

# Applications of Machine Learning

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Machine Learning is a subset of the broad field of Artificial Intelligence. It is dealing with the process of making computers “learn” certain patterns in data. After learning is complete, it can then make predictions on new unseen data based on the trends it has observed in the data provided to it while training.

Recent Technological Advancements is huge evidence to show Machine Learning has wide range of Applications and is a field of endless possibilities. Some say Machine Learning is the future. Understanding what Machine Learning is and how to apply it to the real world unlocks the endless possibilities as mentioned earlier. The only real barrier is then humans themselves and how big they can Dream. Having said that, Let us see some applications of machine learning and discuss a few words about them.

## 1. Machine Learning in Healthcare:

From diagnosing diseases to personalized treatment plans, The field of healthcare is a big benefactor when it comes to Machine Learning technologies. ML can aid in Predictive analytics to identify potential health risks allowing for early intervention, Medical imaging where we can analyse MRI and CT scans to detect anomalies and assist in early diagnosis, drug discovery and development processes are also accelerated through the analysis of biological data.

## 2. Machine Learning in Finance:

Imagine there exists an entity, a “black-box” per se, which assists you to make decisions on when to buy or sell certain stocks in the stock market, only the entity is a lot smarter and can guarantee a fixed percentage of scenarios where it would make a certain profit cut and also situations where it, well, loses all your money! Now let's say you give this entity full control of your mini bank account which has your total budget for investing in stocks. The entity is active 24/7, carefully watching the stock market as prices go up and down, and when the moment is just right, the moment where it thinks it is most confident, based on its experience of course, makes a sale or a purchase. What if these transactions were for small amounts of money where even if there was a loss, the loss was so minimal? Can we just imagine how much profits one could make off of this? Well, in modern day reality, the stock market is in fact filled with a ton of these trading bots, one might ask why isn't everybody rich then? The truth is that the entity performs awesomely well only in our hypothesized imagination. There are a lot of factors that come in to play which require detailed analysis and most important factor of the all is the fact that no machine learning model is that perfect.

### 3. Machine Learning in Ecommerce and Retail:

Much of the advertising that we see on the internet these days has a machine learning algorithm hidden behind it. For example, it makes sense to show people who have a broken phone, advertisements of nearest or relevant phone repair centres, or even a new phone! Because a person whose phone is perfectly fine wouldn't be as much interested in buying a new phone. Now the question comes up, how does the internet know that your phone is broken and to show you advertisements for a new phone? In other words, it needs your data to make certain decisions, then where does it get them from exactly? You don't remember telling it that your phone is broken... Why then is there an Ad for a phone in front of you?? You don't know... you only remember mentioning your phone as broken while talking to your friend when you met last time, so you start to wonder.. could it be? That your phone was listening to your conversation and understood that your phone had an issue? This is a whole another issue regarding data security. But the point is that, in order for models to make decisions, it needs data. Machine Learning thrives on data! This is one application of machine learning. Movie Recommendation systems also work on a similar principle, understanding what you like based on your preference data and predicting what your future preferences might be. What if your preferences shift over time? Well, then the prediction algorithm also has to be adapted to fit your new preferences. We really can see that these systems are actually intelligent!

### 4. Machine Learning in Autonomous vehicles:

The automotive industry is undergoing a transformation with the integration of machine learning into traditional vehicles to give rise to Autonomous Vehicles. These machine learning algorithms are designed to mimic the human decision-making process when it comes to driving a car. With the help of cameras and bunch of other sensing technology the cars can interpret and respond to complex traffic situations by making "driving-decisions" all in real-time. Object detection and recognition systems can identify and distinguish between pedestrians, other vehicles, and obstacles. This field is really interesting because it opens up a new set of moral or philosophical questions for us to address. For example, given a situation of a self driving car which is going to crash, ie; an accident is certain to occur, and say that in that situation there are two people who are likely to be affected say, a child and an old grandma. Given this situation, and the fact the self driving car fully understands this scenario, it has to make a decision on which life to sacrifice, which option should it pick? The child or the grandma? The truth is whichever option you pick, moral and legal accusations are almost certain. There are many such scenarios one could imagine which are similar to this situation, those situations that demand serious philosophical and moral reasoning and not just technological designing. This one of many examples that shows that people who learn to apply machine learning or find new applications for it, (The future generation of machine learning folks) have to start thinking morally and philosophically regarding their design choices and their consequences.

## 5. Machine Learning in Manufacturing:

Again, this is one of the industry's that are hugely impacted by the adoption of machine learning, and this is also a classical example. Take an example of an ice cream manufacturing unit. If we list down the operations that go on inside a manufacturing plant, we would come up with various general stages such as Raw material stage, Processing Stage, Moulding stage, Finishing stage, Packaging stage and a Shipping stage. Faults are very common in this area and they usually come with a recovery cost, sometimes the faults can be so devastating that it can lead to entire businesses shutting down. A fault might be in something like the dispensing unit, packaging unit, or maybe the air filtration unit etc. So, A machine learning application can be a system that can detect faults before it even occurs thereby ensuring safety and also saving costs for the company in the long run, at least to a certain degree. Image recognition algorithm can detect product faults in real time thereby ensuring product quality. Machine learning can also be used in a lot of predictive analysis tasks such as predicting demand of a certain product based on received feedback and so on..

## 6. Machine Learning in Agriculture:

The agriculture industry is also being transformed by machine learning. Farmers now make use of advanced sensor technology, satellite imagery and also collect data from other sources about soil health, weather and crop health. By employing predictive modelling, machine learning can forecast crop yields and optimize resource allocation, enabling farmers to make data-driven decisions for improved productivity. This technology helps in minimizing the environmental impact by optimizing the use of water, fertilizers, and pesticides, making agriculture more sustainable. Machine learning models trained on historical data can identify patterns indicative of potential outbreaks. By detecting early signs of crop diseases or pest infestations, farmers can implement targeted measures, reducing the need for pesticides and minimizing environmental impact.

The applications don't end there really, there are a lot other applications like ML in Speech recognition, Natural Language Processing, Speech to Text, Sentiment Analysis, Image Classification, Image Colorization, Weather forecasting, Games, House pricing prediction etc..

I believe, a discussion about the applications of machine learning as such cannot be fit into 3 pages. If it was actually done then it's certain that you missed out on many applications. Because the field is so large and is having endless possibilities, every single day people come up with new creative ways to use machine learning. The world is not how it was ten years ago. The world is changing everyday and who knows what the world will be like in one, two, ten, or twenty years from now? We are really living in a great time, we get a front row seat to witness how the world is going to change

Here's a collection of some common applications of machine learning. (like said earlier, the list is not exhaustive.)

1. **Autonomous Vehicles:** Machine learning is used to make cars drive by themselves by processing real-time data from sensors and making driving decisions.
2. **Healthcare Diagnostics:** ML algorithms analyse medical data, including images and patient records, to assist in disease diagnosis and treatment planning.
3. **Fraud Detection:** In the financial sector, machine learning is employed to detect fraudulent activities by analyzing transaction patterns and identifying anomalies.
4. **Agricultural Crop Monitoring:** ML helps optimize farming practices by analyzing data on soil conditions, weather, and crop health, enabling precision agriculture.
5. **Virtual Personal Assistants:** Applications like Siri or Google Assistant utilize machine learning for natural language processing and personalized user interactions.
6. **Recommendation Systems:** Platforms like Netflix and Amazon use ML to recommend products and content based on user preferences and behavior.
7. **Image and Speech Recognition:** ML is employed in recognizing and understanding images and speech, powering applications like facial recognition and voice assistants.
8. **Chatbots:** ML-driven chatbots provide automated responses in customer service, improving efficiency in handling inquiries and support.
9. **Natural Language Processing (NLP):** ML algorithms are used to understand and process human language, facilitating translation, sentiment analysis, and text summarization.
10. **Predictive Maintenance:** ML predicts when machinery and equipment are likely to fail, allowing for proactive maintenance to minimize downtime.
11. **Energy Consumption Optimization:** ML algorithms analyze energy usage patterns to optimize consumption and improve efficiency in buildings and industrial processes

12. Credit Scoring: In finance, machine learning assesses credit risk by analyzing various factors, improving the accuracy of credit scoring models.

13. Stock Market Prediction: ML models analyze historical data and market trends to predict stock prices and inform investment decisions.

14. Gesture Recognition: ML enables computers to interpret and respond to human gestures, used in applications like virtual reality and gaming.

15. Social Media Content Moderation: ML algorithms identify and filter out inappropriate or harmful content on social media platforms.

16. Robotics: Machine learning is applied in robotics for tasks such as object recognition, navigation, and grasping.

17. Supply Chain Optimization: ML helps optimize supply chain operations by predicting demand, managing inventory, and improving logistics.

18. Employee Recruitment: ML is used in talent acquisition for resume screening, candidate matching, and predicting successful hires.

19. Air Quality Monitoring: ML models analyze data from sensors to predict air quality and provide insights into pollution patterns.

20. Personalized Marketing: ML enables businesses to deliver targeted and personalized marketing campaigns based on customer behavior and preferences.

21. Game Industry: Player Behavior Prediction: In the gaming industry, machine learning is used to predict player behavior and preferences. Game developers analyze vast amounts of player data, including in-game actions, time spent on different levels, and interactions with virtual items.

22. Artistic Style Transfer: Transforming Photos into Artwork: Another fun application of machine learning is artistic style transfer. Using deep neural networks, algorithms can analyze the style of famous artworks and apply those characteristics to ordinary photos.