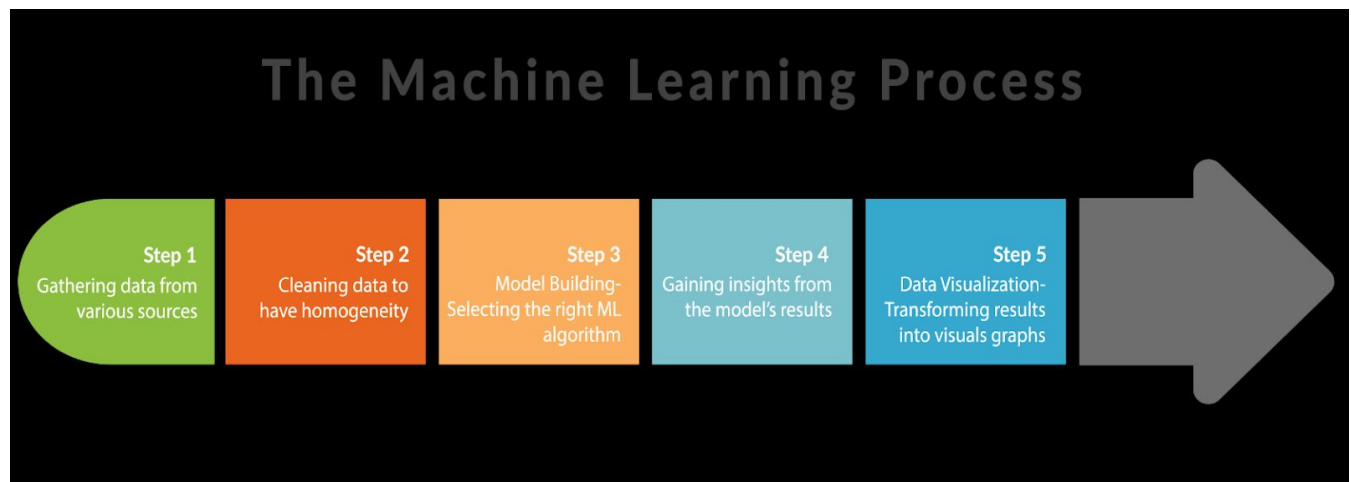


## MACHINE LEARNING

**What does it do? (600 words) What is the state of the art of this new technology? What can be done now? What is likely to be able to do be done soon (say in next 3 years)? What technological or other developments make this possible?**

Machine Learning (ML) and Artificial Intelligence (AI) are commonly used interchangeably, but there is an important distinction between the two: AI is the broader, overarching concept of machines imitating human-like properties, whereas ML branches from AI and involves teaching machines how to learn.

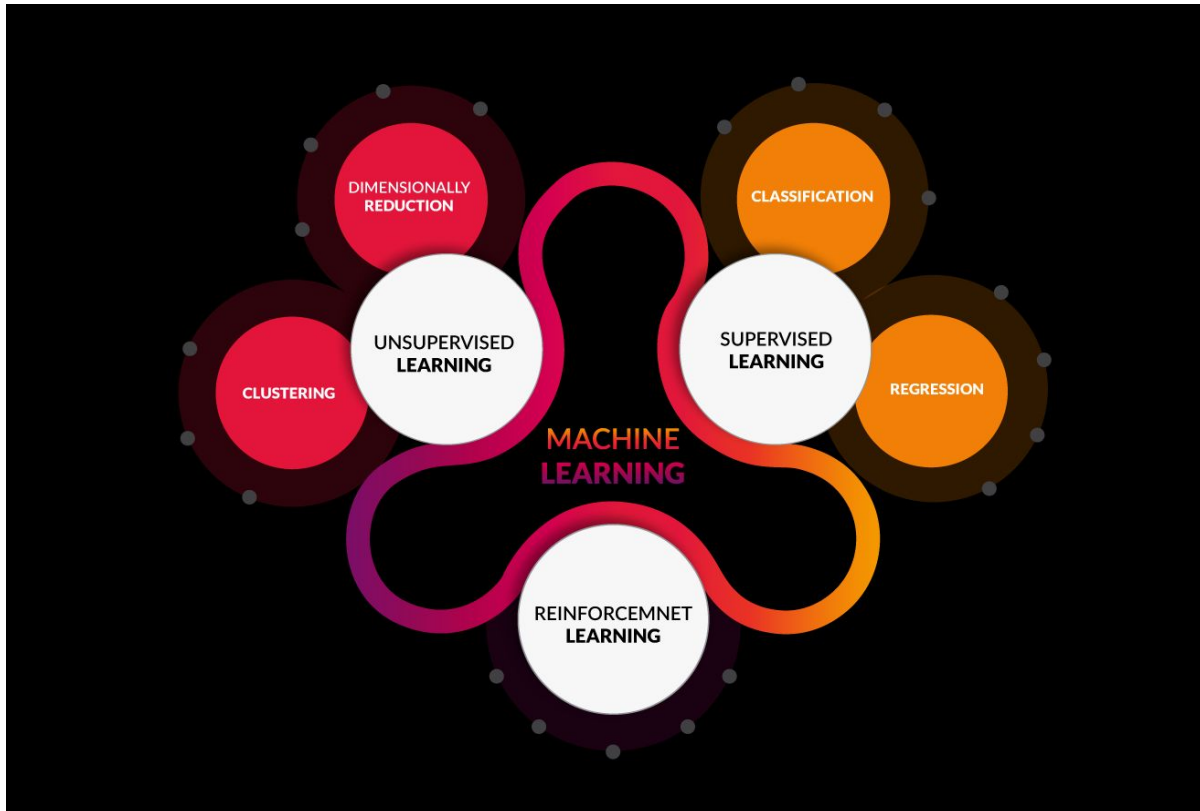
ML is essentially an algorithm and primarily deals with data analysis, and its general functional process can be seen below:



ML enables machines to make conclusions based on the data it was given or has gathered, thus requiring minimal or absent human input. The machine's brain, or algorithm, can be seen as a cycle of data collection, analysis, and feedback, with the feedback being used to gather more quality data and then repeating the cycle. This effectively allows machines to improve themselves continuously.

Moreover, ML can be further divided into three main categories:

1. Supervised Learning
2. Unsupervised Learning
3. Reinforcement Learning



### **Supervised Learning:**

A set of inputs (labeled examples) are given to the algorithm alongside corresponding correct outputs. The algorithm will proceed to identify errors by comparing its own output with the given correct outputs, and then modify the model accordingly. It will use methods, such as classification, regression, prediction and gradient boosting, and patterns to compute values for the remaining unlabeled data. Supervised Learning is commonly used in applications that predict outcomes based on historical data, e.g. determining fraudulent activity by analysing credit and transaction patterns.

### **Unsupervised Learning:**

Contrastingly, there are no given inputs to the algorithm so it must figure out what is being shown. Contrastingly, there are no given inputs to an Unsupervised Learning algorithm, thus being more “independent” in its approach to analysing data. As the system sifts through data, it will attempt to draw inferences and proceed to segment text topics, recommend items and identify data outliers. There are various Unsupervised Learning methods, such as: self-organising maps, nearest-neighbour mapping, k-means clustering and singular value decomposition. This type of algorithm can be used for

marketing purposes, where it can identify and categorise customers with similar attributes so that data can be effectively used in strategic advertisements.

### **Reinforced Learning:**

Reinforced Learning can be best understood as an algorithm that finds correct outputs through a continuous cycle of trial and error. There are 3 primary components: the agent (the learner or decision maker), the environment (everything the agent interacts with) and actions (what the agent can do). Through this process, the algorithm will learn by either being rewarded for correct behaviour or being punished for incorrect behaviour. Therefore, there is little to no human intervention and has found popularity in the areas of robotics, gaming, and navigation. For example, Reinforced Learning can be applied to an AI playing chess, and the positive or negative outcomes of each move will allow the algorithm to progressively get better and better.

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Machine Learning can be strongly linked to robotics and autonomous vehicles, as it's essentially the "brain" that empowers them. Therefore, the developments made in Machine Learning can be reflected in the advancements of robotics/autonomous vehicles. Currently, self-driving cars is being proposed to be widely used in the near future, with some already being tested on roads in the US. For example, Tesla released footage of a fully self-driven car this year in April, and it can be shown that the vehicle steers on its own and slows down accordingly in areas of risk, such as intersections.

**What is the likely impact? (300 words) What is the potential impact of this development? What is likely to change? Which people will be most affected and how? Will this create, replace or make redundant any current jobs or technologies?**

Machine Learning has and will continue to have a positive impact on the world. It will effectively do what humans do, but better. Recent developments show Machine Learning is on an upward trend, with algorithms progressively becoming faster and more efficient in processing data and producing outputs.

Particularly, the development of AI has garnered much attention as its real world application seems to have a hand in major aspects of society, such as: retail, economics, and social networking. Popularly used ridesharing applications, like Uber and Lyft, uses Machine Learning to determine ETAs, optimal pick-up locations, and

more. This has allowed people to enjoy cheaper and more convenient commutes, with the average wait-time for uberX being 4.28 minutes in comparison to taxis being 7.47 minutes (Deloitte, 2017).

However, ridesharing applications have also supposedly dealt a blow to the taxi industry. In May 2019, a class action lawsuit, on behalf of thousands of Australian taxi drivers, has been filed against Uber on the grounds of illegal operation and deliberate financial harm. Despite this, the Australian Taxi Industry Association (ATIA) reported an increase in the number of taxi rides in the 12 months following the introduction of uberX. Although limited in range, ATIA statistics show a steady upward trend on the total annual number of taxi rides between 2004 and 2014.

Additionally, the introduction of uberX and related applications have increased competition in the industry. This has led to innovations within the taxi industry, with applications such as goCatch and Ingogo being used to pre-book taxis. Quality of service has also improved, for example: goCatch banned over 1000 drivers for violating its code of conduct and reduced pick-up times from 15 minutes to 7.5 minutes.

The correlation between the rise of ridesharing applications and the negative effects of it on the taxi industry is not conclusive. Nevertheless, the effects of Machine Learning, in the form of ridesharing applications, has had an overall positive effect for commuters.

**How will this affect you? (300 words) In your daily life, how will this affect you? What will be different for you? How might this affect members of your family or your friends?**

I believe the development of Machine Learning will have a positive effect on all of us.

Many of us have heard of and used ridesharing applications like Uber, and it has greatly improved our commuting experience. Uber has provided a cheaper and faster alternative to taxis. Moreover, Uber has also indirectly improved the quality of taxi service as well. An introduction to the previously monopolised taxi industry has created increased competition between companies, and only further benefits the customer experience (us).

On the same or even greater scale, Machine Learning has made a large impact on the world through the social networking scene.

Widely used applications, such as Facebook, use algorithms for some of their features. When we surf our Newsfeed on Facebook, the content we see can be attributed to algorithms analysing our social media activity and accordingly presenting us with related things. Social media is a huge part of society these days and take up significant portions of some individuals' lives. Apps have effectively become a fundamental part of our lives, and not using it can distance us from popular society.

It can now be seen that Machine Learning is inherently linked to the advancement of technology. Another example of this strong relationship is automation. There's been a recent trend towards full automation in some industries, particularly towards the automotive industry, and can be attributed to technology generally attempting to make things safer, faster, and more efficient. If self-driven cars can successfully implemented into society, its effect can be tremendous; people who don't have driver's licenses will be able to travel more freely, the element of human error will contribute to safer roads, and much more.

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