**Machine Learning in Brief**

Machine Learning is a field of Computer Science that makes computers to learn from experience like human beings or animals. It has evolved from computational learning, pattern recognition and information retrieval. One of the major advantages of machine learning is that the computer can be trained to automate tasks that would be exhaustive or impossible for a human being.

It is a branch of artificial intelligence, deals with the design and development of algorithms that allow computers that can learn from data and predict the data. As intelligence requires knowledge, it is necessary for the computers to acquire knowledge from the empirical data. A machine can be trained to translate the knowledge into features. Those features extracted can be used to develop a model. ML algorithms make data-driven predictions or decisions by building mathematical models from empirical data rather than following a set of predefined program instructions. In traditional programming Program and Input Data determine the output, whereas in Machine Learning the Input data and Output from the past instances determine the program.

Tom M. Mitchell defined Machine Learning as , “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.” [1].

Tens of thousands of machine learning algorithms are available and every year hundreds of new algorithms are being proposed. Every machine learning algorithm has three components called representation, evaluation and optimization. Representation is model space representation and is done in the form of Decision trees, Rule based programs, Bayes/Markov models, Neural networks, Support vector machines and ensemble models. Evaluation is to measure how effective the algorithm is and is done using measures like Mean Square Error, Accuracy , Precision and Recall, Confusion Matrix, Cost, Utility, Entropy, Maximum Likelihood Error, Gini Index and K-L divergence etc. **Optimization**, is how the space of represented model is searched to obtain better evaluation*.*

Machine Learning involves two phases namely Training phase and Test phase. In Training phase the system learns to complete certain tasks like classification or prediction using a given data set containing information of that specific problem. Based on this learning, the system is able to analyze new sample data of same distribution as the trained data and give a prediction. Unfortunately, no method is perfect to solve a particular problem, as it is being dependent on the empirical data.

Machine Learning algorithms are classified into Unsupervised, Supervised and Reinforcement Learning algorithms as shown in Figure 1. Unsupervised Algorithms learn from unlabelled data, Supervised algorithms train from labelled data and Reinforced algorithms use environment information in addition to learning data and can take decisions adaptively.



Machine Learning has applications in various domains like Consumer Goods, Creative Arts, E Commerce, Financial Services, Health Care, Manufacturing, Social Media and Transportation etc., and is expanding into every domain and giving prominent results. The Machine Learning applications include Image Recognition, Speech Recognition, Video Recognition, Fraud Detection, Fault Detection, Disease Prediction, Medical Diagnosing, Sales Prediction, Recommendation Systems, Sentimental Analysis, Information Extraction, Spam Filtering and Chat bots etc.

**Consumer Goods**

 Hello Barbie is a Consumer Good that listens and responds to a child. A microphone on Barbie’s necklace records what is said by the chid and transmits it to the server. At server the recording sent is analyzed to determine the appropriate response and sends the correct response back to Barbie within a second so that she can respond to the child.

**Creative Arts**

In the last few years, Algorithmic music composition has significant impact in the music world. [Music-generating algorithms](https://www.bernardmarr.com/default.asp?contentID=719) generate the theme for lyrics and music automatically based on the inputs like millions of conversations, newspaper headlines and speeches. Machines like IBM Watson BEAT and Google [Magenta](https://magenta.tensorflow.org/) can compose music from different musical elements to inspire composers. It helps musicians understand what their audiences want and compose hit songs.

**E Commerce**

Personalized product search, Search ranking, Product recommendation, Dynamic pricing, Price optimization, Fraud elimination, Demand and Supply prediction are some of the E-commerce application that have significant improvement by using Machine Learning algorithms.

**Finance Services**

Algorithmic Trading, Market Growth & Risk Prediction, Fraud Detection in online payments, Financial Advisory Services are some of the services that the machine learning can aid in the Finance domain.

**Health Care**

Machine learning algorithms can process more information and identify more patterns than humans. [Computer assisted diagnosis (CAD)](http://www.cancernetwork.com/articles/computer-technology-helps-radiologists-spot-overlooked-small-breast-cancers) helps to identify and predict cancer from mammography scans of women in medical diagnosis. Machine learning algorithms can also be used to understand risk factors for disease in large populations and predictions of diabetes, liver diseases, Heart attacks and Parkinson’s disease etc. Machine Learning is now a day’s widely used in Drug Discovery and Manufacturing, Robotic Surgery and Personalized Medication.

**Manufacturing**

**Today in manufacturing industry Asset Management, Supply Chain Management, Product Demand forecasting and Inventory Management are the areas that are adopting machine learning and hence reduce the losses. Manufacturer’s adoption of machine learning and analytics also improves predictive maintenance.**

**Social Media**

In this era, social media has become an integral part of interacting with businesses, influencers or customers. Machine Learning is used to reach new clients or nurture existing business relationships. **Glean Insights from Images, understanding customer voice, product recommendation,** to identify trending topics, hash tags and patterns to understand user behaviour from millions of unstructured user comments, to provide online activity and demographics are some of the applications of Machine Learning algorithms in social media analysis.

**Transportation**

Machine learning applications are used for autonomous vehicles, Traffic Congestion Identification and Prediction, Object detection and traffic sign recognition, Predictive analytics for smart public transport, Passenger and Vehicle safety monitoring, efficient carpooling and ride sharing etc.

## References and useful Blogs:

## Machine Learning, [Tom Mitchell](http://www.cs.cmu.edu/~tom), McGraw Hill, 1997.

## DataScienceCentral.com

## LeadingIndia.AI

## GoogleAI: https://ai.google

## Artificial Intelligence & Deep Learning Public Group:www.facebook.com/groups/DeepNetGroup