Crafted by :

Raudhoh Fitra H.

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Intro to Machine Learning

Introduction to Machine Learning

Supervised and Unsupervised Algorithm

Linear Regression Algorithm

Cost Function

Gradient Descent

Learning Objective

To have a basic understanding of how machine learning works, the various algorithms and evaluation metrics used

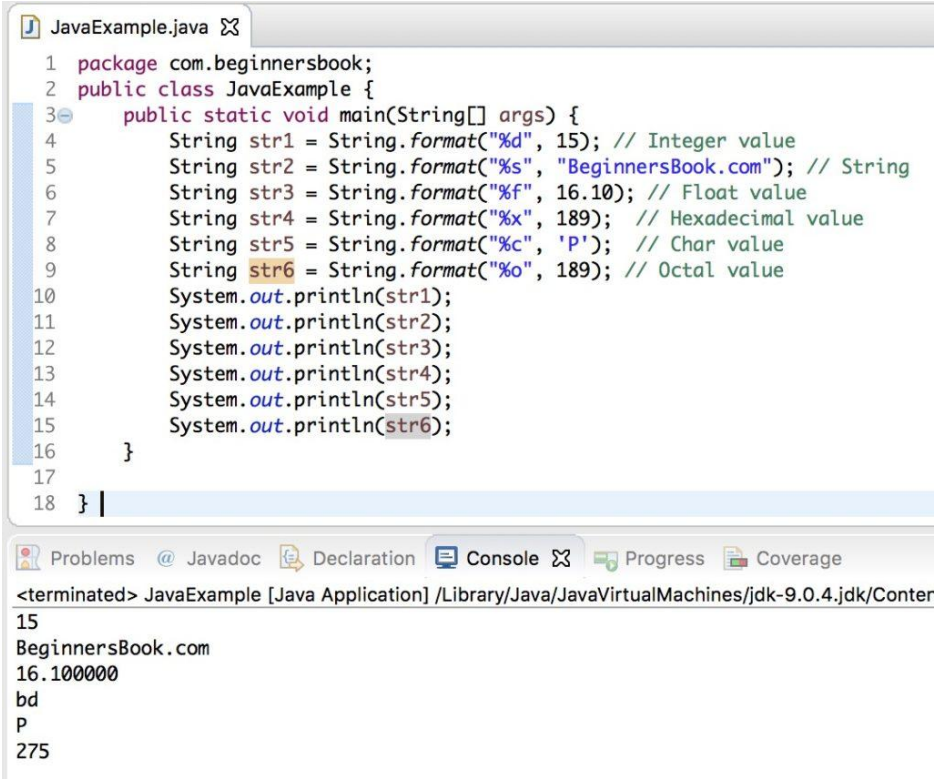
Prerequisite

Jupyter notebook + Python 3.7 installed
Notebook

What is Machine Learning?

“The ability of machine to do certain task performed by human without being explicitly programmed to do that task.”

What machine does



Machine is explicitly programmed to do things.

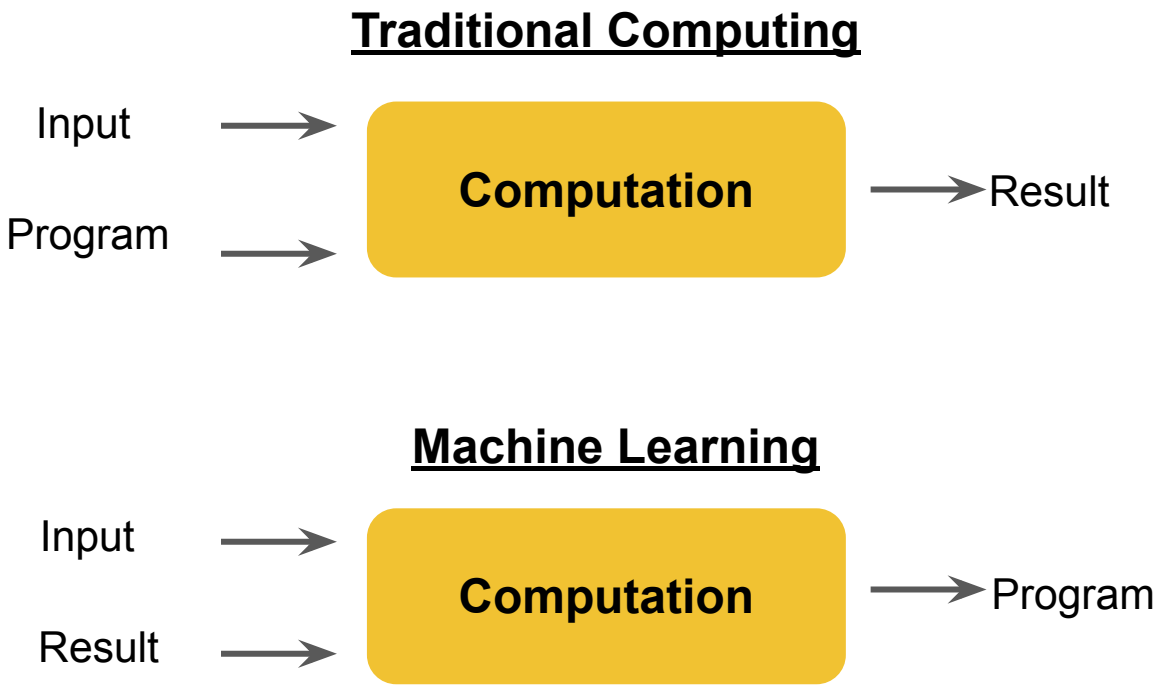
While human has intelligence to learn things

The ability of machine to learn like human does, is ….

Machine Learning

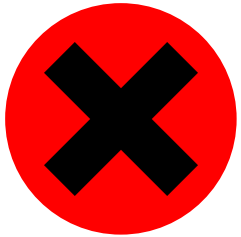
This is how machine do that

Machine Learning vs Traditional Computing



Machine learning and non-Machine Learning case

1. Predicting house price
2. Sentiment analysis
3. Segmenting customer based on buying behavior
4. Credit scoring
5. Spam filtering

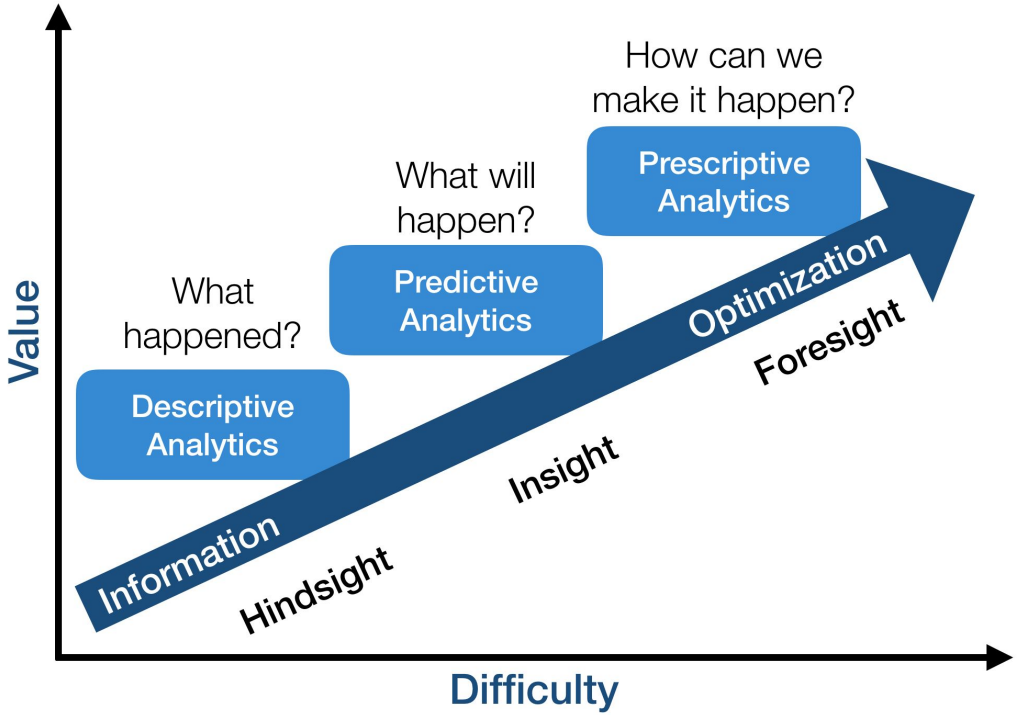


1. Get the average height of students in a class
2. No-reply email

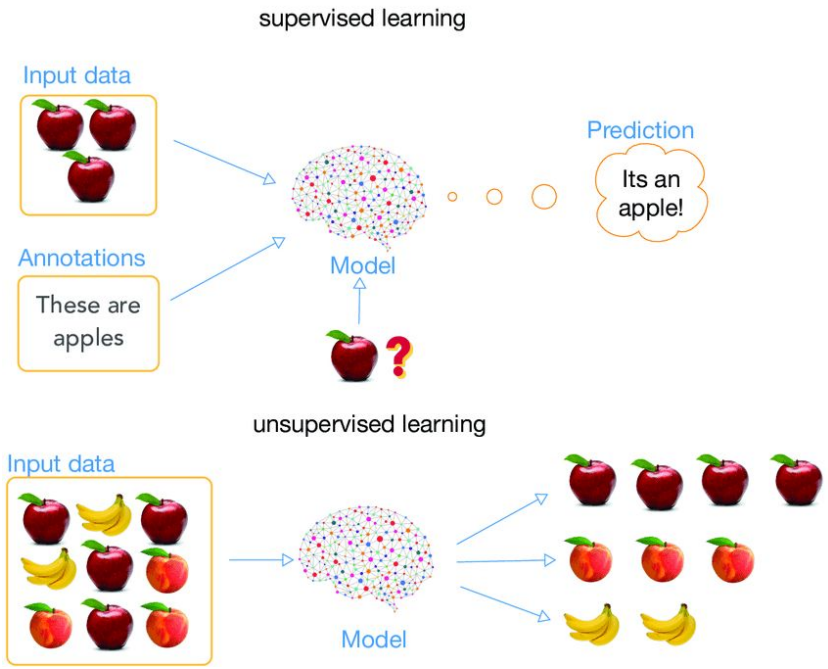
Benefits of Machine Learning

- Real-time decision-making process
- Improve effectiveness and efficiency
- Help marketing Strategy
- Improve the precision of financial rules
- Improve security

Descriptive, Predictive and Prescriptive Analytics



Machine Learning Algorithms



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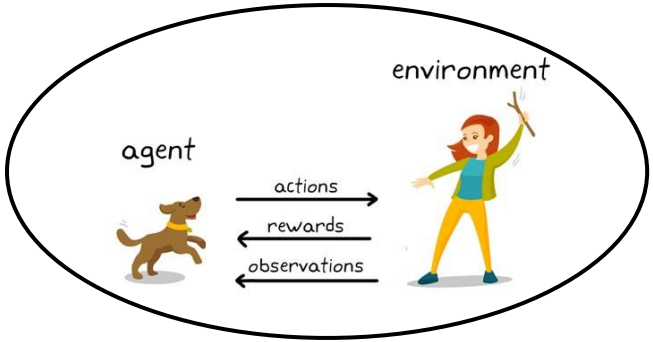
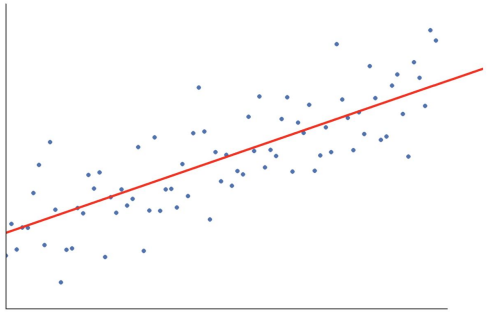
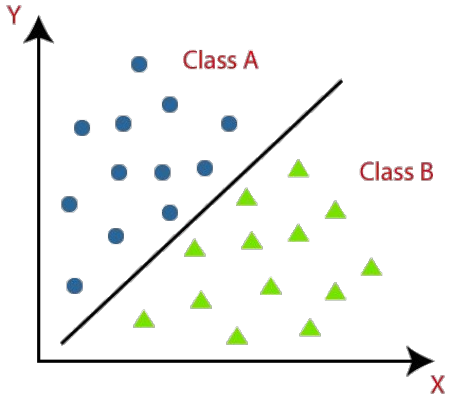
Reinforcement Learning



Supervised Learning

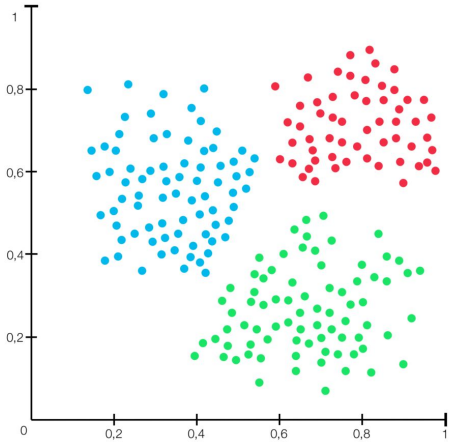
Regression + Classification





Unsupervised Learning

Clustering

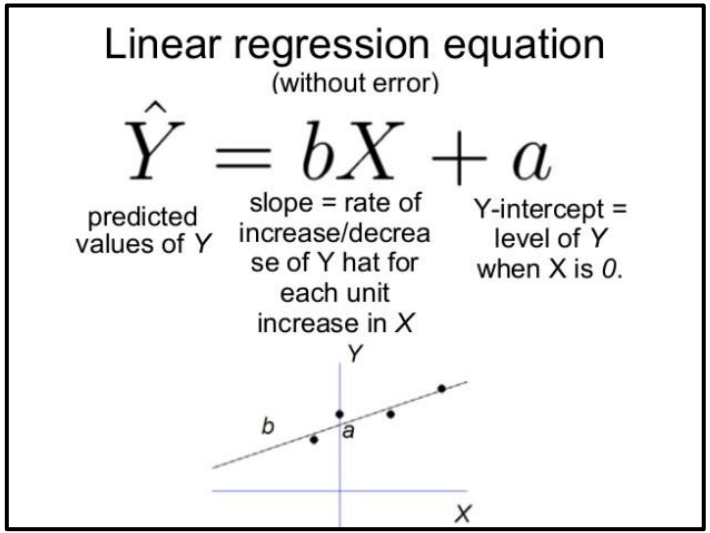


Semi-supervised Learning?

Linear Regression

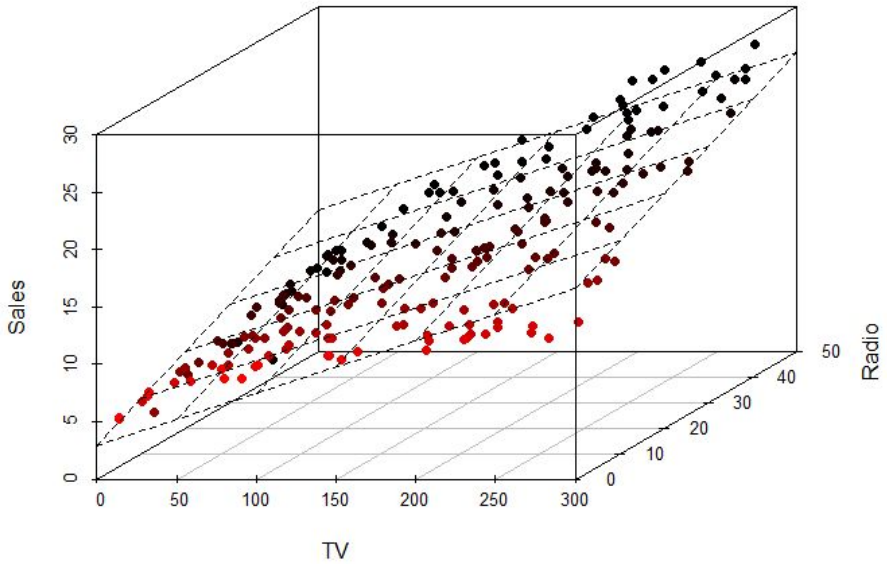
Linear Regression

is a statistical modelling used to examine the relationship between two or more variables. Linear regression performs the task to predict a **dependent variable value** (y) based on a **given independent variable** (x).

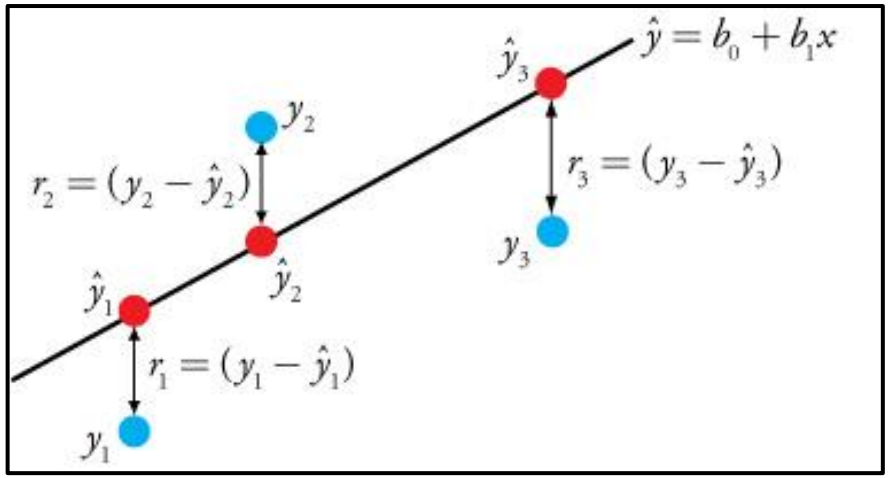


Multivariate Linear Regression

$$y_1 = \beta_0 + \beta_1 x_{11} + \cdots + \beta_k x_{1k} + \varepsilon_1$$
$$y_2 = \beta_0 + \beta_1 x_{21} + \cdots + \beta_k x_{2k} + \varepsilon_2$$
$$\vdots$$
$$y_n = \beta_0 + \beta_1 x_{n1} + \cdots + \beta_k x_{nk} + \varepsilon_n$$



Residual Error



$$\text{MAE} = \frac{1}{n}\sum_{j=1}^{n}|y_j - y_j|$$

Mean Absolute Error

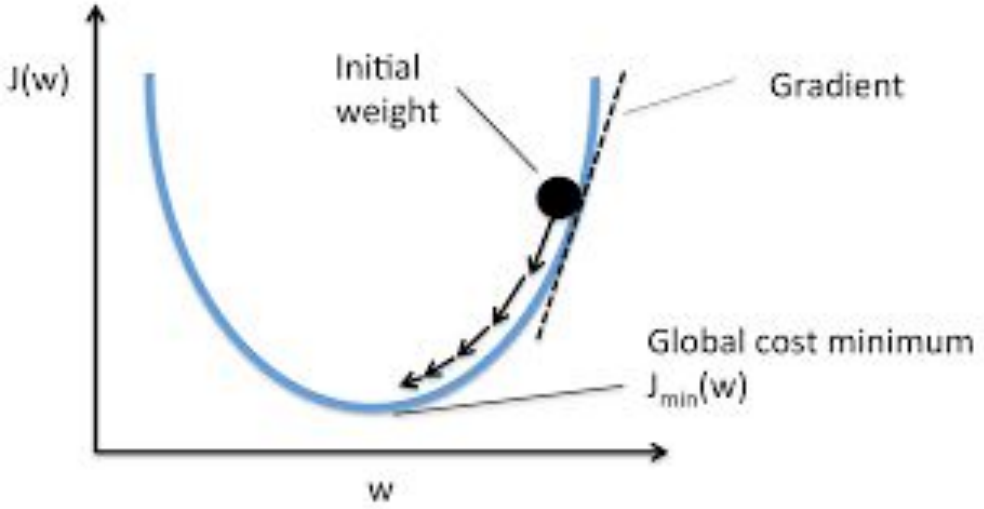
$$MSE = \frac{1}{N}\sum_{i}^{n}(Y_i - y_i)^2$$

Mean Squared Error

$$\text{RMSE} = \sqrt{\frac{1}{n}\sum_{j=1}^{n}(y_j - \hat{y}_j)^2}$$

Root Mean Squared Error

Cost Function & Gradient Descent



Cost function is a function that measures the performance of a machine learning model.

Gradient descent is function that minimize the error, that is mean squared error cost function. By changing the weighting of parameters iteratively.

How Gradient Descent works?

1. Guess theta

Guess/Random $\Theta_{(n+1 \times 1)} \rightarrow \Theta_0, \Theta_1, \ldots.\text{and } \Theta_n$

2. Predict, with these theta

$$pred^{(i)} = \Theta_0 \times 1 + \sum \Theta_i x_i^{(i)}$$

3. Measure error (cost function)

$$error_{(m \times 1)} = y_{(m \times 1)} - pred_{(m \times 1)}$$

$$cost = (1/2m) * \sum_{i=1}^{m} (error)^2$$

4. Update theta

$$\Theta = \Theta - \alpha\ (1/m) * \sum_{i=1}^{m} (error)*x$$

5. Repeat

Questions?