

Machine Learning

Introduction

Introduction to Machine learning

- Machine learning is an application of artificial intelligence that involves algorithms and data that automatically analyse and make decision by itself without human intervention. It describes how computer perform tasks on their own by previous experiences. Therefore we can say in machine language artificial intelligence is generated on the basis of experience.

Why Machine Learning?

- According to a recent study, machine learning algorithms are expected to replace 25% of the jobs across the world, in the next 10 years.
- With the rapid growth of big data and availability of programming tools like Python and R – machine learning is gaining mainstream presence for data scientists.
- Machine learning applications are highly automated and self-modifying which continue to improve over time with minimal human intervention as they learn with more data.

Types of Machine Learning

- There are three types of machine learning
- Supervised learning
- Unsupervised learning
- Reinforcement learning

Supervised Machine Learning Algorithms

Machine learning algorithms that make predictions on given set of samples. Supervised machine learning algorithm searches for patterns within the value labels assigned to data points.

Cont..

- Supervised learning is a technique where the program is given labelled input data and the expected output data. It gets the data from training data containing sets of examples. They generate two kinds of results.
- **Classification:** Predicts which class a given sample of data (sample of descriptive features) is part of (**discrete value**).
- **Regression:** Predicts continuous values.

Unsupervised Machine Learning Algorithms

There are no labels associated with data points. These machine learning algorithms organize the data into a group of clusters to describe its structure and make complex data look simple and organized for analysis.

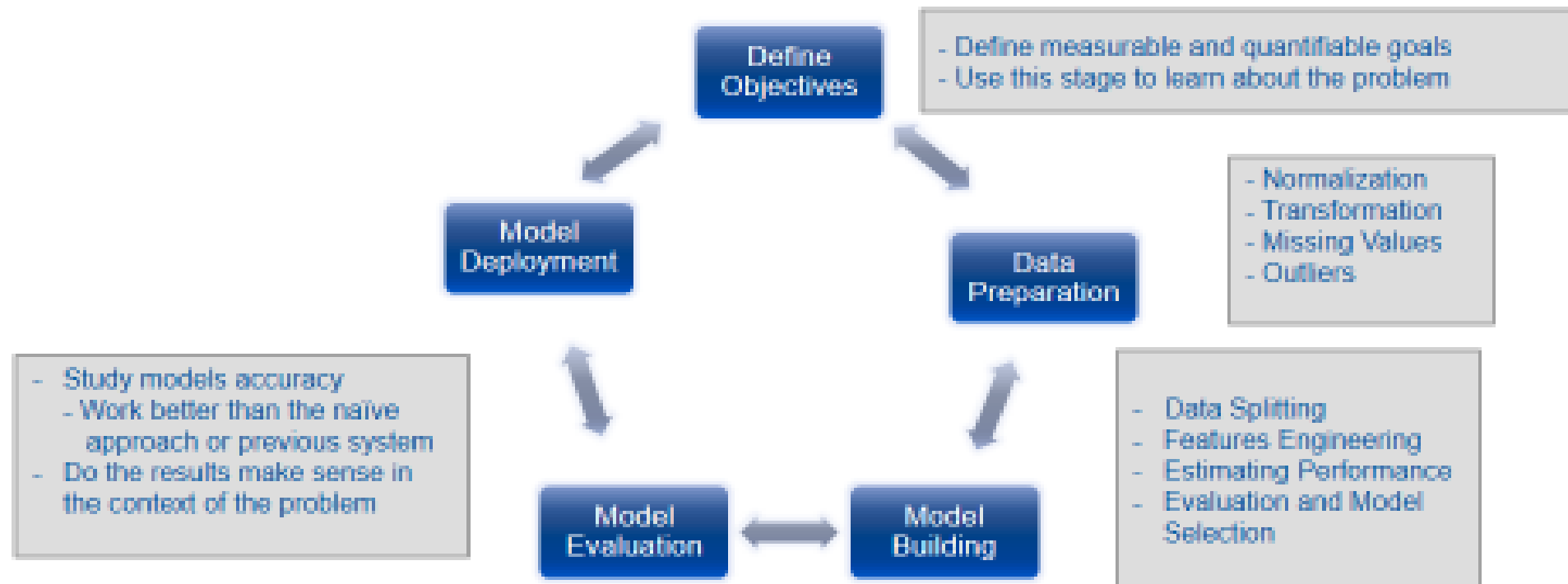
Unsupervised Cont..

- This type of algorithm consists of input data without labelled response. There will not be any pre existing labels and human intervention is also less. It is mostly used in exploratory analysis as it can automatically identify the structure in data.
 - There are not predefined and known set of outcomes
 - Look for hidden patterns and relations in the data
 - A typical example: Clustering

Reinforcement Learning

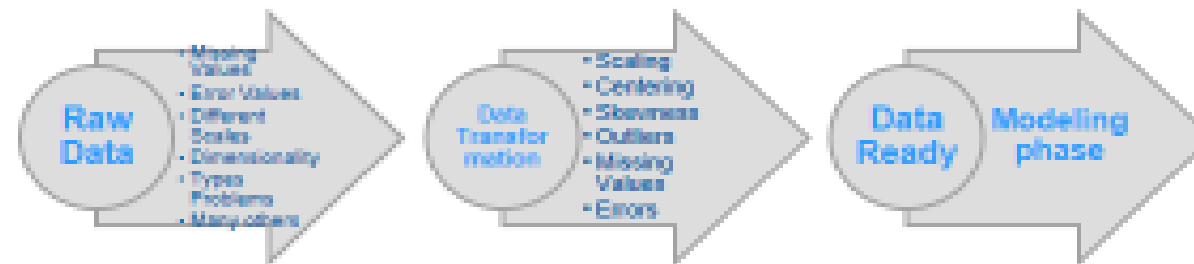
- This model is used in making a sequence of decisions. It is an learning by interacting with the environment. It is based on the observation that intelligent agents tend to repeat the action that are rewarded for and refrain from action that are punished for. It can be said that it is an trail and error method in finding the best outcome based on experience.

Machine Learning as a Process



ML as a Process: Data Preparation

- Needed for several reasons
 - Some Models have strict data requirements
 - Scale of the data, data point intervals, etc
 - Some characteristics of the data may impact dramatically on the model performance
- Time on data preparation should not be underestimated



ML as a Process: Feature engineering

- Determine the predictors (features) to be used is one of the most critical questions
- Some times we need to add predictors
- Reduce Number:
 - Fewer predictors more interpretable model and less costly
 - Most of the models are affected by high dimensionality, specially for non-informative predictors



- Binning predictors

ML as a Process: Model Building

- Data Splitting
 - Allocate data to different tasks
 - model training
 - performance evaluation
 - Define Training, Validation and Test sets
- Feature Selection (Review the decision made previously)
- Estimating Performance
 - Visualization of results – discovery interesting areas of the problem space
 - Statistics and performance measures
- Evaluation and Model selection
 - The 'no free lunch' theorem no a priori assumptions can be made
 - Avoid use of favorite models if NEEDED



Machine Learning Uses:

- Traffic prediction
- Virtual Personal Assistant
- Speech recognition
- Email spam and malware filtering
- Bioinformatics
- Natural language processing

Real Time Examples for Machine Learning

- **Traffic prediction:**
- By using GPS navigation service our location are saved at the central server for managing traffic. Based on the number of gps tracked at the location traffic at the particular Street is identified.
- **Email spam filtering:**
- There are number of approaches clients use. These filters are continuously updated and powered by machine learning.
- **Product Recommendation:**
- In online shopping while we search for a product all its relevant products are displayed in our screen . It is based on the technique of machine learning.

Best Programming Languages for Machine Learning:

- Python,
- java,
- C,
- C++,
- R,
- JavaScript,
- Scala,
- Shell,
- Julia

Advantages of ML

- Fast, Accurate, Efficient.
- Automation of most applications.
- Wide range of real life applications.
- Enhanced cyber security and spam detection.
- No human Intervention is needed.
- Handling multi dimensional data.

Some of the machine learning algorithms are:

- Neural Networks
- Random Forests
- Decision trees
- Genetic algorithm
- Radial basis function
- Sigmoid