



Artificial Intelligence Storytelling by Mitsubishi Electric

"By far the greatest danger of Artificial Intelligence is that people conclude too early that they understand it" stated by the famous researcher and writer Eliezer Yudkowsky, for this reason continues our journey exploring AI. In this edition we will explore the world of Machine Learning and the main learning methods:



"A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P if its performance at tasks in T , as measured by P , improves with experience E ." *Machine Learning is a branch of AI that studies the ability of a system to acquire skills through observation and analysis of data on a large scale and to progressively improve with experience. Deep Learning refers to some ML techniques in which several "layers" of simple processing units are connected in a network.*



In 1952 Arthur Samuel developed the first program "Computer Learning", an intelligent system for the game of checkers able to improve strategies through progressive interaction with users. Between 1957 and 1958 the first Neural Networks were developed with the main objective of recognizing patterns and shapes, but it was only in 1967 that the "K Nearest Neighbors", an algorithm for the recognition and classification of basic models, was conceived. Later, in 1979 some students developed at the university: "Stanford Cart", a robot able to avoid obstacles autonomously. In 90s finally a change of approach happened, increasingly oriented towards Big Data analysis.



Applications are part of our everyday life, ML algorithms are developed for the popular assistants Siri, Cortana and Alexa but not only. Some systems are created to analyze sales data and predict future trends, while other models improve the customization of the customer experience. Pattern recognition allows the system to interpret the surrounding environment, which is why ML is considered a central branch for the development of robotics and industrial automation, in key activities such as quality control and in unstructured environments. typical of industry 4.0.

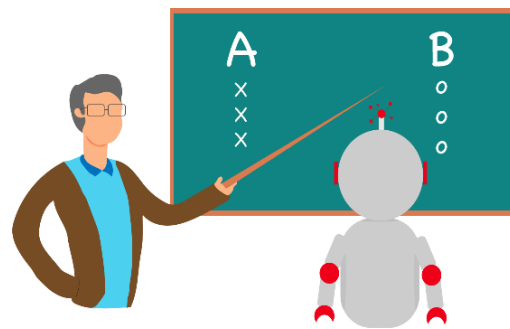
"The art of extrapolating knowledge from data"

Machine Learning has its roots in statistics, it gleans on methods of regression, classification, clustering and association to analyze data and better manage the conditions of uncertainty in the surrounding environment.

Machine Learning provides several learning methods:

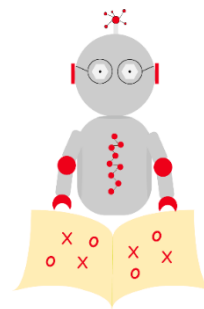
Supervised Learning

In this method of learning, humans "teach" the system through labeled data. For each example, the feature to be recognized is explained to the system (example: A or B) to "train" the model to automatically recognize the correct label. Typically the training data are divided into sets to identify a rule that predicts the output based on the input variables.



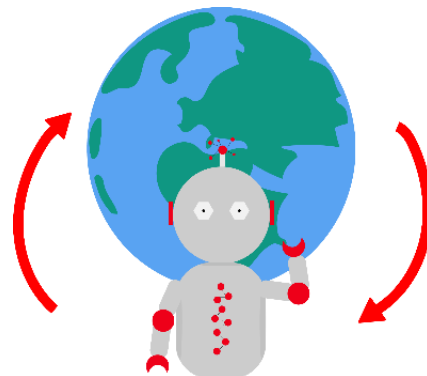
Unsupervised Learning

Unsupervised learning does not require correct labels, the goal is to discover the structure of the analyzed data. The system learns the relationships that link the data, dividing the sample into "clusters" or reducing the "size" of the data, to build a model that identifies groups of elements with common characteristics.



Reinforcement Learning

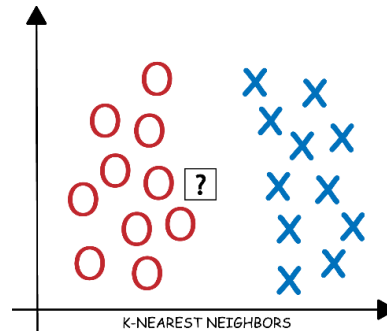
Reinforcement learning is typically used to make a sequence of decisions in an uncertain and unstructured environment. The model learns through interaction with the environment, learns to carry out activities by trial and error through an iterative process in which the system receives rewards and penalties based on the outcome of the activity. The goal of the system is to maximize the total reward.



Among the most important **Supervised Learning** methods, we find:

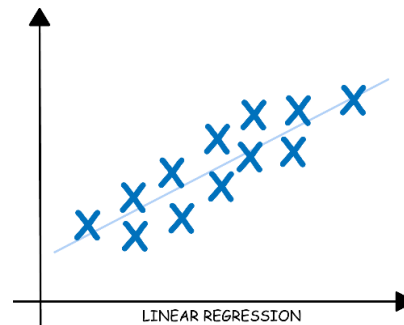
K-Nearest Neighbors

The KNN method is commonly used for classification activities. Once the historical data is labeled and the characteristic values distributed on a graph, the model classifies the new inputs by the category (label) of the closest data. The system uses Euclidean distance to determine which K data is closest and automatically classify the new data.

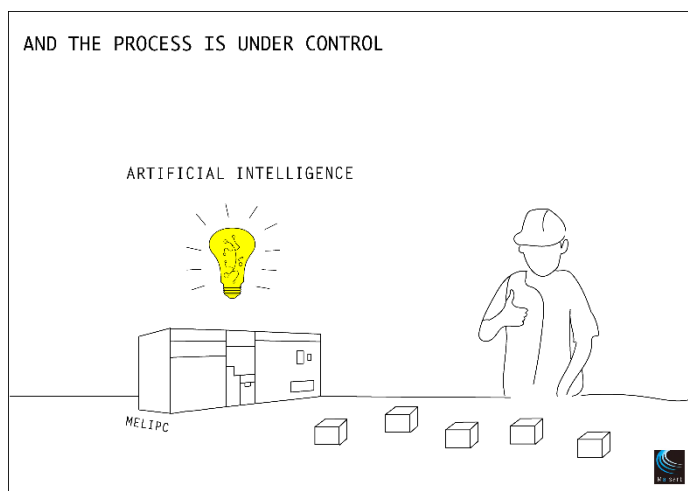


Linear Regression

The goal of the regression is to determine a linear model by correlating the output variables to the input data. The system, starting from historical data, produces a numerical forecast, such as the distance to an obstacle or the future price of a product. The task performed by the ML is to find the relationship that minimizes the error between the actual output and the forecast.



Multiple linear regression, k-Nearest Neighbors and other Artificial Intelligence methods are used by the new MELIPC industrial PC to improve quality and control of the process:



Quality Control in Real Time

MELIPC acquires the model offline and extrapolates the characteristic waveform for the significant parameters of the production process. The comparison between the waveforms allows the analysis and diagnostics in real time of the data arriving from the system.

MAISART Mitsubishi Electric's AI creates the State-of-the-ART in Technology, is the brand that embodies the latest developments in research on Artificial Intelligence technologies.

It is the Mitsubishi Electric's response to the new state of the art in the industrial world and it offers a complete range of intelligent solutions:



MELIPC and Real-Time Quality Control

The new industrial PC, thanks to Statistics and Machine Learning tools, guarantees real-time control of production, providing continuous feedback to the operator and optimizing quality control management. The integrated algorithms allow the analysis and diagnostics of data coming from the system, according to a predictive formula, *which ensures better quality and efficiency to the process.*



E-F@CTORY Starter Package

It is a set of basic programs integrated into the iQ-R modular PLC to support IoT systems in manufacturing. Ideal for monitoring production, developing predictive maintenance systems and managing quality control. Thanks to advanced statistical methods, the system provides visualization and continuous production management functions on GOT, allowing the user to visualize dashboards and graphs with the process KPIs.



ROBOT MELFA FR and AI Force Sensor

Thanks to Maisart technology, the rapid force control algorithm developed for the new force sensor, reduces operation times and eliminates irregular movements of the robot. Artificial intelligence allows to quickly adjust the process parameters, ensuring a cycle time reduced by 65% for insertion and assembly operations.

Mitsubishi Electric represents a technological partner with a complete range of automation solutions and know-how that goes beyond the single products.