Types of Machine Learning Algorithms

We'll cover the following

Machine Learning algorithms can be broadly categorized into the following four groups:

- Supervised Learning
- Unsupervised Learning
- Semisupervised Learning
- Reinforcement Learning

1.Supervised Learning

In Supervised Learning, the training data provided as input to the algorithm includes the final solutions, called labels or class because the algorithm learns by “looking” at the examples with correct answers. In other words, the algorithm has a ***supervisor*** or a ***teacher*** who provides it with all the answers first, like whether it’s a cat in the picture or not. And the machine uses these examples to learn one by one. The spam filter is another good example of this.

Another typical task, of a different type would be to predict a target numeric value like housing prices from a set of features like size, location, number of bedrooms. To train the system, we again need to provide many correct examples of known housing prices, including both their features and their labels.

While categorizing emails or identifying whether the picture is of a cat or a dog was a supervised learning algorithm of type **classification**, predicting housing prices is known as **regression**. What's the difference?

In regression the output is a continuous value or a decimal number like housing prices. In classification, the output is a label like "spam or not-spam" and not a decimal number; the output only takes values like 0 or 1 where we could have 1 for "spam" and 0 for "non-spam". Basically, the **type of algorithm we choose (classification or regression) depends on the type of output we want**.

Examples of Supervised Learning Algorithms:

- Linear Regression
- Logistic Regression
- Support Vector Machines
- Decision Trees and Random Forests
- k-Nearest Neighbors
- Neural networks

While the focus of this lesson is to learn about the broad categories, we will be diving deeper into each of these algorithms individually in the ***"Machine Learning Algorithms"*** lesson.

2. Unsupervised Learning

In Unsupervised Learning the data has no labels; the goal of the algorithm is to find relationships in the data. This system needs to learn without a teacher. For instance, say we have data about a website's visitors and we want to use it to find groupings of similar visitors. We don't know and can't tell the algorithm which group a visitor belongs to; it finds those connections without help based on some hidden patterns in the data. This customer segmentation is an example of what is known as **clustering**, classification with no predefined classes and based on some unknown features.

Another well-known use case is image compression. When saving an image, if we set the palette, let's say, to 32 colors, clustering will find all the "blueish"

pixels, calculate the “average blue” and set it for all the blue pixels. This helps us in achieving a lower file size.

Examples of Unsupervised Algorithms:

- Clustering: k-Means
- Visualization and dimensionality reduction
- Principal Component Analysis (PCA), t-distributed
- Stochastic Neighbor Embedding (t-SNE)
- Association rule learning: Apriori

3. Semi-supervised Learning

Semi-supervised learning deals with partially labeled training data, usually a lot of unlabeled data with some labeled data. Most semi-supervised learning algorithms are a combination of unsupervised and supervised algorithms.

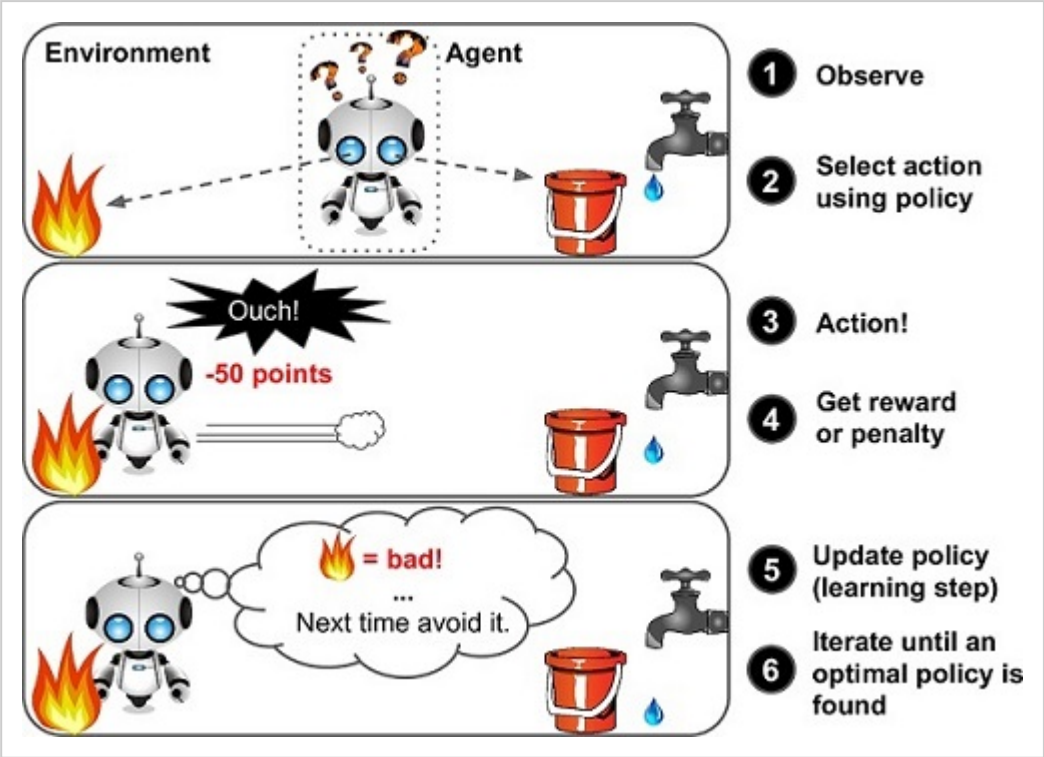
Google photos is a good example of this. In a set of family photos, the unsupervised part of the algorithm automatically recognizes the photos in which each of the family members appears. For example, it can tell that person A appears in picture 1 and 3 while person B appears in picture 1 and 2. After this step, all the system needs from us is one label for each person and then the supervised part of the algorithm can name everyone in every photo. Bingo!

4. Reinforcement Learning

Reinforcement Learning is a special and more advanced category where the learning system or agent needs to learn to make specific decisions. The agent observes the environment to which it is exposed, it selects and performs actions, and gets rewards or penalties in return. Its goal is to choose actions which maximize the reward over time. So, by trial and error, and based on past experience, the system learns the best strategy, called policy, on its own.

A good example of Reinforcement Learning is DeepMind’s AlphaGo. The system learned the winning policy at the game of Go by analyzing millions of games and then playing against itself. At the championship of Go in 2017, AlphaGo was able to beat the human world champion just by applying the

policy it had learned earlier by itself.



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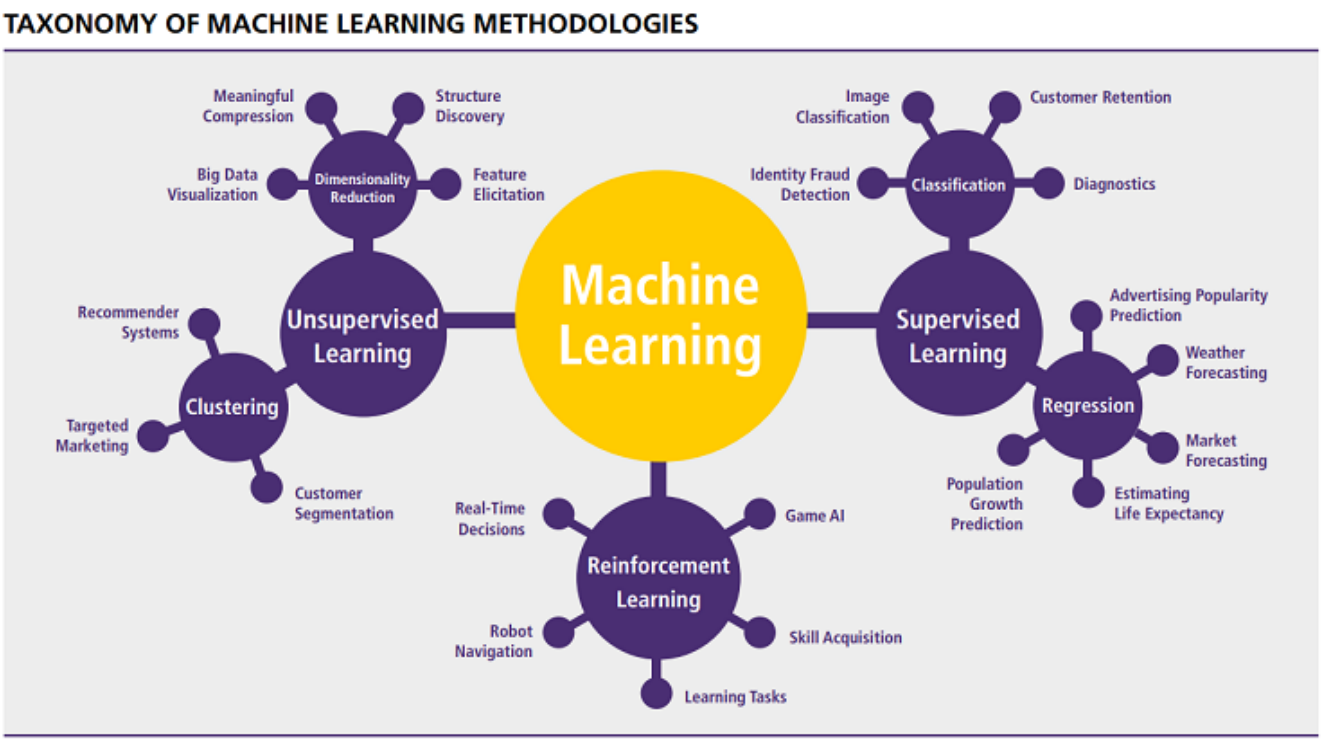

Figure 10: An overview of machine learning techniques; **Source:** Jha, V.

Image Credits: DHL, Artificial Intelligence in Logistics, 2018 (Pdf, 45 pp, No opt-in).

Final Thoughts

This was a gentle introduction to Machine Learning. Hopefully, you are excited to learn more about this cool subject! Now that we are familiar with the broad types of machine learning algorithms, in the next lesson, we are going to dive into the specifics of individual machine learning algorithms.