Machine Learning

Session 1

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Agenda

- Introduction to ML
- Installation and Setup
- Introduction to Python Libraries and hands on sessions.
- Linear Regression

What is *Machine Learning?*

"A field of study that gives computers the ability to learn without being explicitly programmed" - Arthur Samuel

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves.

Top uses cases in *Machine Learning*

Top 10 Use Cases for Data Science & Machine Learning

HEALTHCARE:
Patient Diagnosis

FINANCE:
Fraud Detection

MANUFACTURING:
Anomaly Detection

RETAIL:
Inventory Optimization

GOVERNMENT:
Smarter Services

TRANSPORTATION:
Demand Forecasting

NETWORKS:
Intrusion Detection

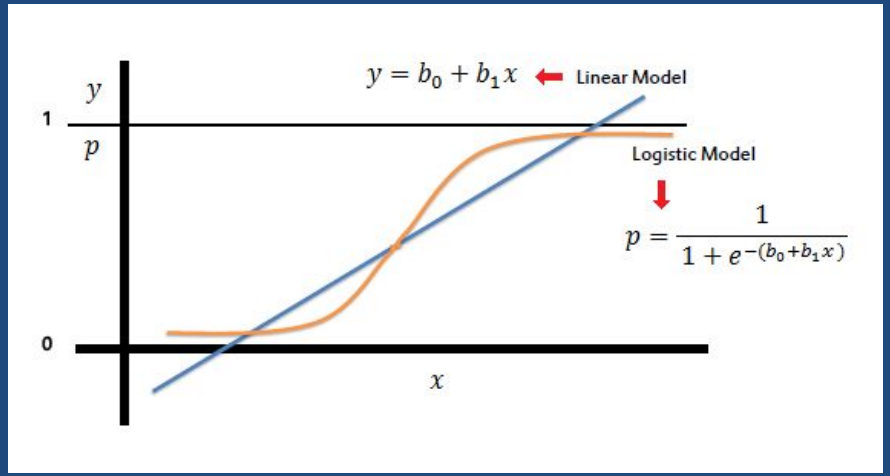
E-COMMERCE:
Recommender Systems

MEDIA:
Interaction & Speed

EDUCATION:
Research Insight

Machine Learning involves ....

Statistics
High Level Algebra
Probability
Calculus



All these subject domains have been in vogue for a long time...but why is ML gaining traction now?

Machine Learning ...

Some key innovations/disruptions in the last decade

Exponential Growth of Big Data
High Computational Power
Cloud Systems and Elasticity
Reduced Computational Costs
Availability of GPU's (Graphical Processing Units)
Available from NVidia and Google (TPU)

Key ML Algorithms

Decision Trees: Useful for Credit Card Application processing.
Naive Bayes: Probabilistic Classifier
Linear Regression: Predict Sales volume next year
Logistic Regression: Binomial Outcome. Credit Scoring.
Support Vector Machines : Binary Classification Algorithm
Clustering: Grouping a set of Objects.

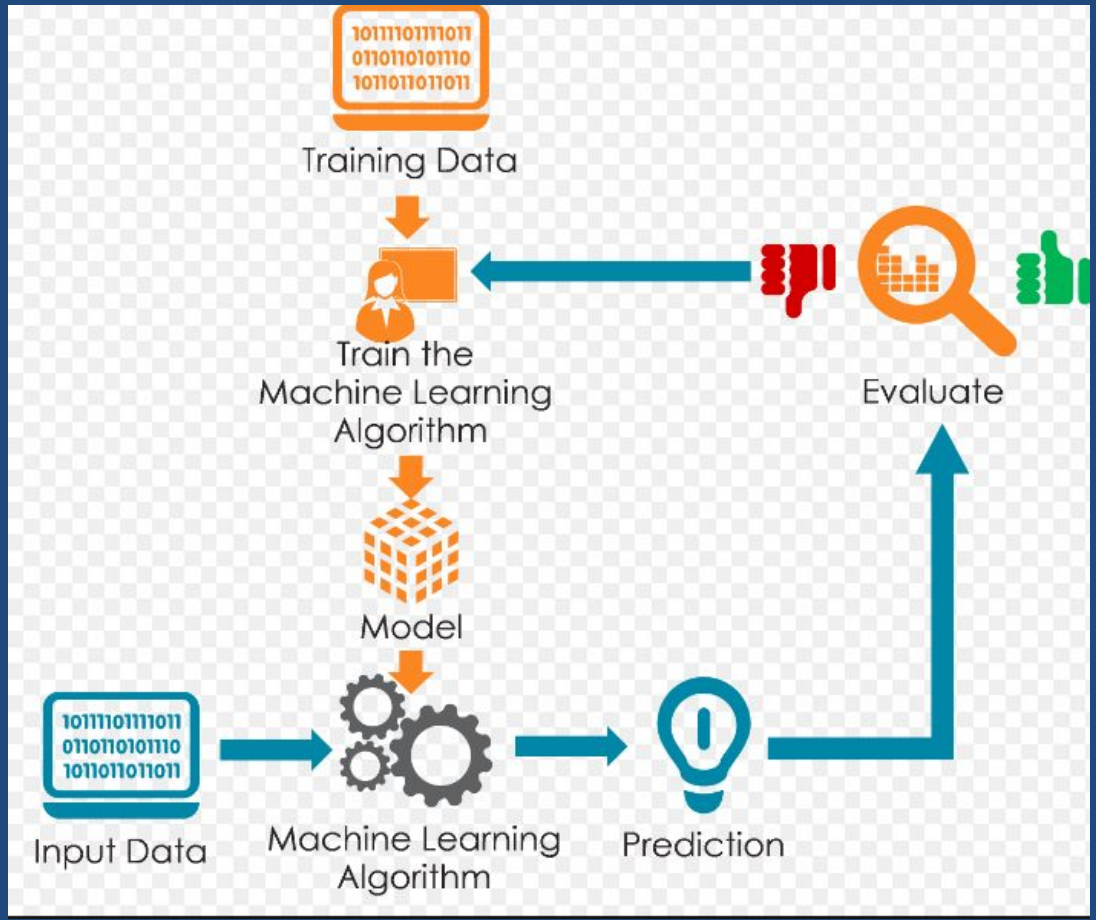
Key ML Libraries

SciPy: SciPy is an ecosystem of Python libraries for mathematics, science and engineering. It is an add-on to Python that you will need for machine learning.

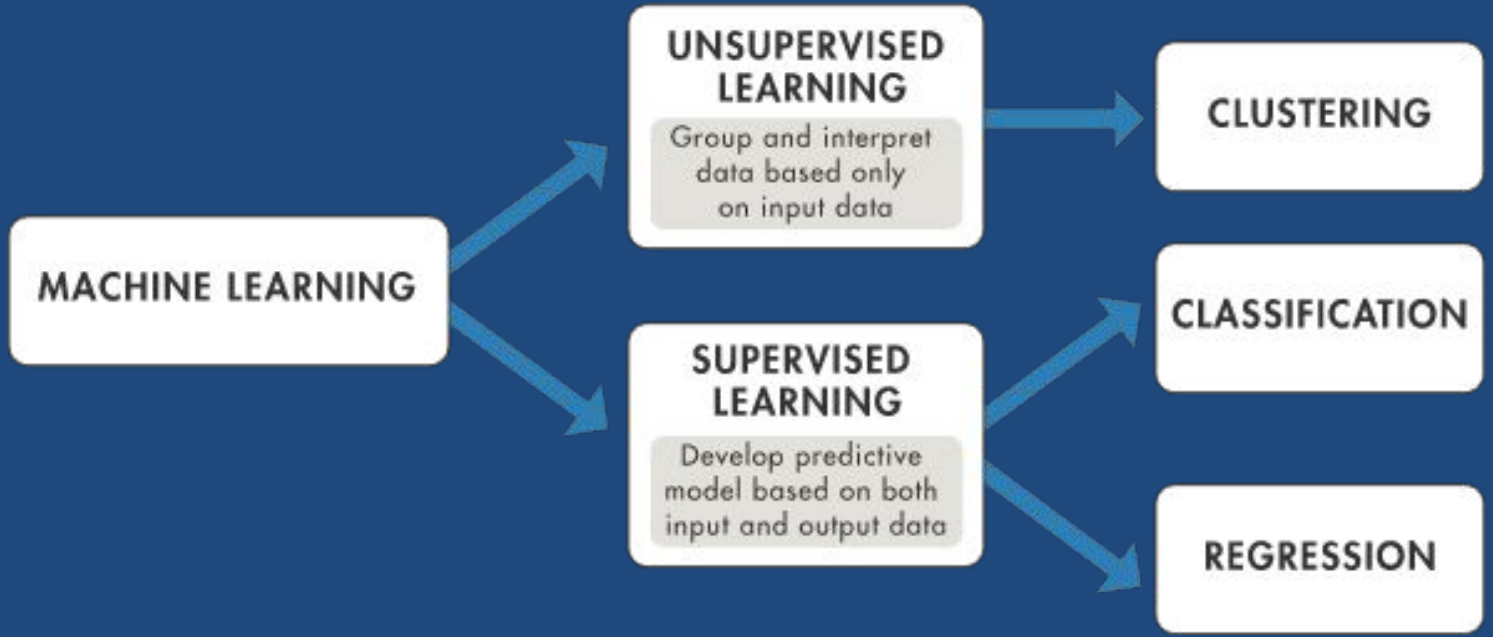
- **NumPy :** Numerical Python Libraries with efficient implementation of multi-dimensional Array. Fast and efficient.
- **MathPlotLib:** Plotting data in Graphs
- **Pandas :** Efficient manipulating and processing of Data

SciKit-Learn: Algorithm implementations , pre and post processing of data.

So how do you do ML?



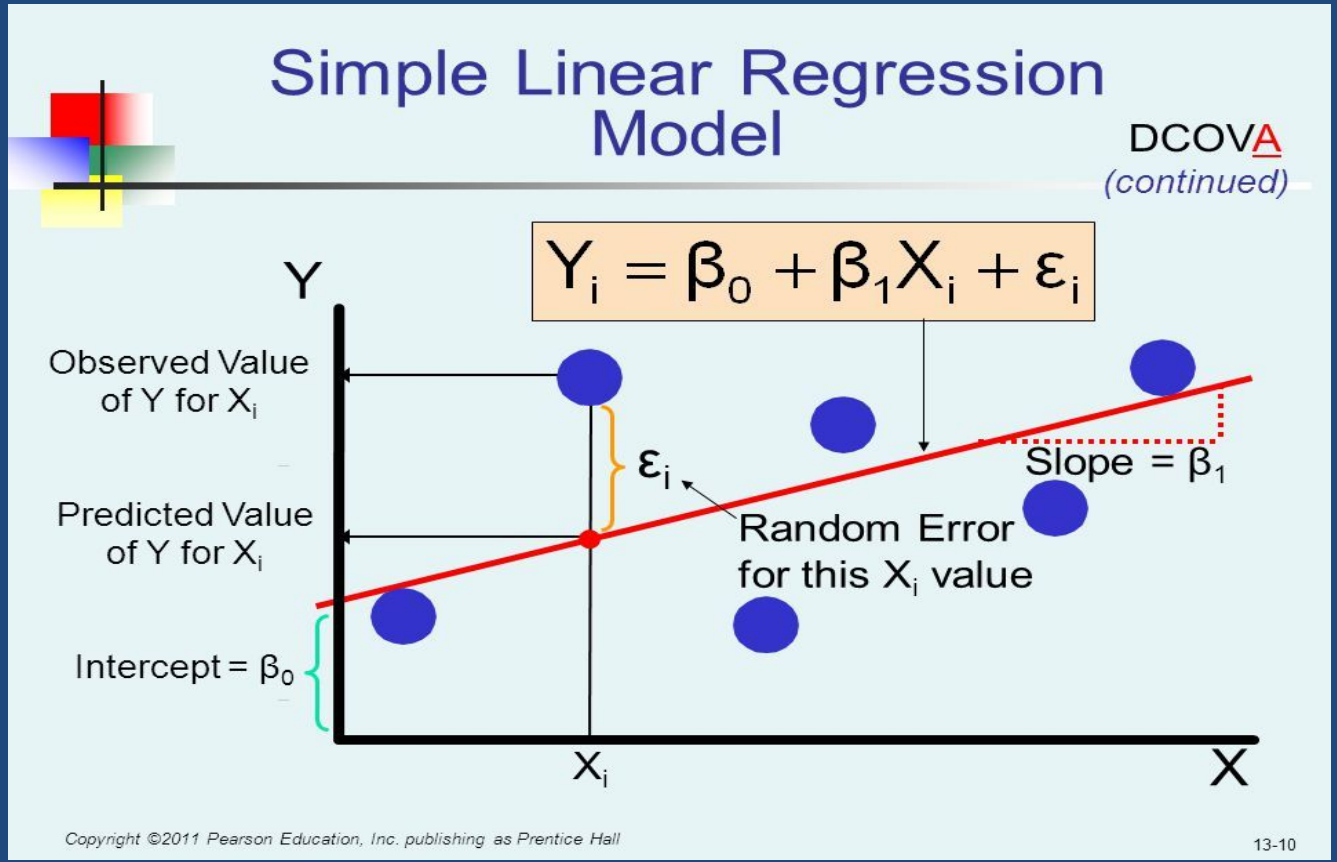
Techniques in ML



Simple Linear Regression

Simple linear regression is a statistical /machine learning method that allows us to summarize and study relationships between two continuous (quantitative) variables. Linear regression attempts to model the relationship between two variables by fitting a linear equation to observed data. One variable is considered to be an explanatory variable, and the other is considered to be a dependent variable.

Simple Linear Regression



Multiple Linear Regression

Multiple Regression Model

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots + \beta_{p-1} X_{i,p-1} + \varepsilon_i$$

- Y_i is the value of the response variable for the i^{th} case
- β_0 is the intercept
- $\beta_1, \beta_2, \ldots, \beta_{p-1}$ are the regression coefficients for the explanatory variables