GETTING STARTED WITH

MACHINE LEARNING

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BY ALTAF SHAIKH

# Getting Started With Machine Learning
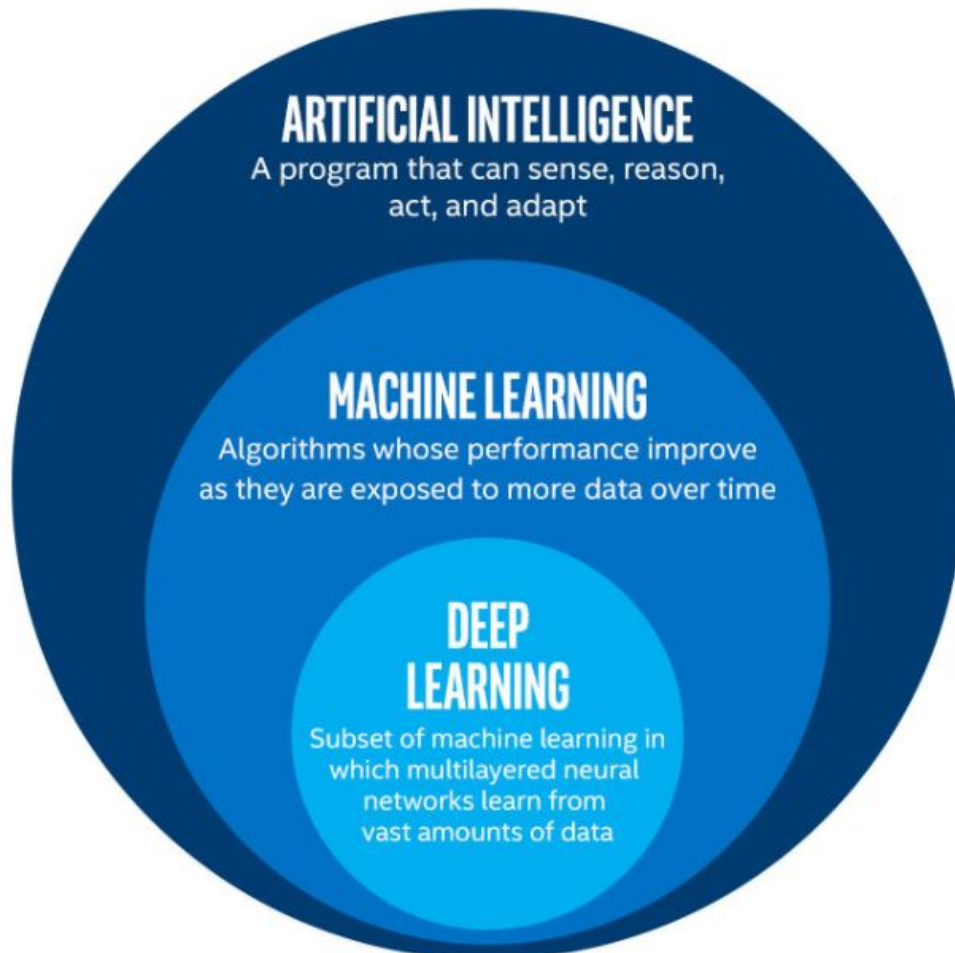
What is Artificial Intelligence?
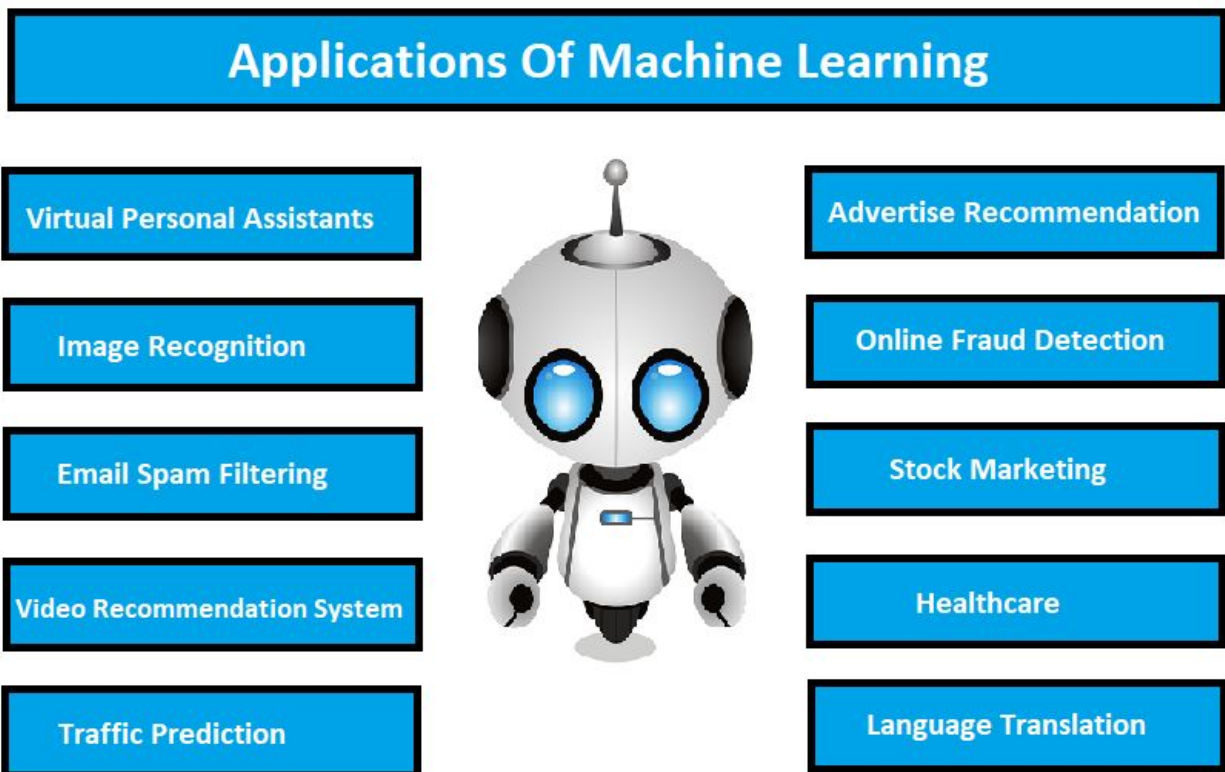
According to the father of Artificial Intelligence, John McCarthy, it is "The science and engineering of making intelligent machines, especially intelligent computer programs". Artificial Intelligence is a way of making a computer, a computer-controlled robot, or a software think intelligently, in the similar manner the intelligent humans think.
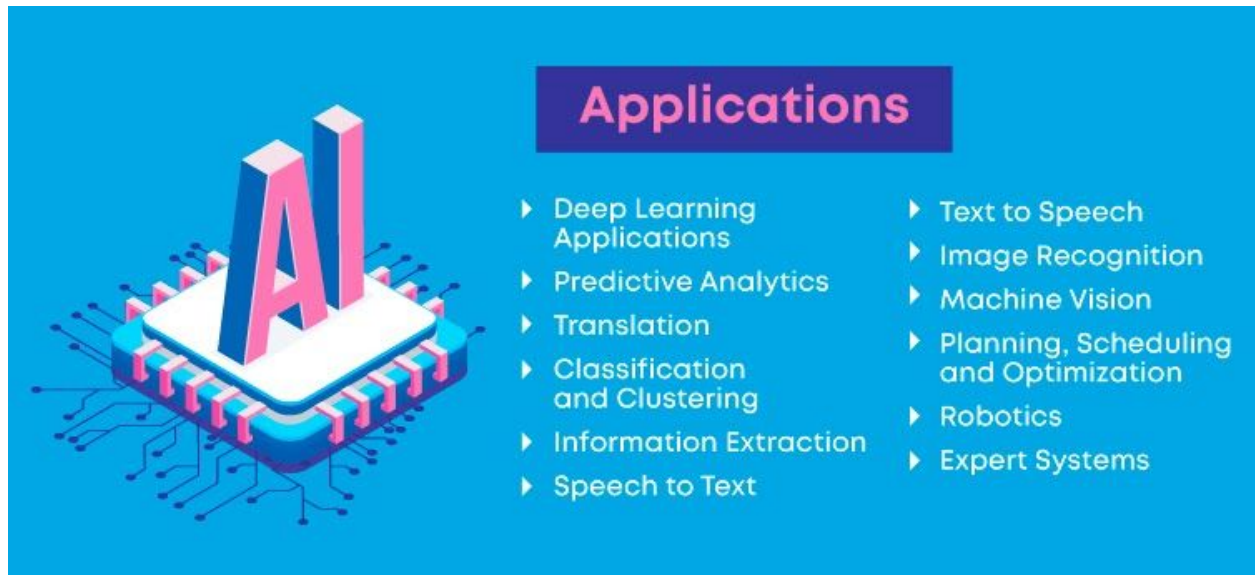
What is **Machine Learning?**
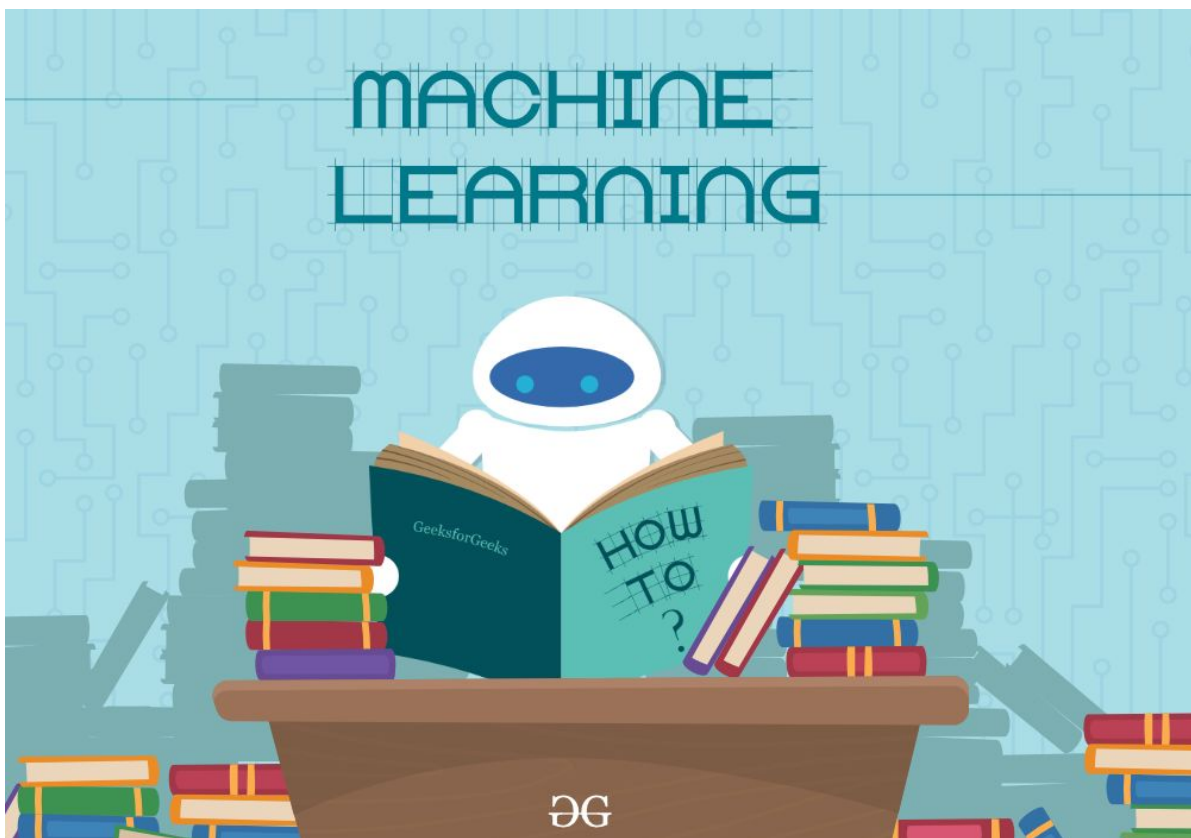
Machine Learning (ML) is basically that field of computer science with the help of which computer systems can provide sense to data in much the same way as human beings do. In simple words, ML is a type of artificial intelligence that extracts patterns out of raw data by using an algorithm or method. The key focus of ML is to allow computer systems to learn from experience without being explicitly programmed or human intervention.

Applications Of Machine Learning

- Virtual Personal Assistants
- Image Recognition
- Email Spam Filtering
- Video Recommendation System
- Traffic Prediction
- Advertise Recommendation
- Online Fraud Detection
- Stock Marketing
- Healthcare
- Language Translation

What is Deep Learning?

"Deep Learning is a subfield of machine learning concerned with algorithms inspired by the structure and function of the brain called artificial neural networks".

It's a particular kind of machine learning that is inspired by the functionality of our brain cells called neurons which lead to the concept of artificial neural network(ANN). ANN is modeled using layers of artificial neurons or computational units to receive input and apply an activation function along with threshold.
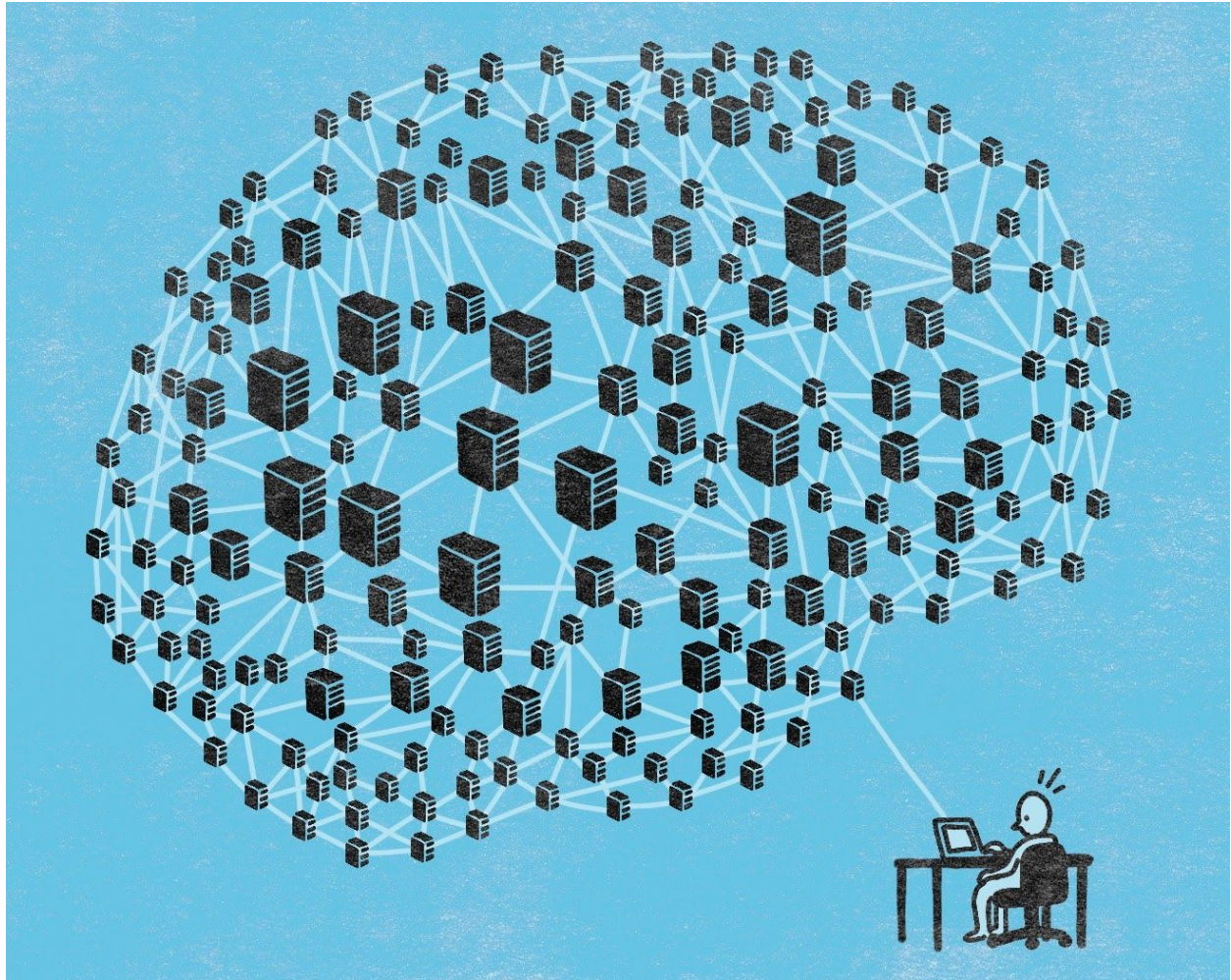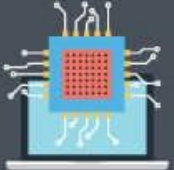
Source: Allison Linn, Microsoft

Here's a short list of general tasks that deep learning can perform in real situations:
1. Identify faces (or more generally image categorization)
2. Read handwritten digits and texts
3. Recognize speech (no more transcribing interviews yourself)
4. Translate languages
5. Play computer games
6. Control self-driving cars (and other types of robots)

From Where to Start?

TYPES OF AI

Inspired by the study of pattern recognition, machine learning enables software algorithms that are self-teaching and can make predictions about data.

MACHINE LEARNING

Taking cues from biological neural networks like the human nervous system, artificial neural networks process a large number of novel and unique inputs, collecting and rationalising it into 'knowledge'. ANNs are perfect for the big data world with its myriad file and data types.

NERUAL NETWORKS

After synthesising inputs of all types, deep learning is the next step. Just like you can carry out a complex abstract task (like making coffee) from countless one-off inputs, deep learning tries to model high-level abstractions about what a given set of inputs might combine to do.

DEEP LEARNING

Machine Learning

Machine Learning vs. Traditional Programming

Traditional programming differs significantly from machine learning. In traditional programming, a programmer codes all the rules in consultation with an expert in the industry for which software is being developed. Each rule is based on a logical foundation; the machine will execute an output following the logical statement. When the system grows complex, more rules need to be written. It can quickly become unsustainable to maintain.

Rules

Data → Computer → Output

Traditional Programming
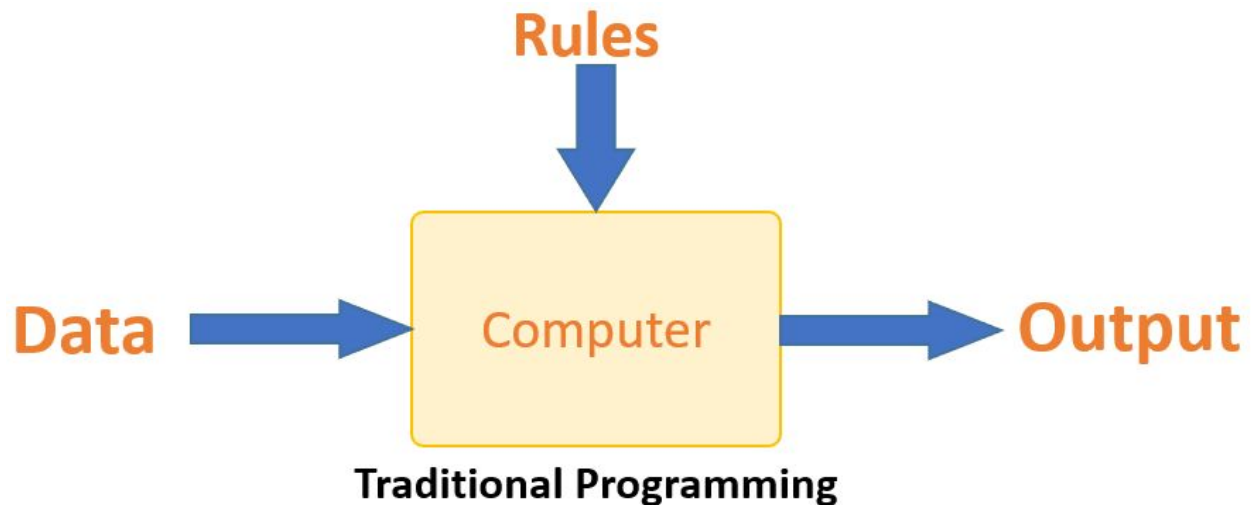
Machine learning is supposed to overcome this issue. The machine learns how the input and output data are correlated and it writes a rule. The programmers do not need to write new rules each time there is new data. The algorithms adapt in response to new data and experiences to improve efficacy over time.

Data →
Output → Computer → Rules
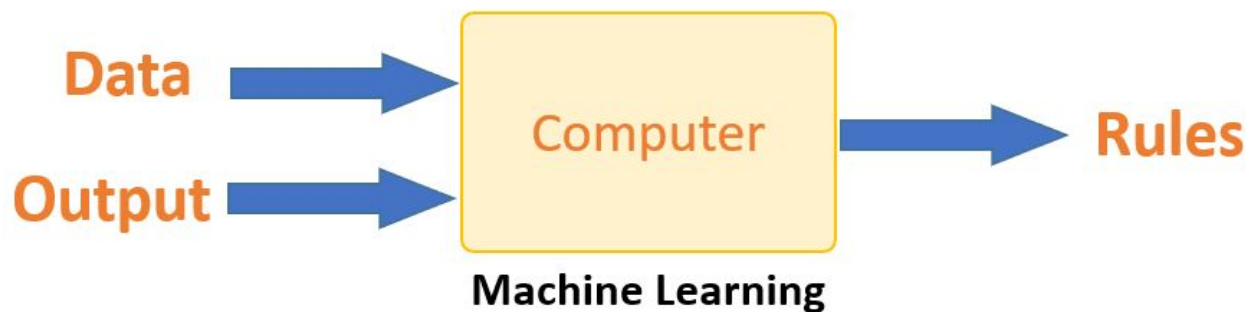
Machine Learning

How does Machine learning work?

Machine learning is the brain where all the learning takes place. The way the machine learns is similar to the human being. Humans learn from experience. The more we know, the more easily we can predict. By analogy, when we face an unknown situation, the likelihood of success is lower than the known situation. Machines are trained the same. To make an accurate prediction, the machine sees an example. When we give the machine a similar example, it can figure out the outcome. However, like a human, if its feeds a previously unseen example, the machine has difficulties to predict.

The core objective of machine learning is the learning and inference. First of all, the machine learns through the discovery of patterns. This discovery is made thanks to the data. One crucial part of the data scientist is to choose carefully which data to provide to the machine. The list of

attributes used to solve a problem is called a feature vector. You can think of a feature vector as a subset of data that is used to tackle a problem.

The machine uses some fancy algorithms to simplify the reality and transform this discovery into a model. Therefore, the learning stage is used to describe the data and summarize it into a model.

Learning Phase

Training data → Features vector → Algorithm → Model
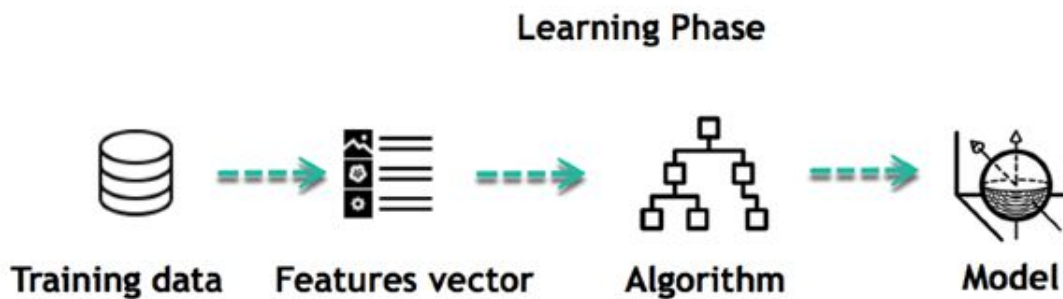
For instance, the machine is trying to understand the relationship between the wage of an individual and the likelihood to go to a fancy restaurant. It turns out the machine finds a positive relationship between wage and going to a high-end restaurant: This is the model

Inferring

When the model is built, it is possible to test how powerful it is on never-seen-before data. The new data are transformed into a features vector, go through the model and give a prediction. This is all the beautiful part of machine learning. There is no need to update the rules or train again the model. You can use the model previously trained to make inference on new data.

Inference from Model

Test data → Features vector → Model → Prediction
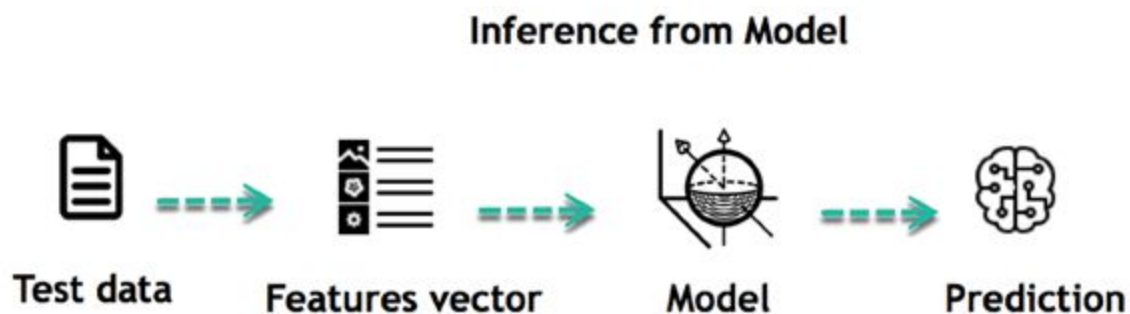
The life of Machine Learning programs is straightforward and can be summarized in the following points:

1. Define a question
2. Collect data

3. Visualize data
4. Train algorithm
5. Test the Algorithm
6. Collect feedback
7. Refine the algorithm
8. Loop 4-7 until the results are satisfying
9. Use the model to make a prediction

Once the algorithm gets good at drawing the right conclusions, it applies that knowledge to new sets of data.

Types of Machine Learning

Machine learning is sub-categorized to three types:
- Supervised Learning – Train Me!
- Unsupervised Learning – I am self sufficient in learning
- Reinforcement Learning – My life My rules! (Hit & Trial)
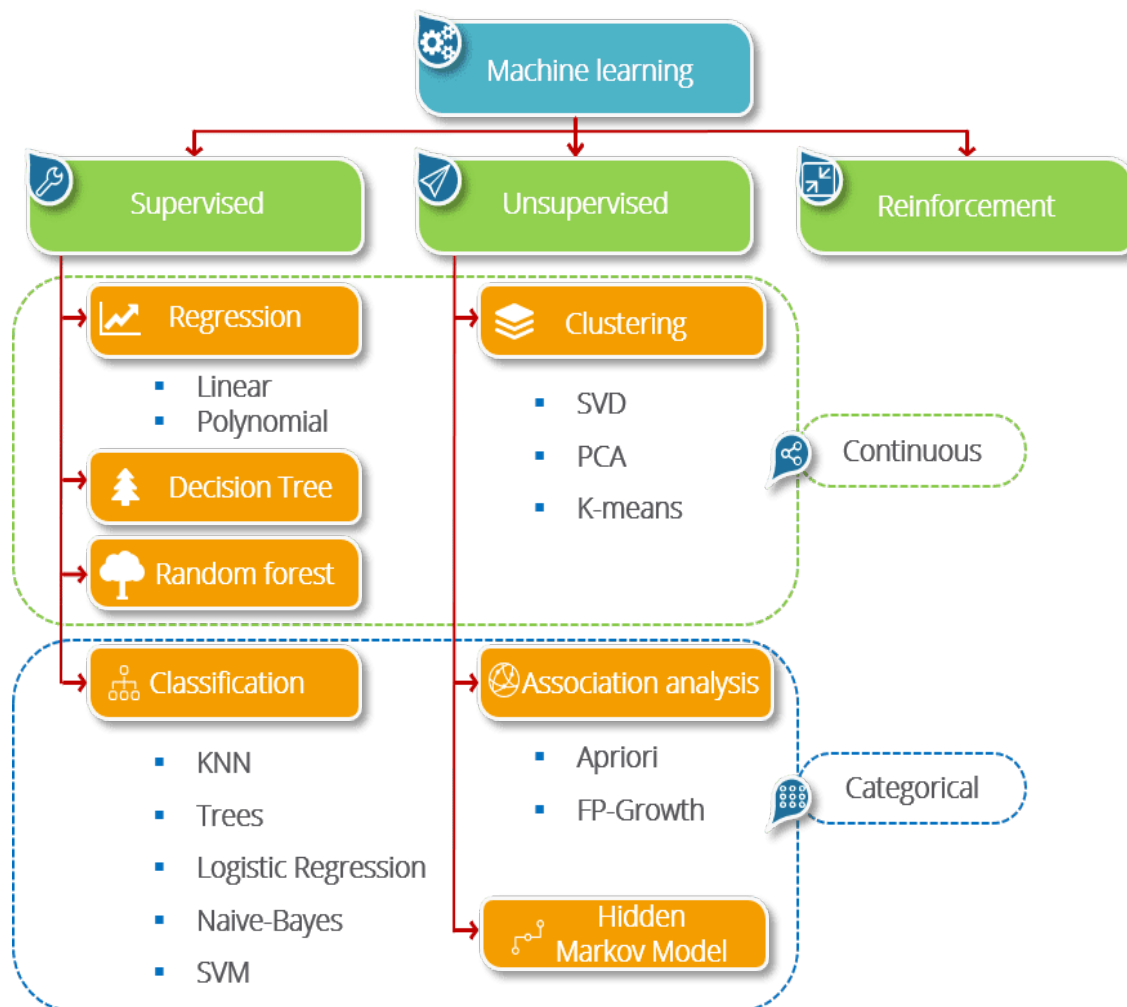
Languages used in machine learning:

1. Python

Python dominates the scene when it comes to ML languages, and it's not going away anytime soon. Python's strength lies in the fact that it's very adaptable. Plus, its syntax is incredibly simple, making it a beginner- friendly language. Python also has amazing libraries like NumPy, SciPy, Matplotlib, Pandas, TensorFlow and Scikit-learn that make scientific computing very easy. It's no wonder then that 57% of machine learning engineers use Python and 33% prioritize it for development.

Python libraries that used in Machine Learning are:

- Numpy
- Scipy
- Scikit-learn
- seaborn
- TensorFlow
- Keras
- PyTorch
- Pandas
- Matplotlib

2. R – Programming

R was designed explicitly for statistics and data visualisation. This is partly why it has become so popular in data science and machine learning. R has an active open source community that keeps the language fresh and updated. Plus, R is free to download which makes it a much better option than the far more expensive alternatives like SAS and Matlab. R has a few GNU bundles that make it a great language for Machine Learning. It's not only easy to create Machine Learning algorithms using R, but you can also create statistical visualisation of those algorithms with R studio.

Libraries:
- Data Visualization
    - DataExplorer
    - esquisse
- Machine Learning
    - MLR
    - parsnip
    - Ranger
    - purrr

3. JavaScript

Surprisingly enough, the ubiquitous JavaScript makes it to this list at number 3. JavaScript has gone from being a language that was used primarily in web development to one that is being used across the board. JavaScript has managed to make significant inroads into Machine Learning with TensorFlow.js. TensorFlow.js is an open source library that uses JavaScript to build machine learning models entirely in the browser. TensorFlow.js is a great way for JavaScript developers to begin learning ML.

Libraries:
1. Brain.js
2. ConvNetJS
3. Deeplearn.js
4. Mind
5. Neuro.js
6. Synaptic
7. TensorFlow.js
8. WebDNN

5. C#

While C# is not an obvious choice when it comes to machine learning languages, developers who come from a .NET background have often yearned to be able to delve into data science and machine learning. Luckily, with **ML.NET,** they can now use C# to experiment with Machine Learning. ML.NET is a machine learning framework for .NET which is open-source and cross-platform.

6. Java

Java continues to be one of the most popular programming languages in the world. Many large companies use Java to develop their desktop apps and backend systems. While it's not a particularly popular language for Machine Learning, it does have a great Machine Learning framework called **Weka**. Similar to Python's Scikit-learn, Weka is great for more traditional machine learning and data mining. This includes things like Regression, Decision Trees, Feed Forward Neural Networks, Support Vector Machines, and Naive Bayes.

Libraries:
1. ADAMS
2. Deeplearning4j
3. ELKI
4. JavaML
5. JSAT
6. Mahout
7. MALLET
8. Massive Online Analysis
9. RapidMiner
10. Weka

Useful Sites:

Google Colaboratory:
https://colab.research.google.com/

Kaggle:
https://www.kaggle.com/

Towards Data Science
https://towardsdatascience.com/

Join Tensorflow Community:
Mumbai: https://www.meetup.com/en-AU/tfugmumbai/

Projects:
1. Iris Flowers Classification ML Project– Learn about Supervised Machine Learning Algorithms
2. BigMart Sales Prediction ML Project – Learn about Unsupervised Machine Learning Algorithms
3. Social Media Sentiment Analysis using Twitter Dataset
4. Learn to build Recommender Systems with Movielens Dataset
5. MNIST Handwritten Digit Classification
6. Sales Forecasting with Walmart
7. Stock Price Predictions
8. Human Activity Recognition with Smartphones
9. Predicting the Survival of Titanic Passengers
10. Classifying Cats vs Dogs with a Convolutional Neural Network on Kaggle
11. Fashion MNIST with Keras and Deep Learning
12. Twitter Sentiment Analysis Detect hate/racist speech in tweets Plotting WorldCloud for hate words Plot the graph for hate/racist tweets and non-racist/hate tweets Using extracting features from cleaned tweets- Bag-of-Words/TF-IDF

Resources:

1. Andrew Ng's coursera.org/learn/machine-learning
2. Michael Nielsen's Neural Networks and Deep Learning
3. Geoffrey Hinton's Neural Networks for Machine Learning
4. Goodfellow, Bengio, & Courville's Deep Learning
5. Ian Trask's Grokking Deep Learning,
6. Francois Chollet's Deep Learning with Python
7. Udacity's Deep Learning Nanodegree (not free but high quality)
8. Udemy's Deep Learning A-Z ($10–$15)
9. Stanford's [CS231n](CS231n) and [CS224n](CS224n)
10. Siraj Raval's YouTube channel
11. Sentdex's YouTube Channel

References:

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Thank You