Presentation

Machine Learning 101

As humans, we learn from our past experiences. However, machines lack the ability to learn or think for themselves. Instead, they can only follow instructions given to them by people.

Is it then possible to train machines to learn from past data and perform tasks as efficiently as humans, or even faster?

This is where machine learning comes in. It's not just about learning, but also about understanding and reasoning. In this presentetiom, I’m going to cover the basics of machine learning.

Glossary

Here are some words that I want to explain to help you better understand this presentation.

- machine learning
- supervised
- outliers
- reinfrorced
- algorithm
- model

What is machine learning?

Example with songs….

To begin, let's consider a situation that we can all relate to.

Paul enjoys listening to music on various streaming platforms, and he evaluates each song by deciding whether he likes or dislikes it based on different factors. These factors are called variables, which can be observed or measured. We can divide them into two categories:

- Quantitative, which can be described by a number, either discrete or continuous.
- Categorical, which must be assigned a label created by us.

For example, "tempo" can be considered either quantitative if we analyze it over BPM or categorical if we break it into categories like "slow" and "fast." Other variables that can be

considered include "genre," "intensity," and "gender of voice."

For our example, we will only use tempo and intensity to analyze Paul's musical preferences. Our diagram shows that Paul enjoys songs with a fast tempo and soaring intensity, but dislikes relaxed songs with light intensity.

Machine learning was developed to predict whether Paul is likely to like or dislike a new song based on its tempo and intensity. While sometimes this prediction is straightforward based on past choices, in other cases, specific algorithms are necessary to make an accurate prediction.

All models are wrong

As the famous statitian George Box has said “all models are wrong but some are useful”.

Drawing up a model of how something will work is a great way of working out a new process but its important to remember that your process is not your model nor will it behave like one. Models are designed to represent something and are often simplified. They are however a great oportunity to think around a process and really understand it.

To generalize machine learning we are going to be using this chart. As you can see some input is given to a ml model which then gives the output according to the algorithm applied.

How do machines learn?

Supervised

We need to create a machine that is going to recognize coins from different countries. In our example we have one pound, one euro and one zloty. Each coin has a different weight. Our model is supposed to predict the currency of a coin based on its weight. The weight becomes the a feature of a coin while the currency is only the label that is going to be associated with each value. Our model needs to learn that if the coin given to it weights 3 grams its one euro etc.

Other examples of supervised learning are:

- facebook recognizing someone in a picture based on an album of their tagged photographs(facebook is using tagged photos as labels)
- recommending new songs based on past choices because the system is training a classifier on preexisting labels like genres of songs.

Unsupervised

Unsupervised learning is a type of machine learning where the algorithm learns patterns and relationships from a dataset without any explicit labels or target values. In other words, the algorithm tries to find inherent structures and patterns in the data by grouping similar data points together or identifying clusters.

k-nearest neighbors algorithm

Unsupervised learning is a type of machine learning used to detect fraud, where there are no labels such as "fraud" and "not fraud." The model tries to identify outliers, or anomalous transactions, and flags them as potential instances of fraud.

Reinforcement Learning

Reinforcement learning is based on giving feedback or rewards to the machine.

In our example, we want a machine to recognize the animal in a picture. Let's say we only give it photos of dogs. First, we provide the system with an image of a dog and ask the machine to identify the animal. The system identifies it as a cat, so we have to give the machine negative feedback and say, "Hey machine, it is actually a dog, not a cat." After training the machine enough, it will be able to recognize animals from many different photos. Not only will it know the animals in the pictures it has already seen, but it will also predict the animals in new photos from outside the training dataset with high accuracy.

Where is Machine Learning Used?

- Healthcare
- Sentiment Analysis
- Fraud Detection
- E-commerce

Another interesting machine learning model used by Uber calculates differential pricing in real-time based on:

- Demand
- Number of cars available
- Bad weather
- Rush hour

Uber also uses predictive modeling to predict where the demand will be high.