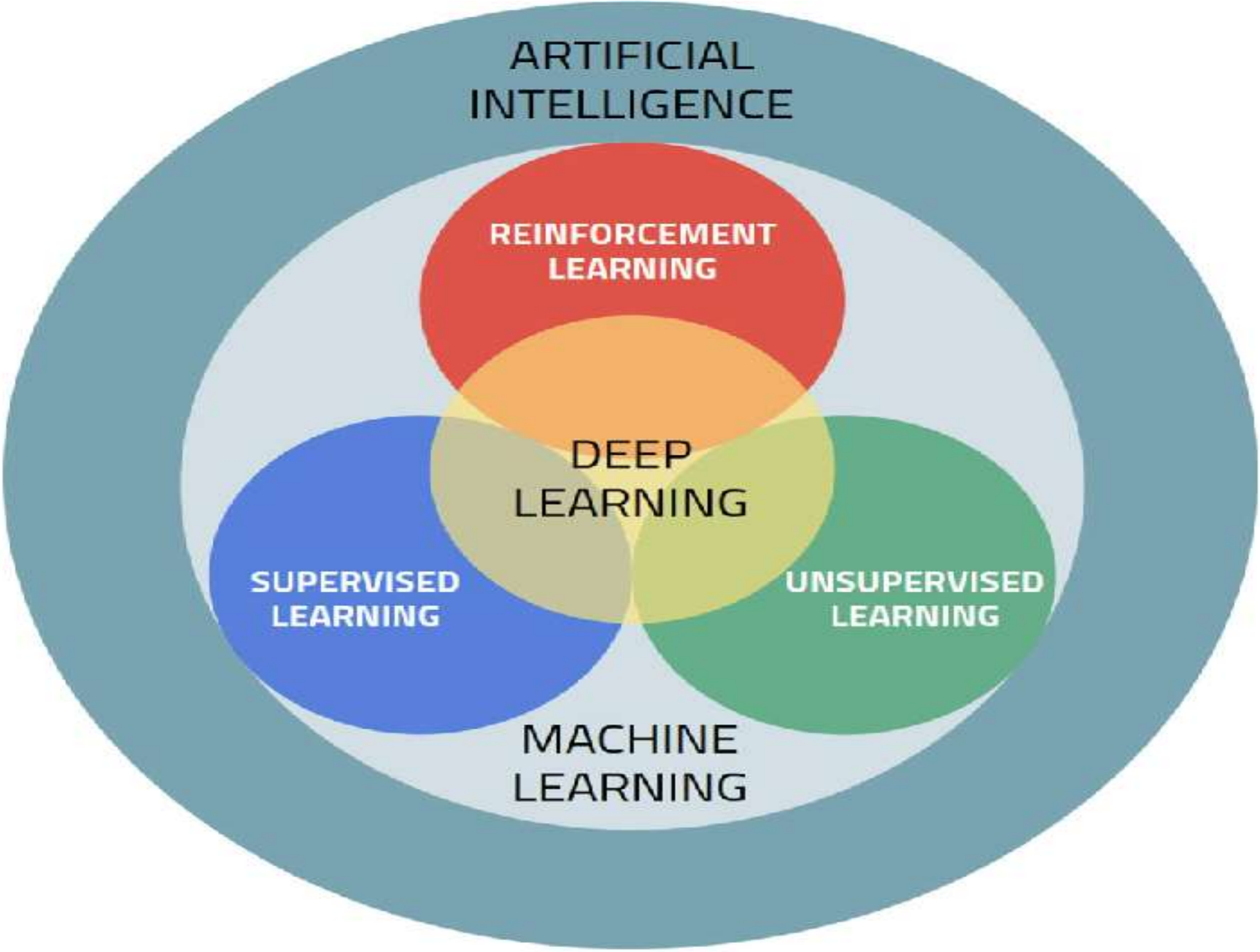
Introdução ao Aprendizado de Máquina e Redes Neurais (*Machine Learning and Atificial Neural Networks*)

Ementa

- Introdução ao Aprendizado de Máquina (Machine Learning) e às Redes Neurais Artificiais.
- Aprendizado de Máquina: supervisionado, não supervisionado e por reforço.
- Métodos e algoritmos de classificação, de regressão e de agrupamento.
- Redes Neurais Artificiais: Perceptron, Adalaine, Redes Neurais Feedforward, Funções de Ativação, Função Custo, Gradiente Descendente, Backpropagation, hiperparâmetros, métricas.
- Deep Learning: Redes Neurais Multi Camadas, Convolucionais, Recorrentes, Generative Adversarial Networks.
- Projeto, implementação e treinamento de sistemas autônomos utilizando Aprendizado de Máquina.
- TensorFlow, Keras, IBM Watson Studio.
- Treinamento em CPU, GPU e TPU.

Áreas de pesquisas

- Sistemas Autônomos, Veículos Autônomos e Robôs Autônomos.
- Visão Computacional, Detecção de Padrões, Identificação.
- Inteligência Artificial, Redes Neurais Artificiais.
- Machine Learning, Deep Learning, Convolutional Neural Networks, Generative Adversarial Networks, Recurrent Neural Network, etc.


ARTIFICIAL
INTELLIGENCE
REINFORCEMENT
LEARNING
DEEP
LEARNING
SUPERVISED
LEARNING
UNSUPERVISED
LEARNING
MACHINE
LEARNING

Artificial intelligence, machine learning, and deep learning

First, we need to define clearly what we're talking about when we mention AI. What are artificial intelligence, machine learning, and deep learning (see figure 1.1)? How do they relate to each other?

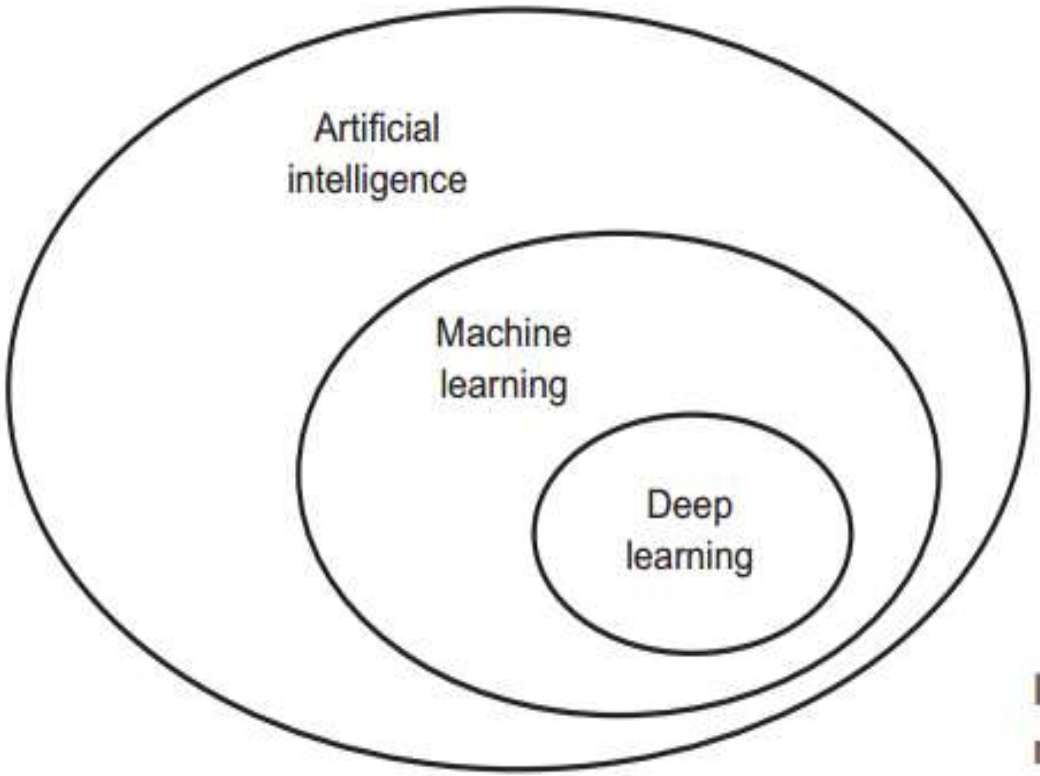
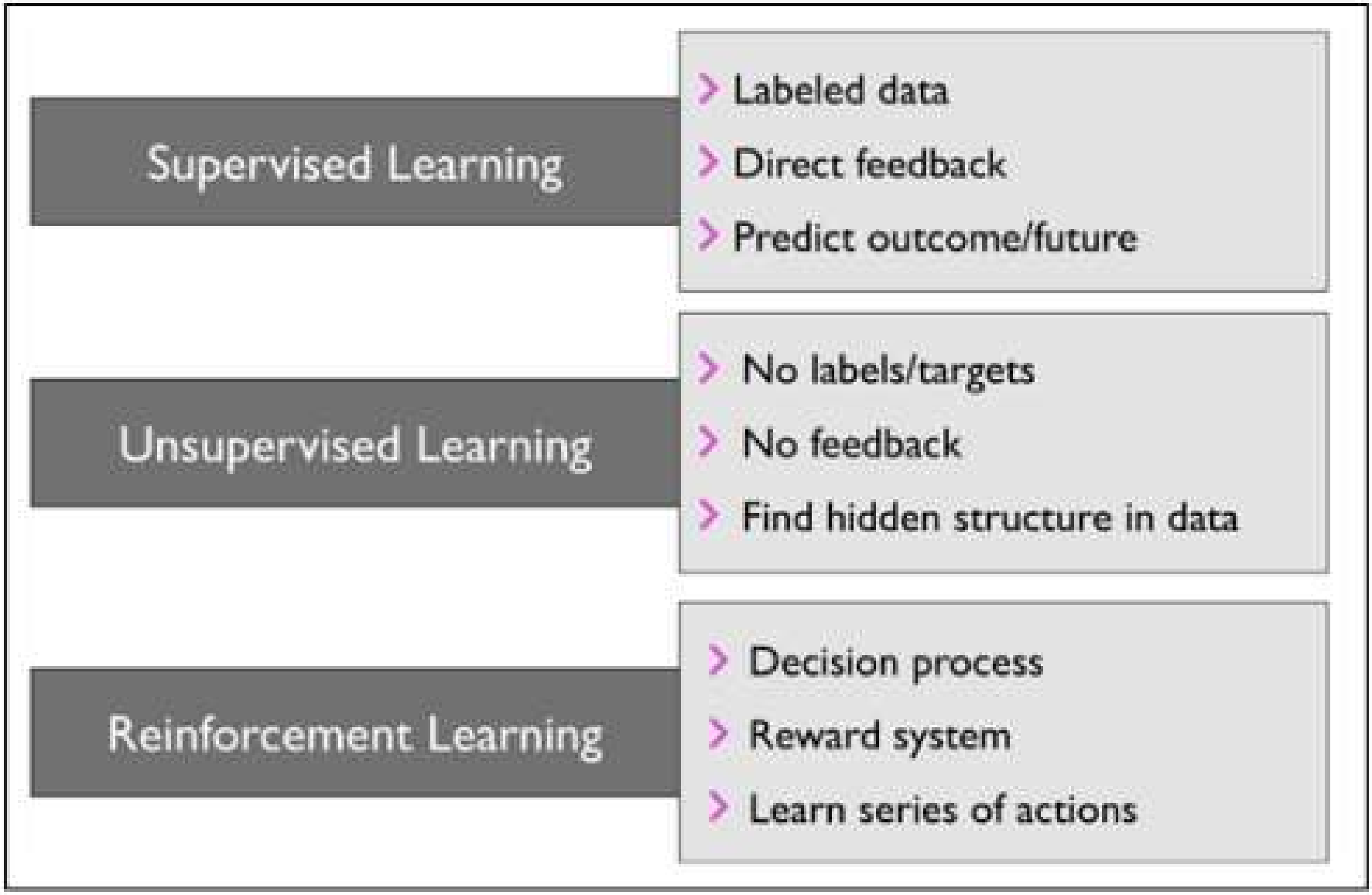
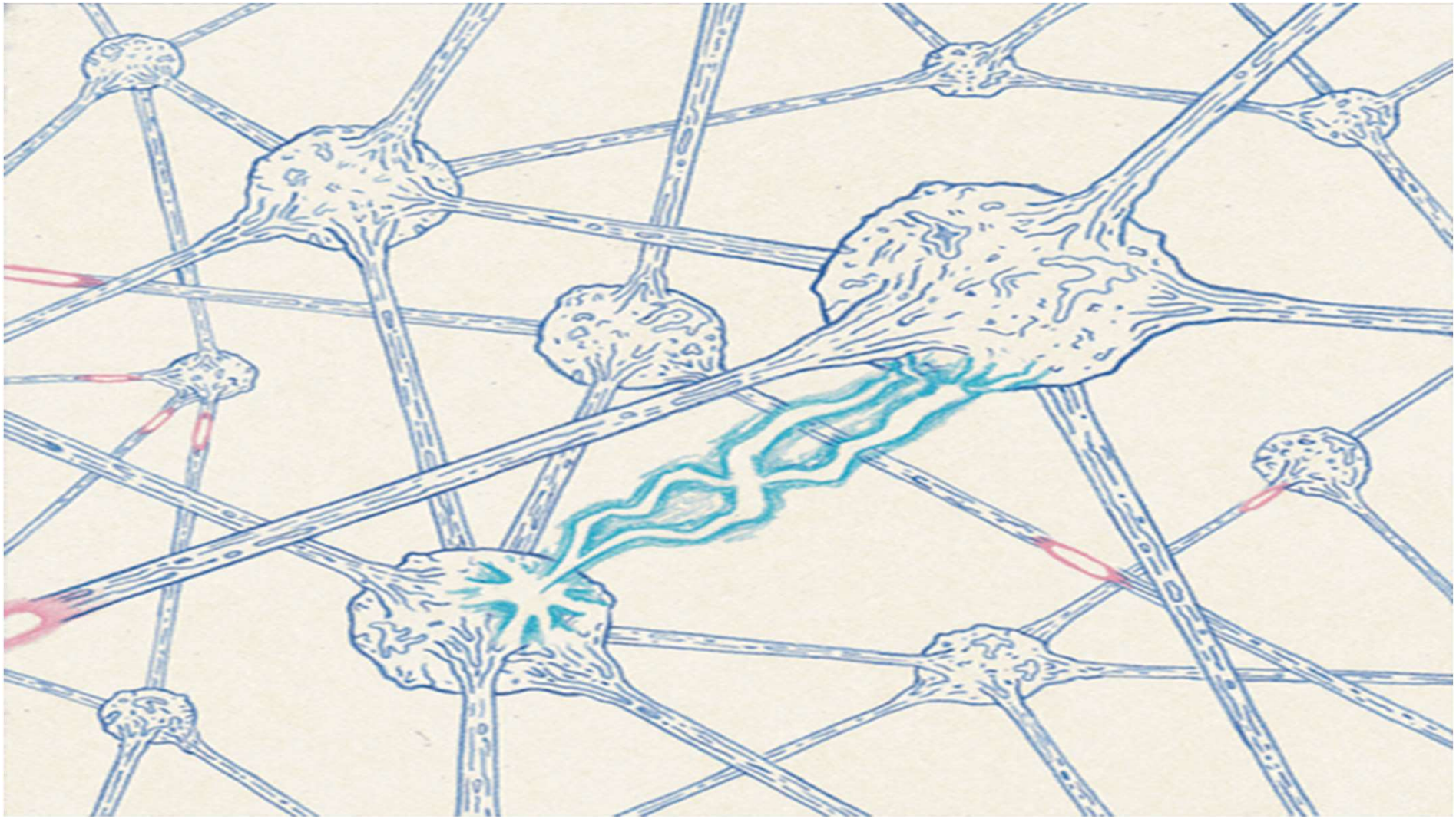


Figure 1.1 Artificial intelligence, machine learning, and deep learning

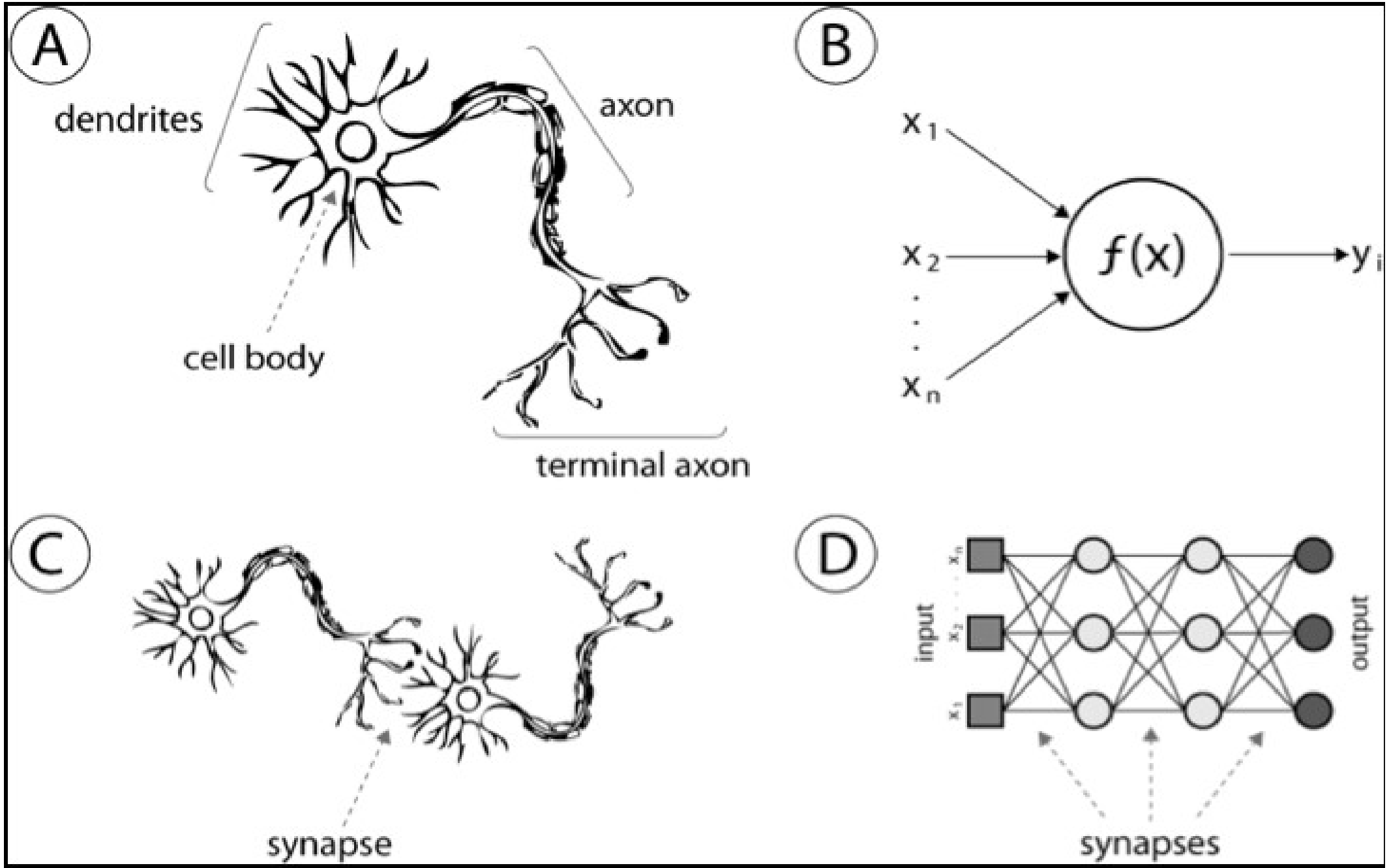
The three different types of machine learning



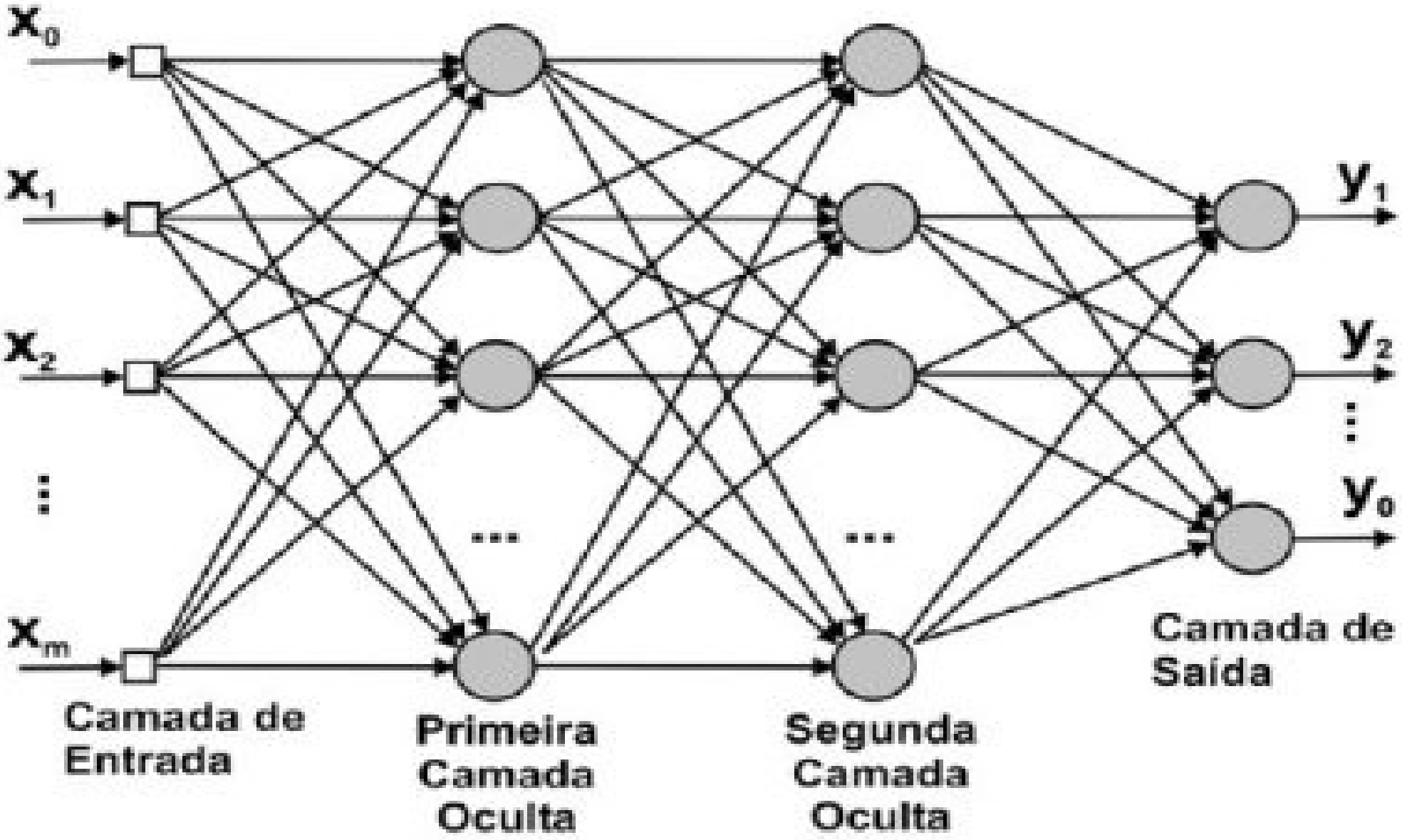
Redes Neurais



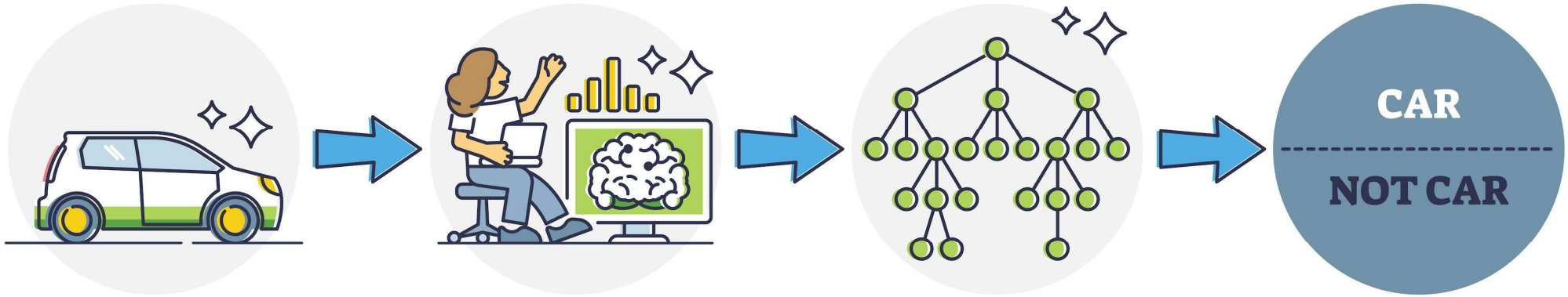
Redes Neurais Artificiais



Redes Neurais Artificiais

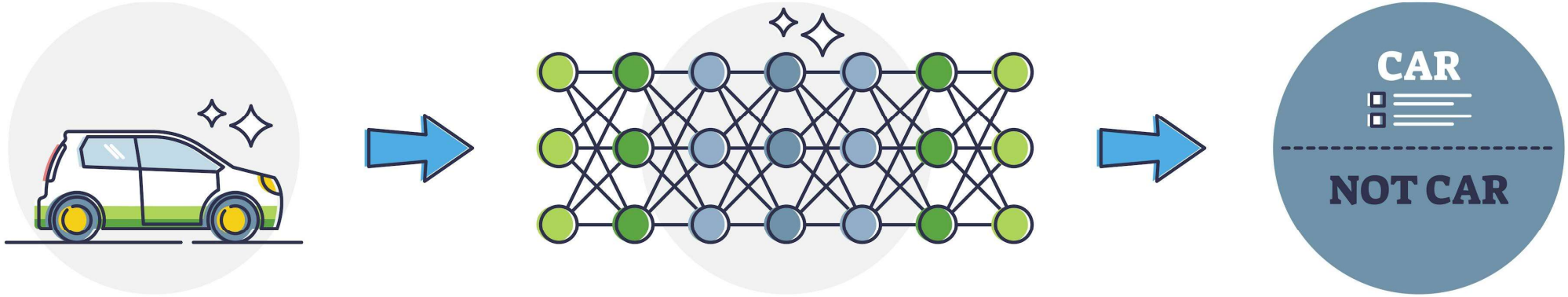


MACHINE LEARNING



INPUT | FEATURE EXTRACTION | CLASSIFICATION | OUTPUT

DEEP LEARNING



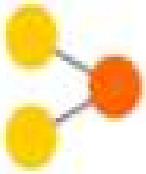
INPUT | FEATURE EXTRACTION + CLASSIFICATION | OUTPUT

A mostly complete chart of

Neural Networks

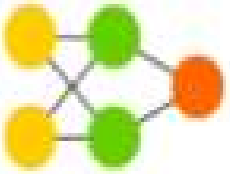
- Backfed Input Cell
- Input Cell
- Noisy Input Cell
- Hidden Cell
- Probablistic Hidden Cell
- Spiking Hidden Cell
- Output Cell
- Match Input Output Cell
- Recurrent Cell
- Memory Cell
- Different Memory Cell
- Kernel
- Convolution or Pool

Perceptron (P)

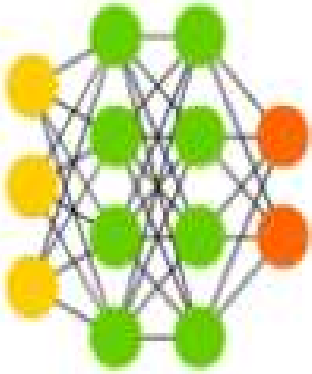


Feed Forward (FF)

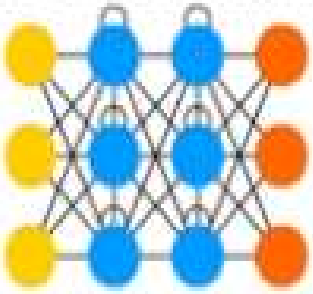
Radial Basis Network (RBF)



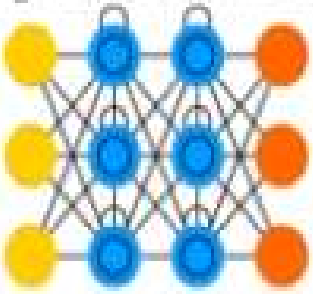
Deep Feed Forward (DFF)



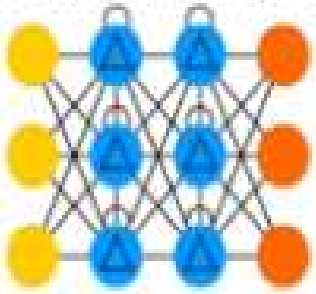
Recurrent Neural Network (RNN)



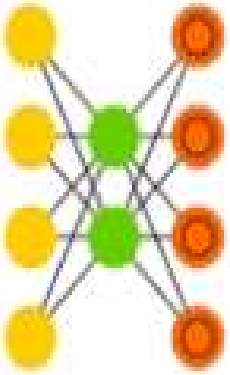
Long / Short Term Memory (LSTM)



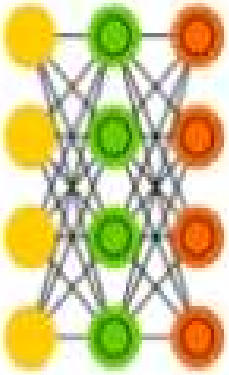
Gated Recurrent Unit (GRU)



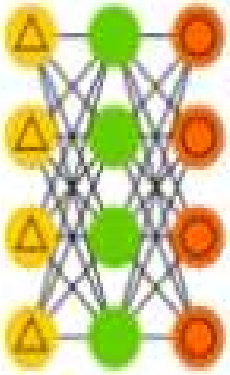
Auto Encoder (AE)



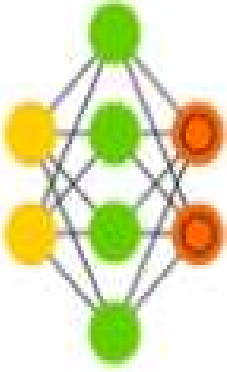
Variational AE (VAE)



Denoising AE (DAE)



Sparse AE (SAE)



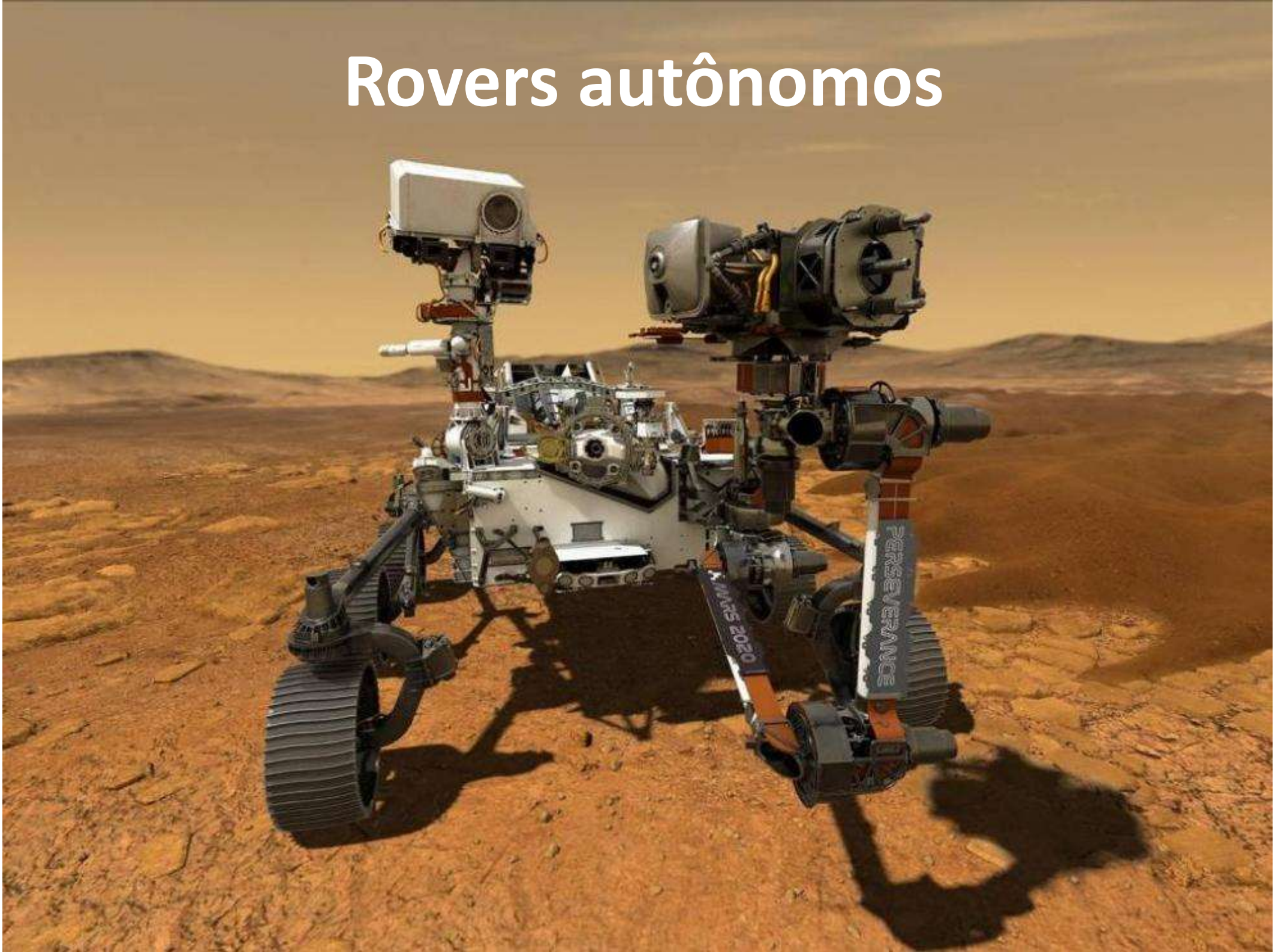
Reconhecimento facial

Veículos Autônomos

Robôs industriais autônomos

Robôs humanóides autônomos

Rovers autônomos



Generative Adversarial Networks (GANs)

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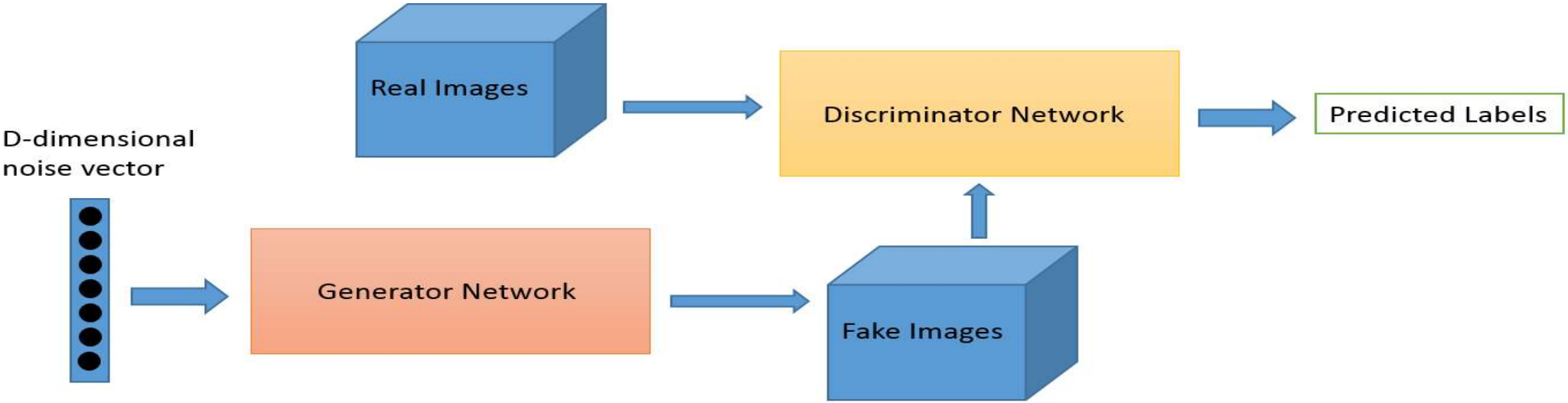
Generative Adversarial Network (GAN)

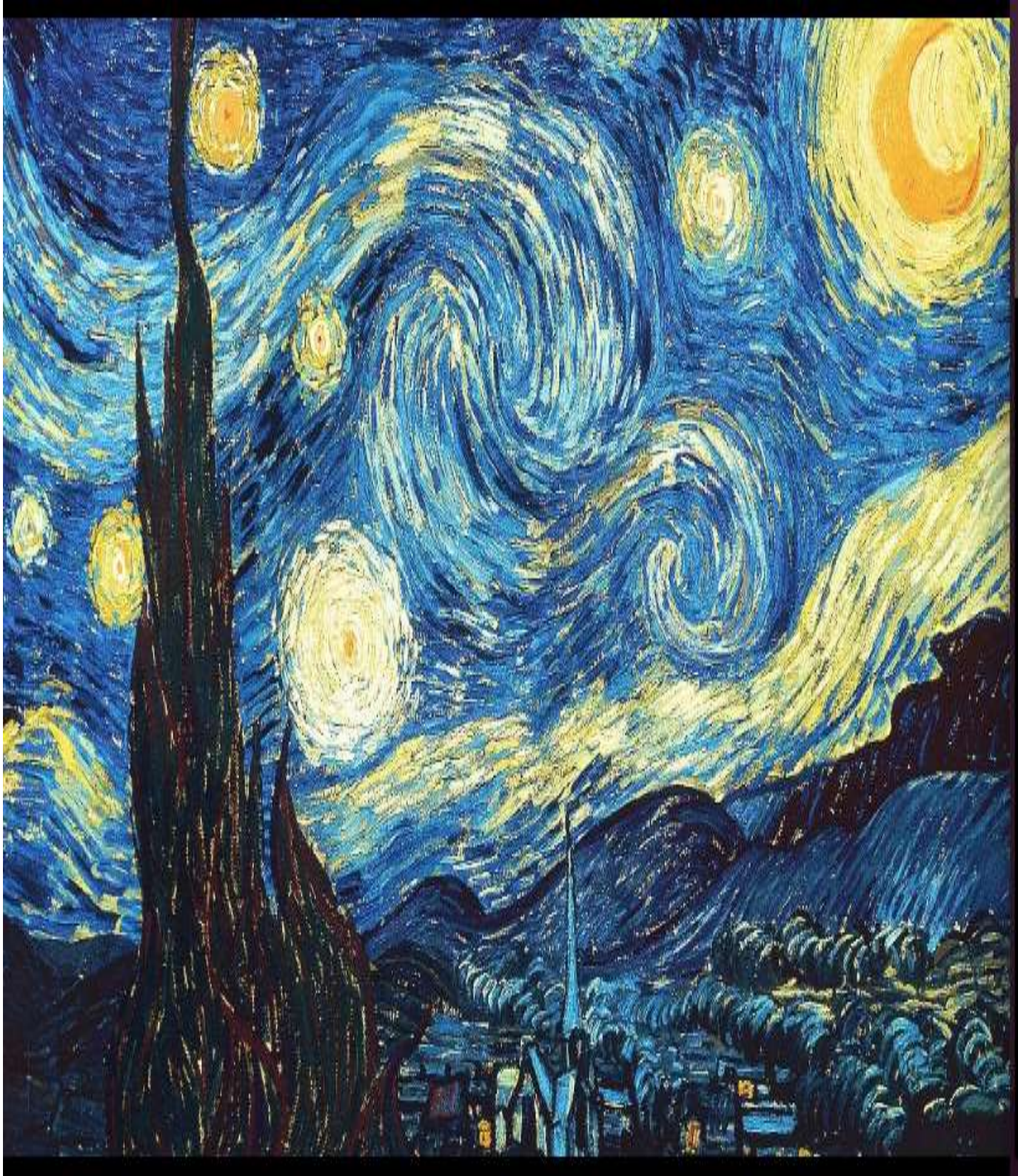


D: Detective

R: Real Data

G: Generator (Forger)

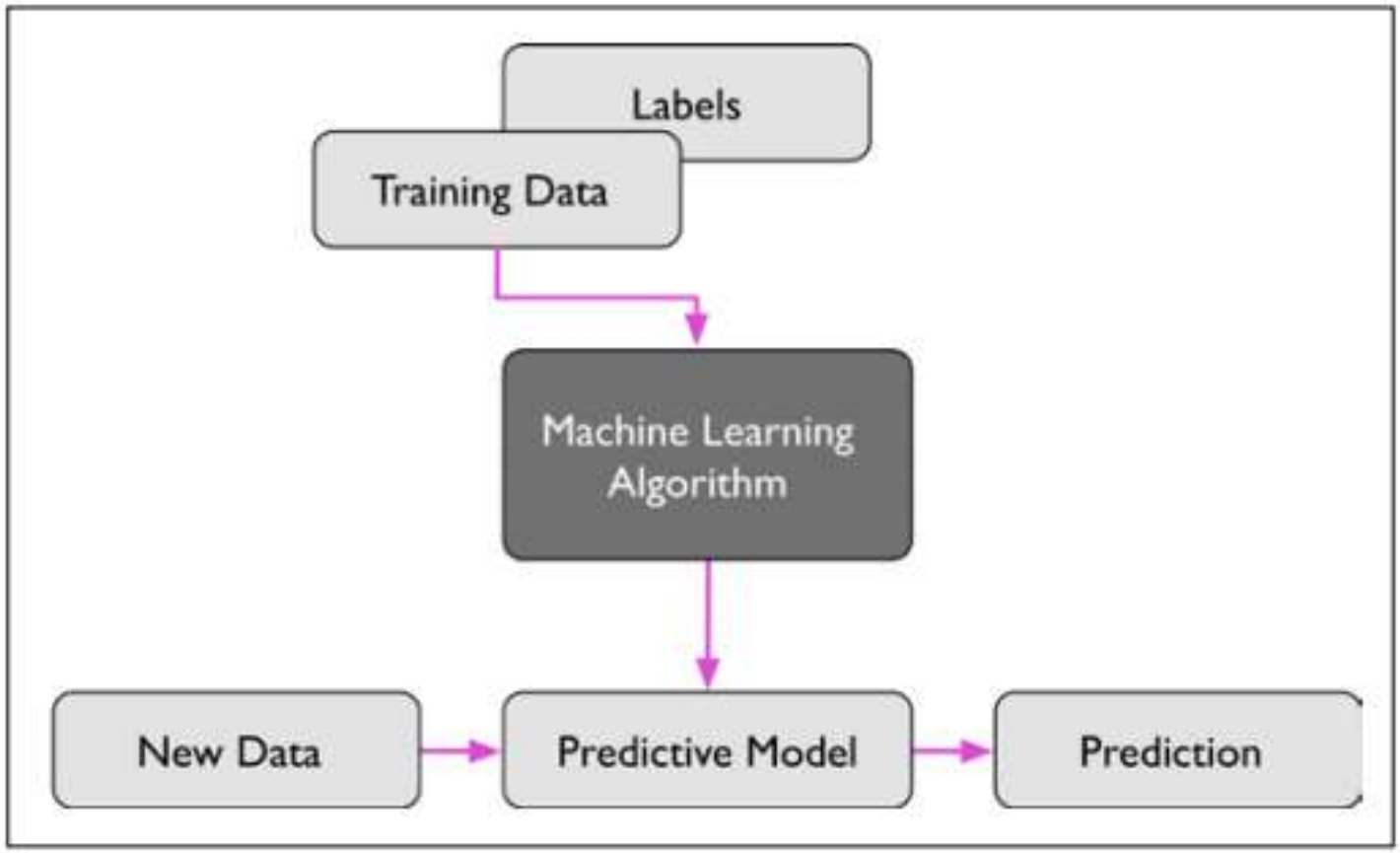
I: Input for Generator




out_3.jpg

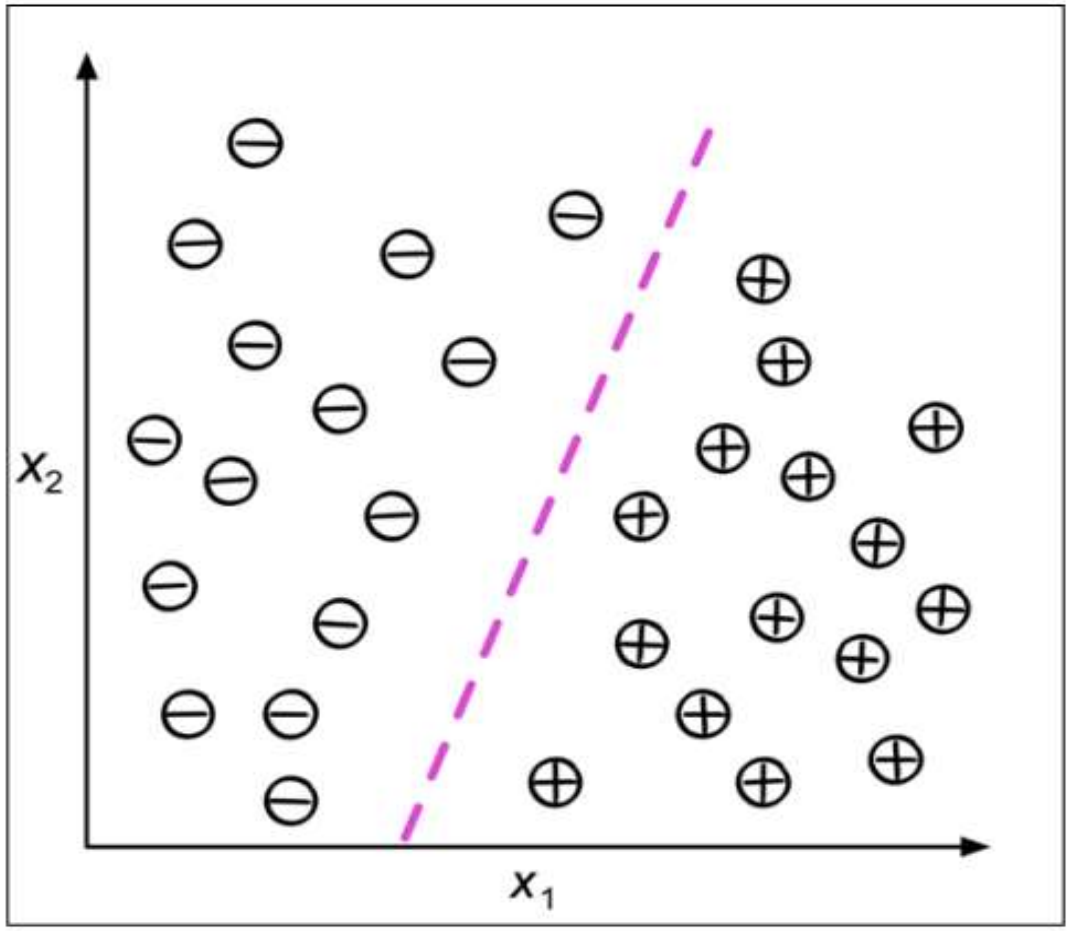
Making predictions about the future with supervised learning

The main goal in supervised learning is to learn a model from labeled training data that allows us to make predictions about unseen or future data. Here, the term **supervised** refers to a set of samples where the desired output signals (labels) are already known.



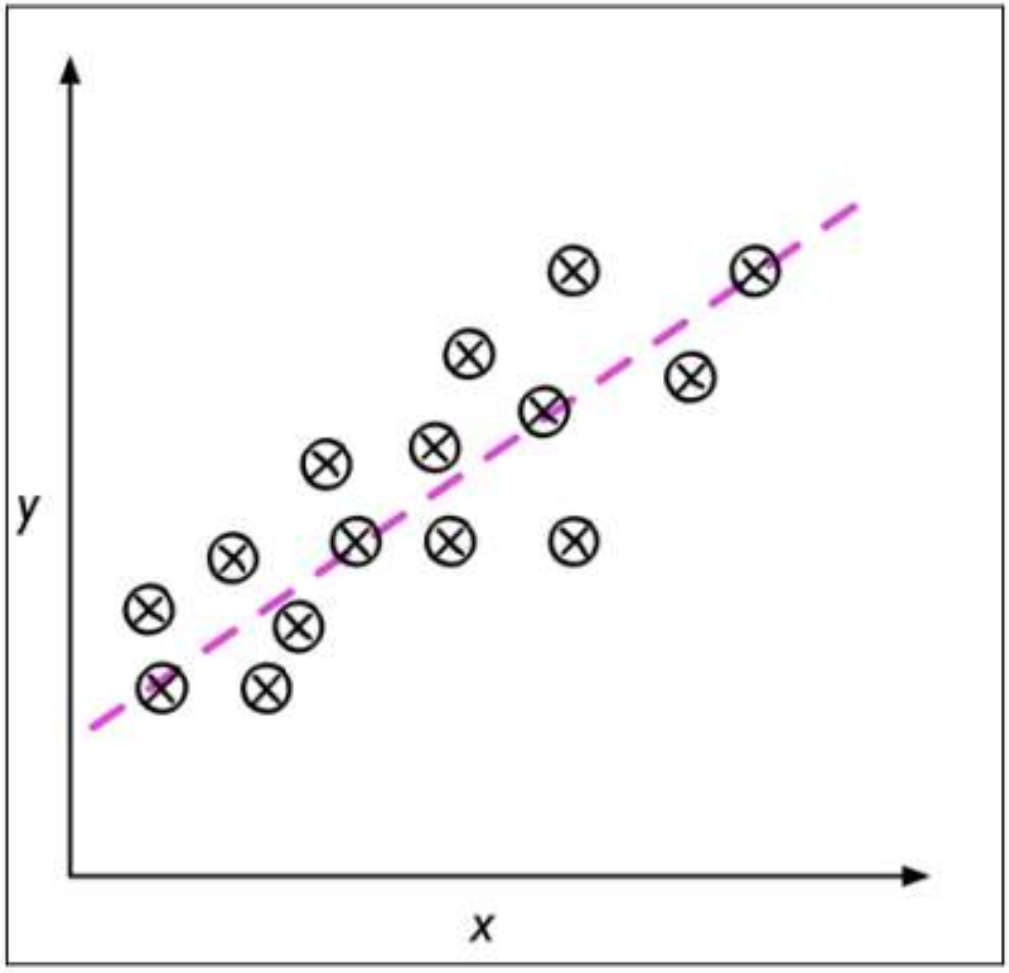
Classification for predicting class labels

Classification is a subcategory of supervised learning where the goal is to predict the categorical class labels of new instances, based on past observations. Those class labels are discrete, unordered values that can be understood as the group memberships of the instances. The previously mentioned example of email spam detection represents a typical example of a binary classification task, where the machine learning algorithm learns a set of rules in order to distinguish between two possible classes: spam and non-spam emails.



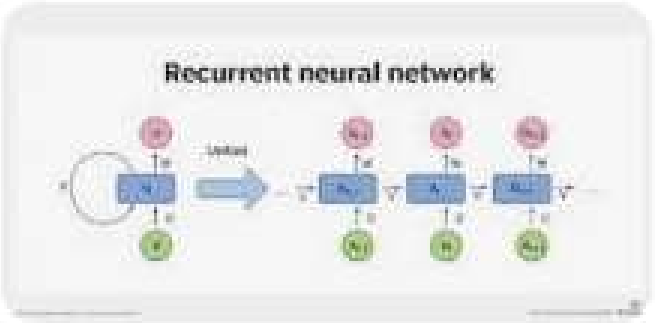
Regression for predicting continuous outcomes

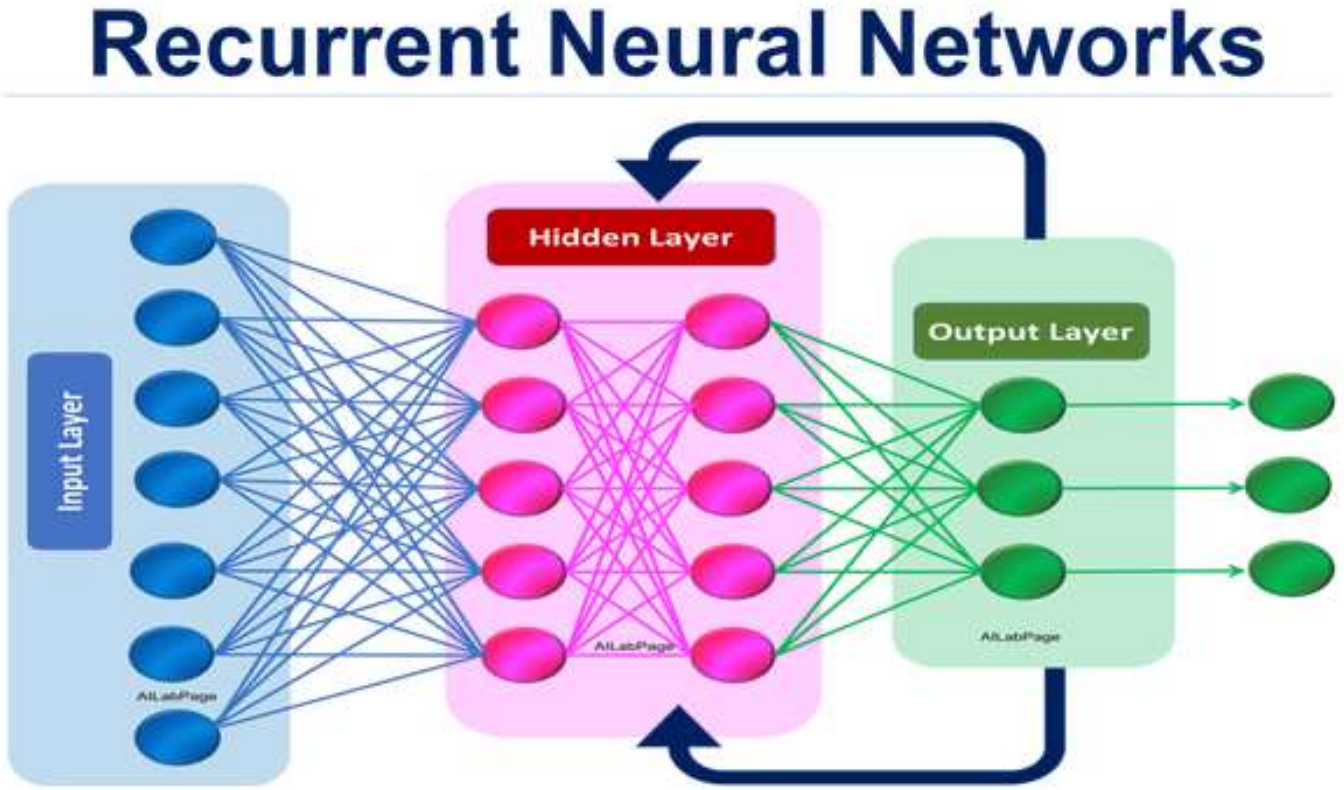
We learned in the previous section that the task of classification is to assign categorical, unordered labels to instances. A second type of supervised learning is the prediction of continuous outcomes, which is also called **regression analysis**. In regression analysis, we are given a number of predictor (**explanatory**) variables and a continuous response variable (**outcome** or **target**), and we try to find a relationship between those variables that allows us to predict an outcome.



What is recurrent neural network?

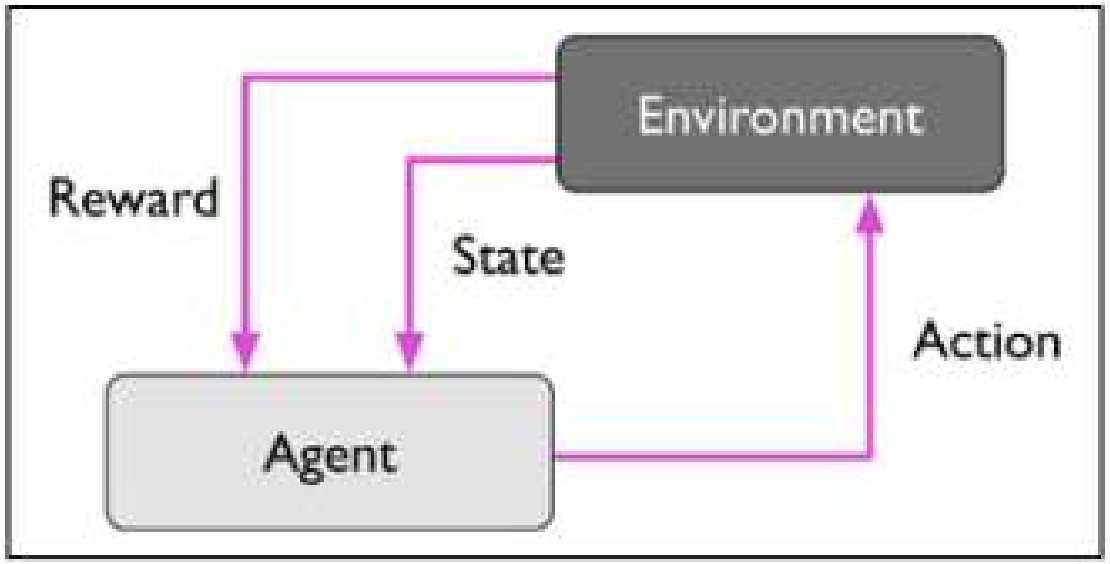
A recurrent neural network is **a type of artificial neural network commonly used in speech recognition and natural language processing**. Recurrent neural networks recognize data's sequential characteristics and use patterns to predict the next likely scenario.





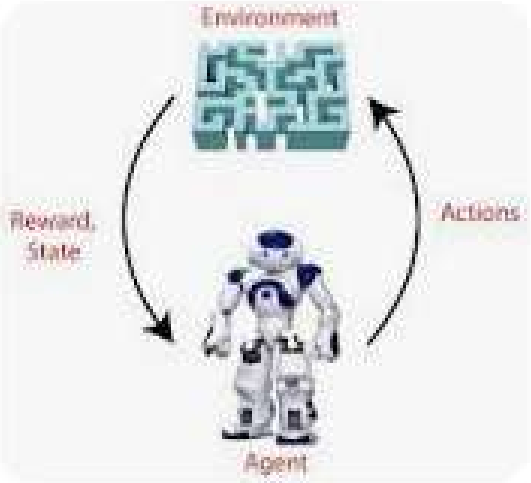
Solving interactive problems with reinforcement learning

Another type of machine learning is **reinforcement learning**. In reinforcement learning, the goal is to develop a system (**agent**) that improves its performance based on interactions with the environment. Since the information about the current state of the environment typically also includes a so-called **reward signal**, we can think of reinforcement learning as a field related to supervised learning. However, in reinforcement learning this feedback is not the correct ground truth label or value, but a measure of how well the action was measured by a reward function. Through its interaction with the environment, an agent can then use reinforcement learning to learn a series of actions that maximizes this reward via an exploratory trial-and-error approach or deliberative planning.

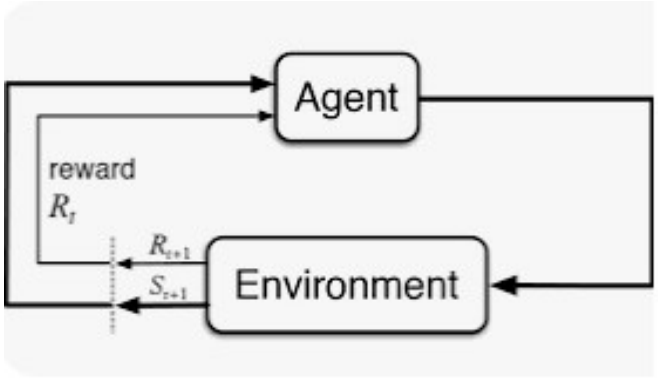


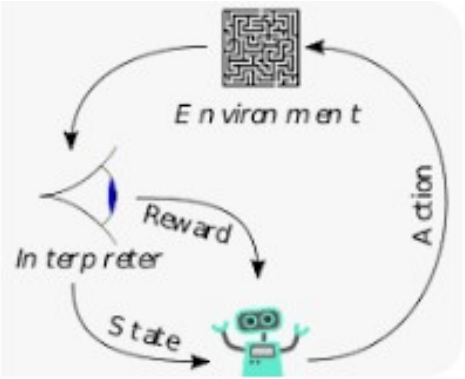
What is reinforcement learning examples?

Hence, we can say that "Reinforcement learning is **a type of machine learning method where an intelligent agent (computer program) interacts with the environment and learns to act within that**." How a Robotic dog learns the movement of his arms is an example of Reinforcement learning.

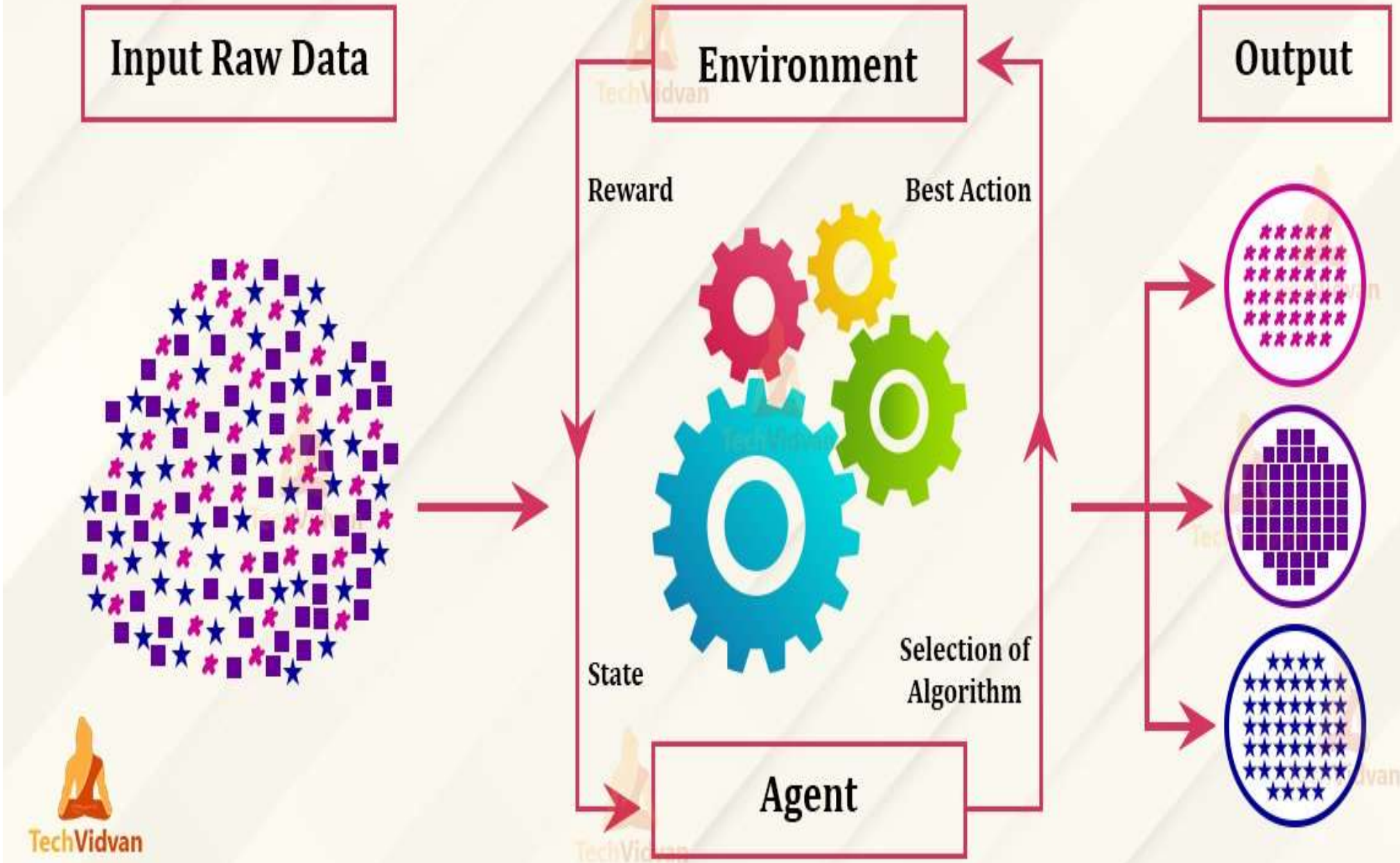


Reinforcement learning (RL) is **an area of machine learning concerned with how intelligent agents ought to take actions in an environment in order to maximize the notion of cumulative reward**. Reinforcement learning is one of three basic machine learning paradigms, alongside supervised learning and unsupervised learning.





Reinforcement Learning in ML



A roadmap for building machine learning systems