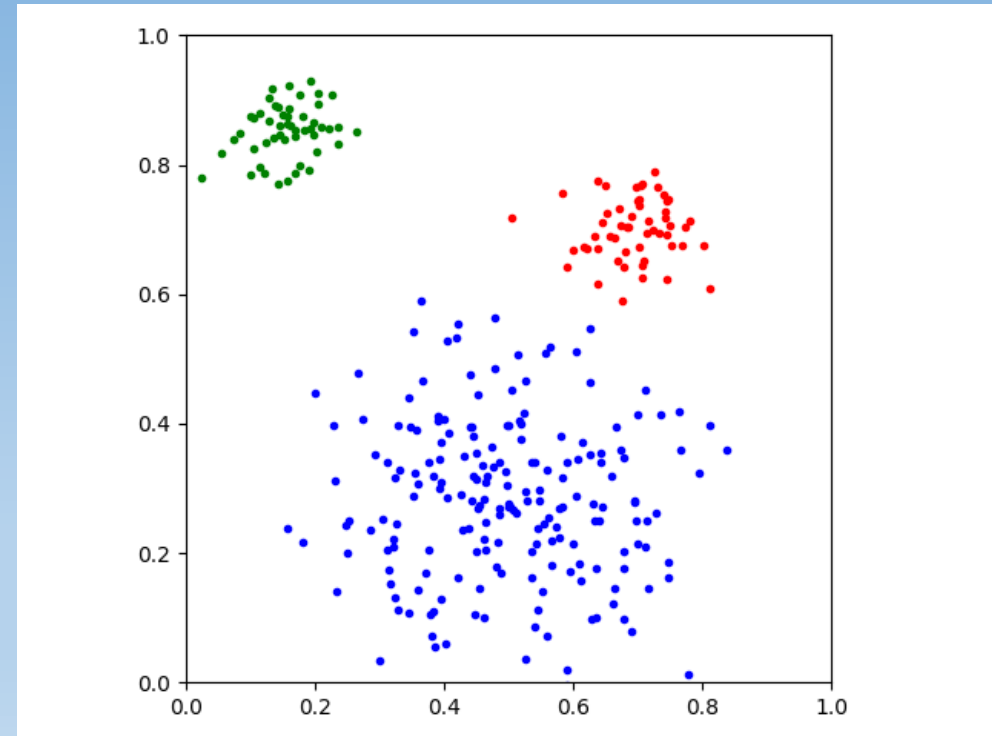


cat

dog

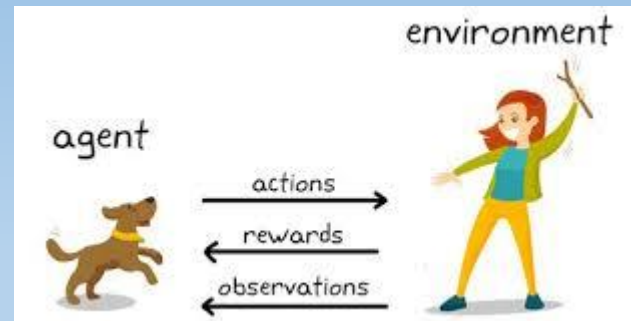
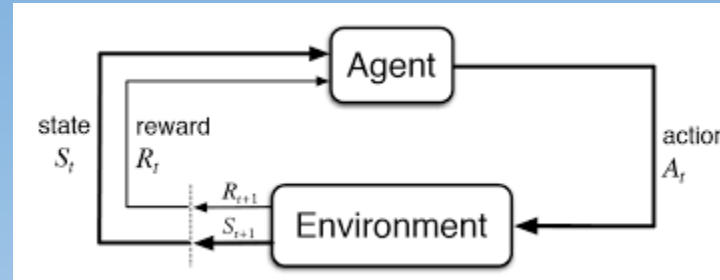
Types of machine learning

- 2- **Unsupervised learning**



Types of machine learning

- 3- Reinforcement learning



Fundamentals of machine learning

Data: (Training – validation – test)

Humans learn by observation and unsupervised learning

Machine learning needs lots of (labeled) data to compensate

Model

$$\hat{y} = f(\mathbf{x}; \theta)$$

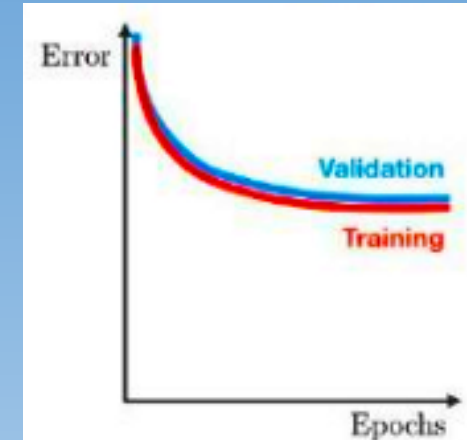
Optimization

Mathematical optimization: “the selection of a best element (with regard to some criterion) from some set of available alternatives

Model

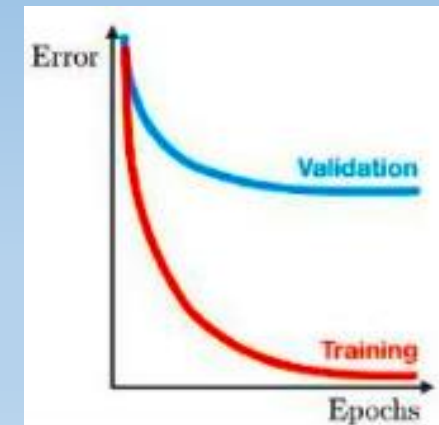
- **Underfitting**

- The model is too “simple” to represent all the relevant class characteristics
- E.g., model with too few parameters
- Produces high error on the training set and high error on the validation set



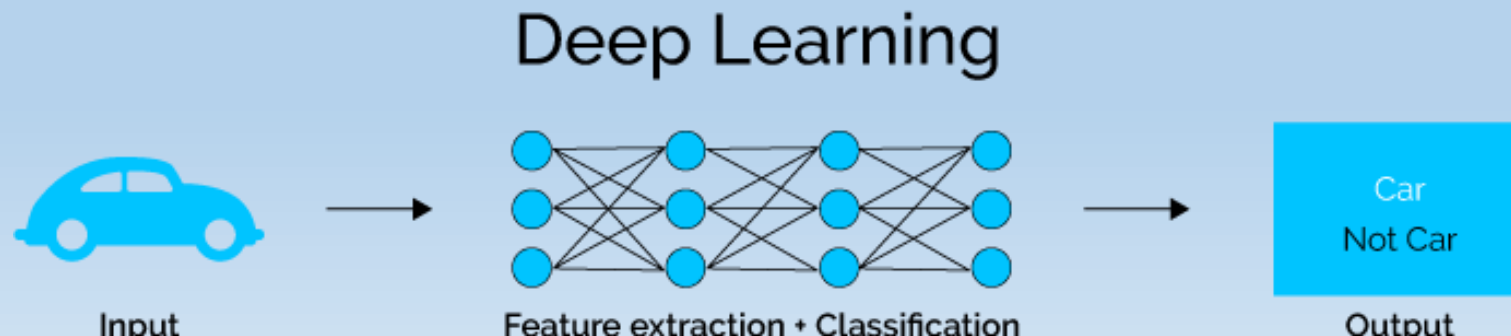
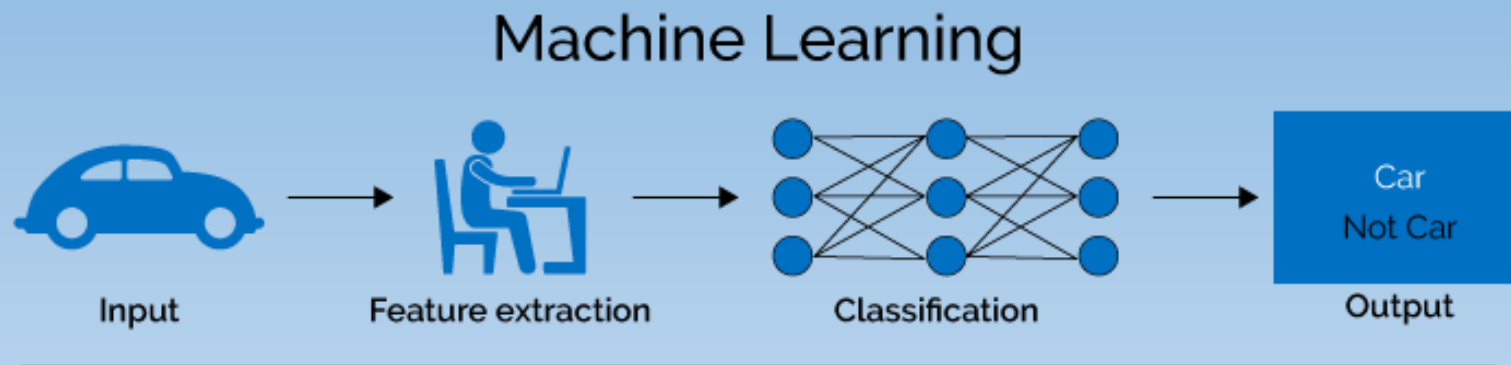
- **Overfitting**

- The model is too “complex” and fits irrelevant characteristics (noise) in the data
- E.g., model with too many parameters
- Produces low error on the training error and high error on the validation set

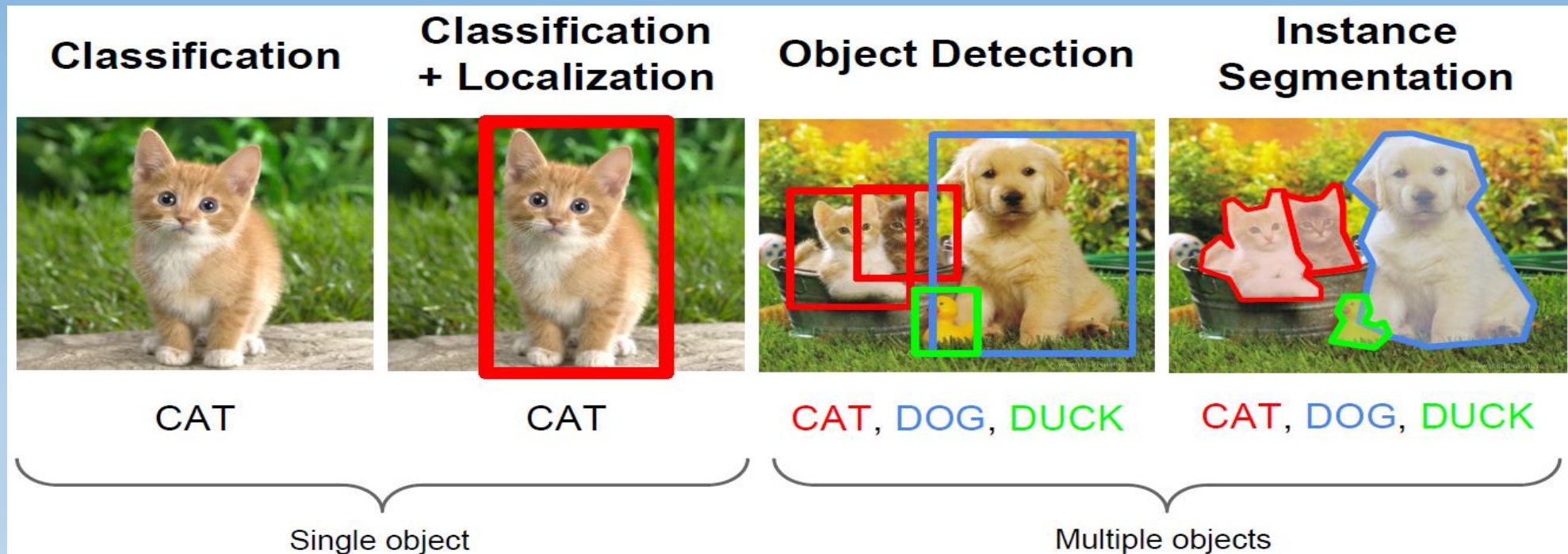


Deep learning and Machine learning

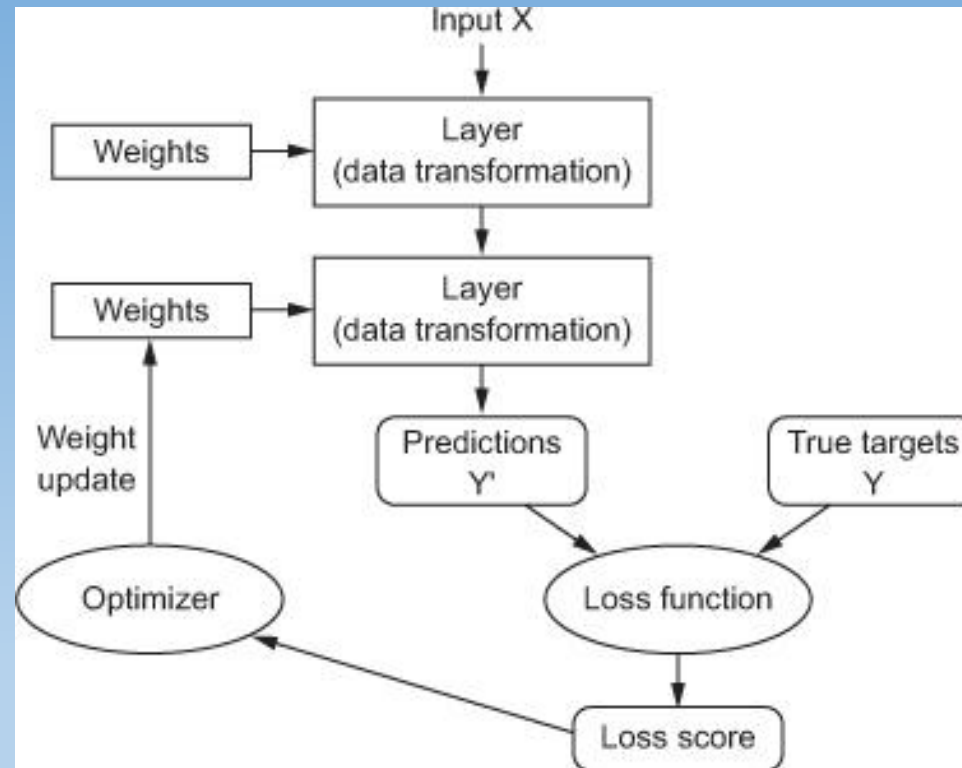
- **Deep learning** (DL) is a machine learning subfield that uses multiple layers for learning data representations DL is exceptionally effective at learning patterns



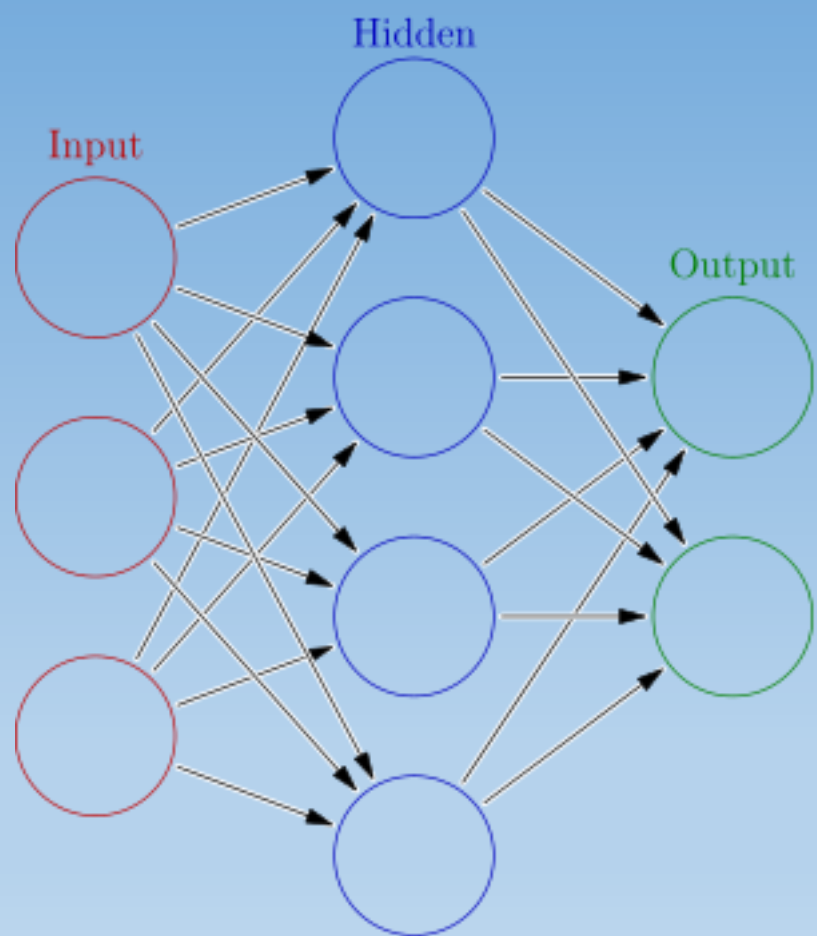
- DL provides a flexible, learnable framework for representing visual, text, linguistic information
- Requires large amounts of training data
- Since about 2010, DL has outperformed other ML techniques
First in vision and speech, then NLP, and other applications



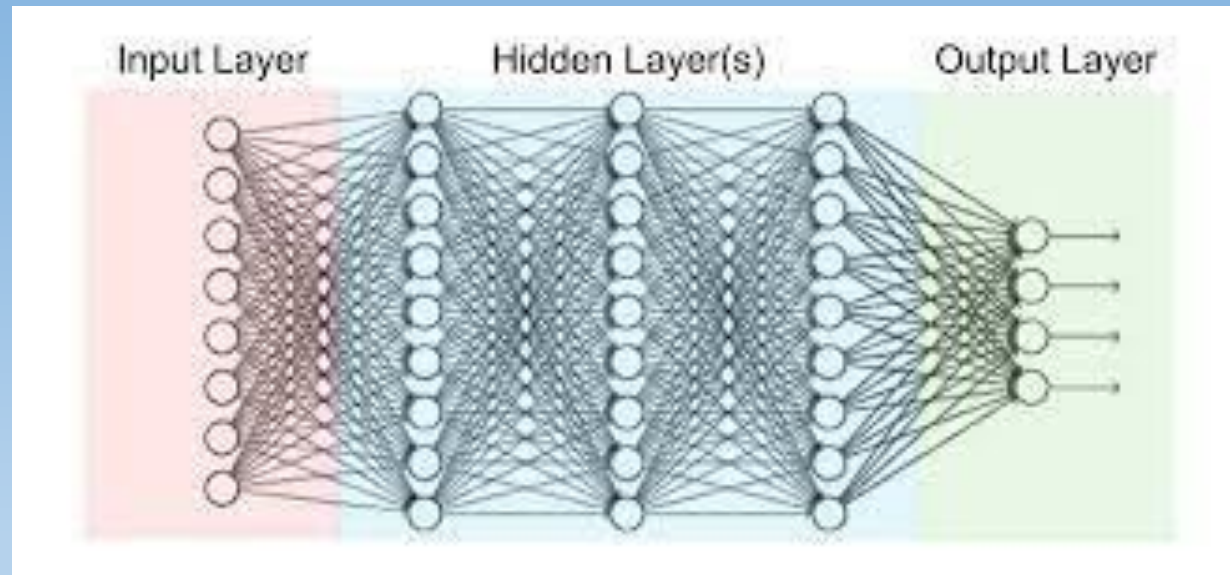
Anatomy of a deep neural network



Elements of Neural Networks



Elements of DL



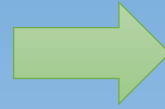
Convolutional Neural Networks (CNNs)

- *Convolutional neural networks* (CNNs) were primarily designed for image data
- CNNs use **a convolutional operator** for extracting data features
 - Efficient to train
 - Have **less parameters** than NNs with fully-connected layers
- CNNs are **robust to spatial translations** of objects in images
- A convolutional filter slides (i.e., convolves) across the image

Convolutional Neural Networks (CNNs)

1	1	1	0	0
0	1	1	1	0
0	0	1	1	1
0	0	1	1	0
0	1	1	0	0

1	0	1
0	1	0
1	0	1

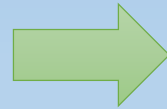


1	1	1	0	0
0	1	1	1	0
0	0	1	1	1
0	0	1	1	0
0	1	1	0	0

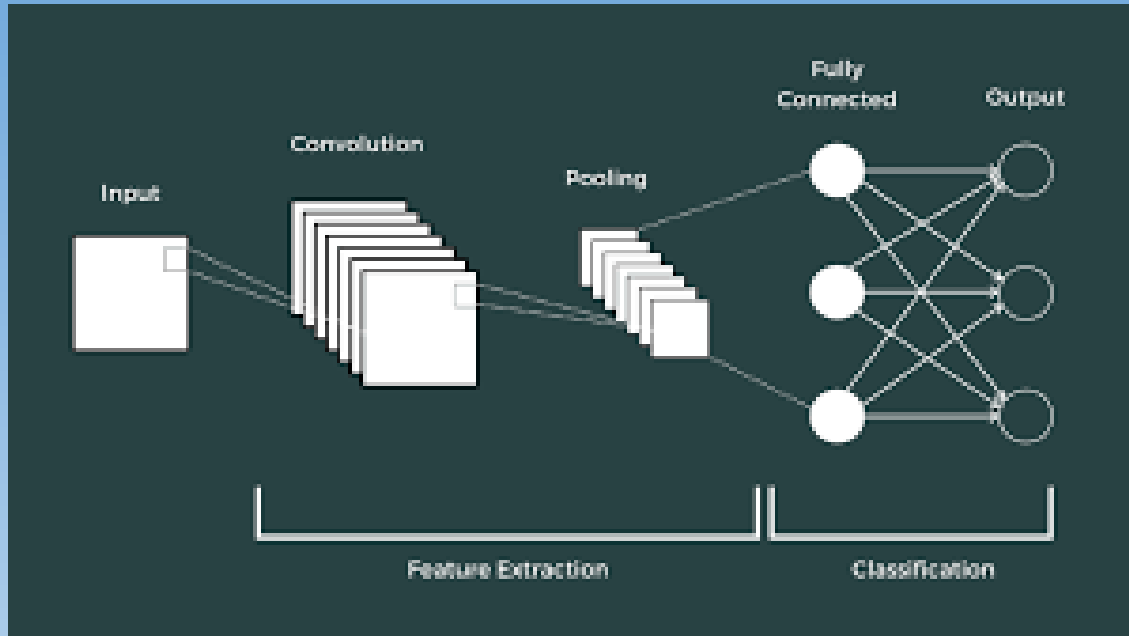
Image

4		

Convolved Feature



Convolutional Neural Networks (CNNs)



Max pooling: reports the maximum output within a rectangular neighborhood

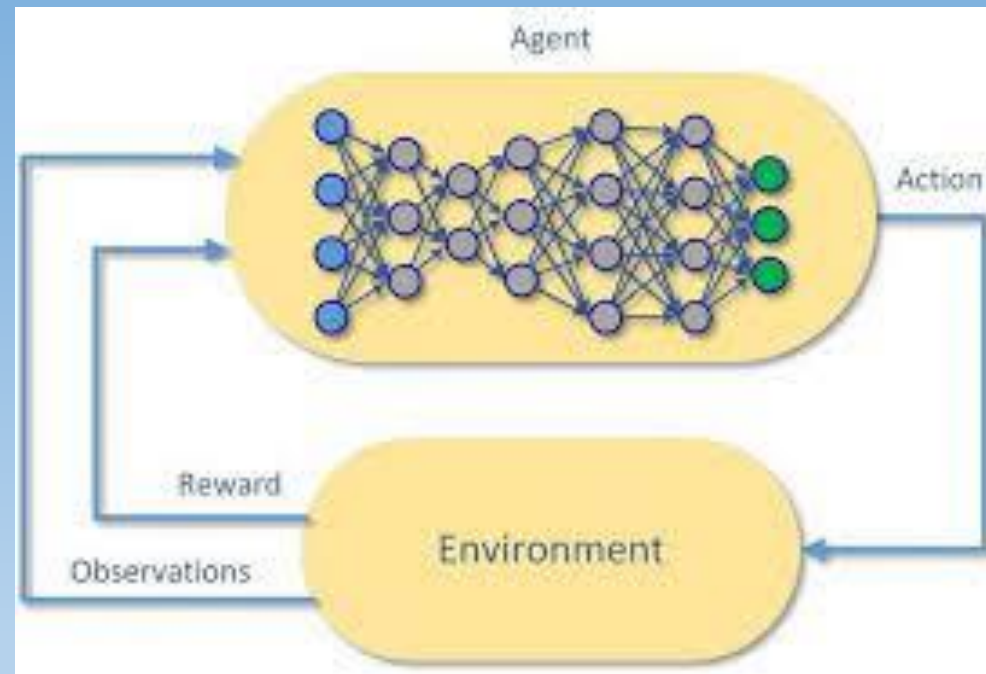
Average pooling: reports the average output of a rectangular neighborhood

Pooling layers reduce the spatial size of the feature maps

Different types of CNN models

- LeNet: LeNet is the most popular CNN architecture it is also the first CNN model which came in the year 1998. ...
- AlexNet: Starting with an 11x11 kernel, Alexnet is built up of 5 conv layers. ...
- ResNet: ...
- GoogleNet / Inception:

deep reinforcement learning



ChatGPT

ChatGPT is an artificial intelligence chatbot developed by OpenAI using both supervised and reinforcement learning techniques

