

## A Survey: Concepts Of Machine Learning And Its Applications

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### Abstract

*In today's world there are many fields which are generating electronic data. The electronic data contains useful information to predict the future. As the size is very large, it is a difficult for humans to perform predicting manually. To solve the problem, with the help of training and test datasets, we train a machine it can predict the future by itself. Machine learning a process in which we teach a computer system how to make accurate predictions when data is given. To train the machine, various kinds of machine learning algorithms and tools are available. This paper focus on the survey of the few machine learning applications and concept which are used in many disciplines and domains in detail.*

**Keywords:** Machine Learning, Accuracy, Datasets, Training.

### I. Introduction

In the past two decades Machine Learning has become one of the important concept of information technology. As the amount of data is increasing and data is becoming available, the good reason is to believe that data analysis will become even more pervasive as a necessary ingredient for technological progress. Machine learning can appear in many. We will discuss the applications, and different types of data they deal with. The latter is key if we want to avoid reinventing the wheel for every new application. Instead, much of the art of machine learning is to reduce a range of fairly disparate problems to a set of fairly narrow prototypes. Much of the science of machine learning is then to solve those problems and provide good guarantees for the solutions.

Machine learning is an application of computer science (AI) that gives systems the power to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the event of computer programs that may access data and use it learn for themselves. The process of learning begins with observations or data, like examples, direct experience, or instruction, so as to appear for patterns in data and make better decisions within the future supported the examples that we offer. the first aim is to permit the computers learn automatically without human intervention or assistance and adjust actions accordingly.

But, using the classic algorithms of machine learning, text is taken into account as a sequence of keywords; instead, an approach supported semantic analysis mimics the human ability to grasp the meaning of a text.

### Evolution Of Machine Learning

As new computing technologies are emerging, machine learning today is not like the previors. Machine Learning came into existence from pattern recognition and the theory that computers can learn to perform specific tasks without being programmed; researchers of artificial intelligence wanted to see if computers could learn from data. The computational aspect of

machine learning is important because the models are exposed to new data, they are able to independently adapt. They learn from previous computations to produce reliable, repeatable decisions and result.

### **How Machines Learn**

The components of learning process. The learning process can be divided into four components, whether by a human or a machine. They are data storage, abstraction, generalization and evaluation. The various components and the steps involved in the learning process.

### **COMPONENTS OF LEARNING PROCESS**

#### **1. Data Storage**

Processes for storing and retrieving large amounts of data which are an important component of the learning process. For advanced reasoning humans and computers utilize data storage as a foundation. For human beings, the data is stored in the brain and using electrochemical signals the data is retrieved. To store and retrieve data in computers we use hard disk drives, flash memory, random access memory and similar device.

#### **2. Abstraction**

The second component in the learning process is called as abstraction. It is the process of extracting information about stored data. It involves creating general concepts about the data as a whole. The creation of knowledge includes application of known models and creation of new models. The process of fitting a model to a dataset is known as training. When a model has been trained, the data is transformed into an abstract form that outline the original information.

#### **3. Generalization**

Generalization is the third component in the learning process. The word generalization gives a detail about the method of turning the knowledge about stored data into a form which will be utilized for future work. These work is to be administrated on tasks that are similar, but not identical, to those what are seen before. In generalization, the goal is to find those properties of the information that may be most relevant to future tasks.

#### **4. Evaluation**

This is that the last component of the evaluation process. It is the method of giving feedback to the user to live the utility of the learned knowledge. This feedback is then utilised to effect improvements within the whole learning process.

### **II . Machine Learning**

While designing a machine (a software system), the programmer always incorporates a specific purpose in mind. For instance, consider J. K. Rowling's Harry Potter Series and Robert Galbraith's Cormoran Strike Series. To substantiate the claim that it absolutely was indeed Rowling who had written those books under the name Galbraith, two experts were engaged by The London Sunday Times and using Forensic Machine Learning they were ready to prove that the claim was true. They develop a machine learning algorithm and "trained" it with Rowling's in addition as other writers writing examples to seek and learn the underlying patterns and so "test" the books by Galbraith. The algorithm concluded that Rowling's and Galbraith's writing matched the foremost in several aspects. So rather than designing an algorithm to handle the matter directly, using Machine Learning, a researcher seek an approach through which the machine, i.e., the algorithm will come up with its own solution supported the instance or training data set provided there to initially.

Whereas Computer Science concentrate on manually programming computers, ML addresses the problem of getting computers to re-program themselves whenever exposed to

new data based on some initial learning strategies provided. On the other hand, Statistics focuses on data inference and probability, Machine Learning includes additional concerns about the feasibility and effectiveness of architectures and algorithms to process those data, compounding several learning tasks into a compact one and performance measures. Machine Learning was the exceptional outcome when applied science and Statistics joined forces. Computer Science computing focuses on building machines that solve particular problems, and tries to spot if problems are solvable at all. the most approach that Statistics fundamentally employs is data inference, modelling hypotheses and measuring reliability of the conclusions.

The idea for defining Machine Learning is little different but partially dependent on both nonetheless. Whereas Computer Science concentrate on manually programming computers, ML addresses the problem of getting computers to re-program themselves whenever exposed to new data based on some initial learning strategies provided. On the other side , Statistics concentrates on data inference and probability, Machine Learning includes additional concerns about the feasibility and effectiveness of architectures and algorithms to process those data, compounding several learning tasks into a compact one and performance measures.

### **Machine Learning And Human Learning**

Machine Learning is about study of human and animal brain in Neuroscience, Psychology, and related fields. The researchers proposed that how a machine could learn from experience likely wouldn't be significantly different than how an animal or a personality's mind learn with time and skill. However, the research focused on solving machine learning problems using learning methods of human brain failed to yield much promising result up to now than the researches concerned with statistical- computational approach. This could be thanks to the very fact that human or psychology remains not fully understandable thus far. no matter these difficulties, collaboration between human learning and machine learning is increasing for machine learning is getting used to elucidate several learning techniques seeing in human or animals. for instance, machine learning method of temporal difference was proposed to elucidate neural signals in animal learning. it's fairly expected that this collaboration is to grow considerably in coming years.

### **Data Mining**

Data mining is called as Knowledge Discovery Process is a field of science that is used to find out the properties of datasets. Large sets of data collected from RDMS or data warehouses or complex datasets like time series, spatial, etc are mined to take out interesting correlations and patterns among the data items. Data mining uses techniques developed by machine learning for predicting the outcome.

### **Artificial Intelligence**

Artificial Intelligence is a branch of science which deals with the creation of intelligent machines. These machines are called intelligent as they have their own thinking and decision-making capabilities like human beings. Artificial Intelligence, Machine learning, and Data mining are frequently used altogether in today's world. These words are highly inter-related to each other and sometimes are used interchangeably.

### **Artificial Intelligence And Machine Learning**

A large area of Artificial Intelligence is Machine Learning. From this, we refer that AI uses machine learning algorithms for its brilliant behavior. Computer is said to learn from some task if the error frequently decreases and if it matches the performance as desired. Machine learning will study algorithms that will perform the task of extraction automatically. Machine learning comes from statistics but it is not actually. Similar to AI, machine learning also has a very broad scope.

### **III . MACHINE LEARNING: TYPES OF ALGORITHMS**

A number of Machine Learning algorithms have designed and introduced over previous years. All of them are not popularly known. Some algorithms did not satisfy nor gave solution to the problems, so some other algorithms were introduced in its place. Here the algorithms that are categorized into two and those two groups are further sub-divided. In this, will try to mention most popular ML algorithms and compares three most widely used ML algorithms.

#### **Supervised Machine Learning**

Input data or training data has a pre-determined label. Previous data is used to make predictions in supervised machine learning. Supervised machine learning is used in the spam filtering of emails. As everyone is using Gmail, Yahoo, or Outlook. Machine learning algorithms are used for finding whether the email is spam or not. Depending on the past data like received emails, data that we use etc., the system makes predictions about an email as for whether it is a spam or not. These predictions may not be perfect, but they are accurate most of the times. The relation between the input and the output variable is known. The machine learning algorithms will predict the outcome on the input data which will be compared with the expected outcome. A function or a classifier is built and trained to predict the label of test data.

#### **Unsupervised Machine Learning**

Unsupervised learning does not rely on trained data sets to predict the outcomes but it uses direct techniques such as clustering and association in order to predict outcomes. Trained data sets mean the input for which the output is known. Input data or training data is not labelled. A classifier is designed by deducing existing patterns or cluster in the training datasets.

#### **Reinforcement Learning**

The algorithm is trained to make a sequence of decisions. It is about taking action in a particular situation to maximize the reward. The classifier is not programmed directly to choose the action, but instead trained to discover the most rewarding actions by trial and error.

#### **Transduction**

It refers to study in the fields like statistical theory to refer to predicting specific examples given specific examples from a domain. Transduction, deriving the values of the unknown function for points of interest from the given data. Even though it shares similar characteristic with supervise learning, but it does not develop a clearly developed classifier. It attempts to forecast the output based on training inputs, and test inputs.

#### **Learning To Learn**

The classifier is made to learn from the bias it induced during past stages. It is necessary and efficient to organise the ML algorithms with respect to learning methods when one need to consider the significance of the training data and choose the classification rule that provide the greater level of accuracy.

### **IV. ALGORITHMS GROUPED BY SIMILARITY**

#### **1. Regression Algorithm**

Regression analysis is part of predictive analytics and exploits the co-relation between output variable (target) and continuous variable. The notable regression models are: Linear Regression, Logistic Regression, Polynomial Regression, Ridge Regression, Stepwise Regression, Ordinary Least Squares Regression (OLSR), Multivariate, etc.

#### **2. Instance-Based Algorithm**

It is also called as memory-based learning algorithms do not create an abstraction from

particular instances. Instead they store the data and at query time derive an answer from examination of the query. Every time a new problem or example is arised, it will exam in accordance with the stored instances in order to determine or forecast the target function value. It can simply replace a stored instance by a new one if that is a good fit than the former. Because of this, they are also known as winner-take-all method.

Examples: K-Nearest Neighbour (KNN), Learning Vector Quantisation (LVQ), Self-Organising Map (SOM), Locally Weighted Learning (LWL) etc.

### **3.Regularization**

Regularization is the simple and most important concept in the world of Machine Learning. Regularisation is a technique which is used to decrease the errors by fitting the function on the given training set and avoid overfitting.

Examples: Ridge Regression, Least-Angle Regression (LARS) Least Absolute Shrinkage and Selection Operator (LASSO), Elastic Net, etc.

### **4.Decision Tree Algorithms**

A decision tree is a tree structured classifier with nodes representing the place where we take an attribute and ask a query; edges show the answers to the query; and the leaves represent the outcome or class label. We call decision tree because, it is similar to a tree, it begins with the root node, which expands on further branches and constructs a tree-like structure. It can be very useful for solving decision-related problems.

Examples: Classification and Regression Tree (CART), C4.5 and C5.0, Chi-squared Automatic Interaction Detection (CHAID), Iterative Dichotomiser 3 (ID3) Decision Stump, M5, Conditional Decision Trees etc.

### **5.Bayesian Algorithms**

A set of Machine Learning algorithms employ Bayes' Theorem to solve classification and regression problems.

Examples: Naive Bayes, Gaussian Naive Bayes, Multinomial Naive Bayes, Averaged One-Dependence Estimators (AODE), Bayesian Belief Network (BBN), Bayesian Network (BN) etc.

### **6.Support Vector Machine (SVM)**

A SVM model is generally a representation of seperate classes in a hyperplane in multidimensional space. A support vector machine takes the data points and outputs the hyperplane (which in two dimensions it's simply a line) that better separates the tags. The line is the decision boundary. The hyperplane will be produced in an repeated manner by SVM, the error can be minimized. The aim of SVM is to split the datasets into classes to find a highest marginal hyperplane (MMH).

Example are Based on the kernel in use, SVM can perform both linear and nonlinear classification.

### **7.Clustering Algorithms**

It is the assignment of a group of observations into subsets (called clusters) so that observations in the same cluster are similar in some manner.

Examples: K-Means, K-Medians, Affinity Propagation, Ward hierarchical clustering, Spectral Clustering, Agglomerative clustering. DBSCAN, Gaussian Mixtures, Birch, Mean Shift, Expectation Maximisation (EM) etc.

### **8.Association Rule Learning Algorithms**

It checks for the dependency of one data item on another data item and maps accordingly so that it can be more profitable. It tries to find some interesting relations or associations among the variables of dataset. It is based on different rules to discover the interesting relations between variables in the database.

Examples: Apriori algorithm, Eclat algorithm etc.

### **9.Artificial Neural Network (ANN) Algorithms**

Artificial Neural Network is a branch of Artificial Intelligence concerned with simulating neurons and applying them to perform learning tasks and representing knowledge.

Examples: Perceptron, Back- Propagation, Hop-field Network, Radial Basis Function Network (RBFN) etc.

### **10.Deep Learning Algorithms**

The ability to process large numbers of features makes deep learning very powerful when dealing with unstructured data. Deep learning uses self-taught learning and algorithm constructs with many hidden layers, big data, and powerful computational resources. The algorithmic framework is called the neural network, while the hidden layers in the network give it the moniker of deep learning.

Examples: Deep Boltzmann Machine (DBM), Deep Belief Networks (DBN), Convolutional Neural Network (CNN), Stacked Auto-Encoders etc.

### **11.Dimensionality Reduction Algorithms**

Dimensionality reduction refers to techniques for reducing the number of input variables in training data.

Examples: Principal Component Analysis (PCA), Principal Component Regression (PCR), Partial Least Squares Regression (PLSR), Sammon Mapping, Multidimensional Scaling (MDS), Projection Pursuit, Linear Discriminant Analysis (LDA), Mixture Discriminant Analysis (MDA), Quadratic Discriminant Analysis (QDA), Flexible Discriminant Analysis (FDA) etc.

### **12.Ensemble Algorithms**

Ensembles can give us a boost in accuracy on the dataset. Ensemble learning is a form of hybrid learning system in which multiple analytics are mixed brilliantly with the purpose of obtaining good (more accurate, more robust, etc.) results than a single analytics can provide. These methods are meta-algorithms that combine several machine learning techniques into one predictive model in order to reduce variance, bias, or improve predictions. Examples: Boosting, Bootstrapped Aggregation (Bagging), AdaBoost, Stacked Generalisation (blending), Gradient Boosting Machines (GBM), Gradient Boosted Regression Trees (GBRT), Random Forest, Extremely Randomised Trees etc.

## **V. APPLICATIONS**

Machine Learning is becoming mandatory in real-life applications. Until 1985, there was no remarkable commercial ML applications.

### **A.Web Search**

Search engines provide users with Internet resources – links to web sites, documents, text snippets, images, videos, etc. In reply to questions. They utilize techniques which are section of the area of information retrieval, and depend on statistical and pattern matching methods. Search engines have to get into account various key features and requirements of this particular instance of the information retrieval problem. First, they have to be able to process hundreds of millions of searches a day and answer queries in a matter of milliseconds. Then resources on the WWW are updated stably, with information being frequently added, removed or changed – the overall contents changing by up to 8% a week – in a pool consisting of billions of documents, the users specifies possibly semantically difficult queries in a language with limited expressive power, and often not make use or proper use of available syntactic features of that language.

### **B.Speech Recognition**

When we use Google, we see a option "Search by voice" it comes under speech recognition, and it's a famous application of machine learning. Speech recognition is a The process of converting voice instructions into text, and it is also known as "Speech to text", or "Computer speech recognition." Now a days, machine learning algorithms are popularly used in different applications of speech recognition. Google assistant, Siri, Cortana, and Alexa these are using speech recognition technology to follow the voice instructions.

### **C. Medical Diagnosis**

In different medical domains, ML provides methods, techniques, and tools that can help in solving diagnostic and prognostic problems. For the analysis of the importance of clinical attributes and of their combinations for prognosis it is being used, E.g. Forecasting of disease progression, for extracting the medical knowledge for outcome research, ML is used to detect deadly diseases (e.g. cancer) based on the symptoms of patients and correspond them with the previous data of similar kind of patients.

### **D. Fraud Prevention**

In many cases, daily transactions are high in volume and data. It makes difficult for humans to analyzing each transaction physically, then how to observe if a transaction is fraudulent. To address this issue, AI-based systems are designed, it will follow what type of transactions are fraudulent. Some Corporations are using neural networks to decide fraudulent transactions depending on certain factors like the latest frequency of transactions, transaction length and kind of agents included.

### **E. Computer Vision**

In recent vision systems, e.g., facial recognition softwares, systems capable of automatic classification microscopic pictures of cells, employ machine learning approaches for good response. For example, A computer vision system with a handwriting analyser, trained to arrange letters with handwritten addresses automatically with an response level as high as 85%.

### **F. Robot Or Automated Control**

The cars that can drive themselves without a human pilot. Automated systems use machine learning to see their surroundings, make sense of them and forecast how others behave. With so many shifting variables on the road, an advanced machine learning system is crucial to success. Google developed self driving cars.

### **Popular Machine Learning Software Tools**

Scikit Learn: Scikit-learn is for machine learning development in python. It provides a library for the Python programming language.

PyTorch is a Torch based, Python machine learning library. The torch is a Lua based computing framework, scripting language, and machine learning library.

TensorFlow provides a JavaScript library which helps in machine learning. APIs will help you to build and train the models.

Shogun Shogun provides various algorithms and data structures for machine learning. These machine learning libraries are used for research and education.

Apache Mahout Apache Mahout helps mathematicians, statisticians, and data scientists for executing their algorithms.

Keras is an API for neural networks. It helps in doing quick research and is written in Python.

Accors.Net Accord.Net provides machine learning libraries for image and audio processing.

Rapid Miner provides a platform for machine learning, deep learning, data preparation, text mining, and predictive analytics. It can be used for research, education and application development.

## VI. FUTURE SCOPE

In Machine learning research field that has took attention of many intelligent minds and it has the possible to reveal further. But the three most important future sub-problems are chosen to be discussed here. The highly developed AI can only learn as effectively as the training it receives; machine learning systems require large amounts of data to be trained. In the future, machine learning systems may require less data to “learn,” resulting in systems that can learn much quicker with significantly smaller data sets.

The important problems with quick scientific advancement is that, we close up them with leaps for granted. Few applications of machine learning discussed above may have unthinkable as a decade ago, and which scientists and researchers are progressing is nothing short of unbelievable.

## VII. CONCLUSION

Machine learning and artificial intelligence have changed our life by making it easier, we have discussed different applications here, it also allows us to take business decisions, optimize operations and augment productivity for industries to stand out in the market.

Corporations enter the AI production (including retail, logistics and transportation) will get advantage from the expand capability and unlocked potential of machine learning. Development of a software to solve perception tasks using sensors, like speech recognition, computer vision etc. Anyone can easily label an image by using a letter by the alphabet it denotes, but to make an algorithm to perform this task is hard.

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