Supervised learning

Classification - Regression

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Today Outline :

Supervised Learning Definition

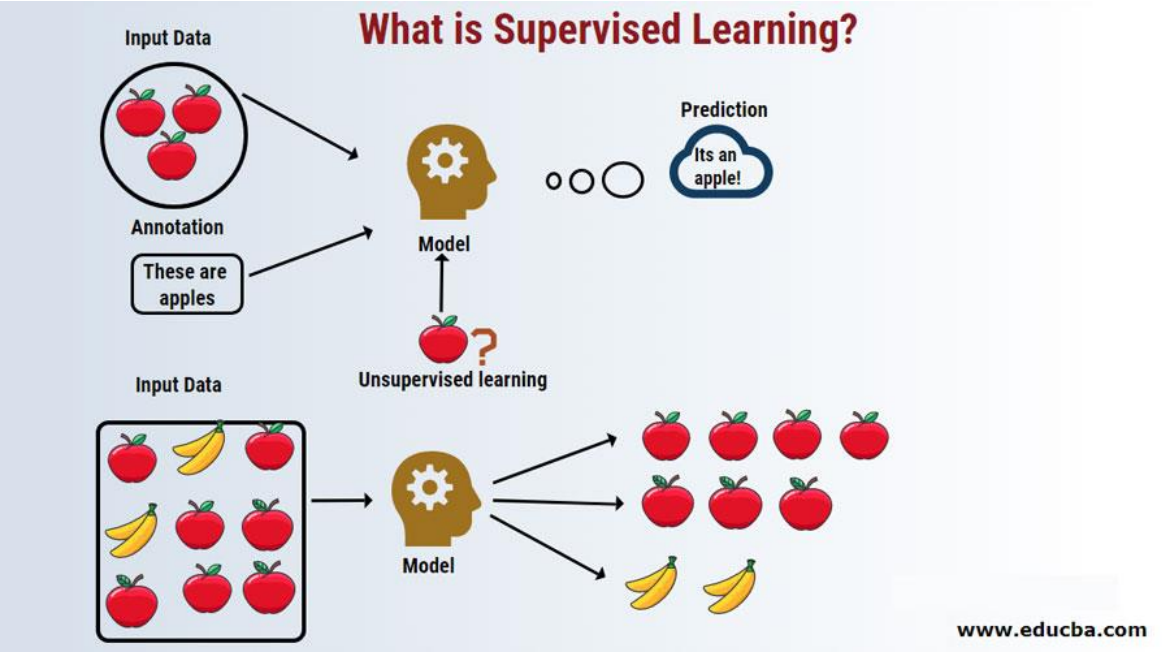
Supervised Learning Types

Supervised Learning Algorithms

Supervised Learning Applications

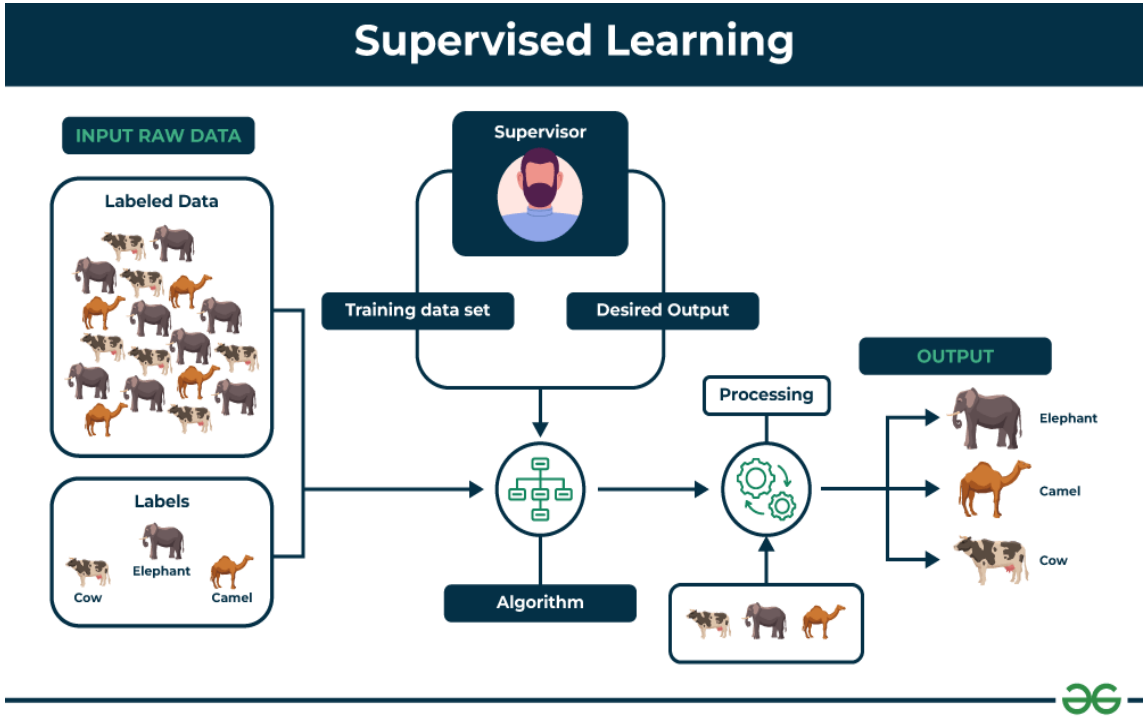
Supervised Learning generalization

Model selection & Model evaluation



Supervised learning : is a category of machine learning that uses labeled datasets to train algorithms to predict outcomes and recognize patterns.
Unlike unsupervised learning, supervised learning algorithms are given labeled training to learn the relationship between the input and the outputs.

dataset has a set of **features**, that are called the **independent variable**, these are used to make predictions. Secondly it has a **target** column or the **outcome** which is the **dependent variable** that the model is trying to predict. So, after the model is trained and is ready, given certain new datapoints of the independent variable type the model will give a outcome of the dependent variable type with certain accuracy.



Supervised Learning algorithms

Classification

- Logistic Regression
- K-Nearest Neighbors
- Naïve Bayes Classifiers
- Support Vector Machines
- Decision Trees & Random Forests

Regression

- Simple linear Regression
- Polynomial linear Regression
- Multilinear Regression

Supervised Learning Applications

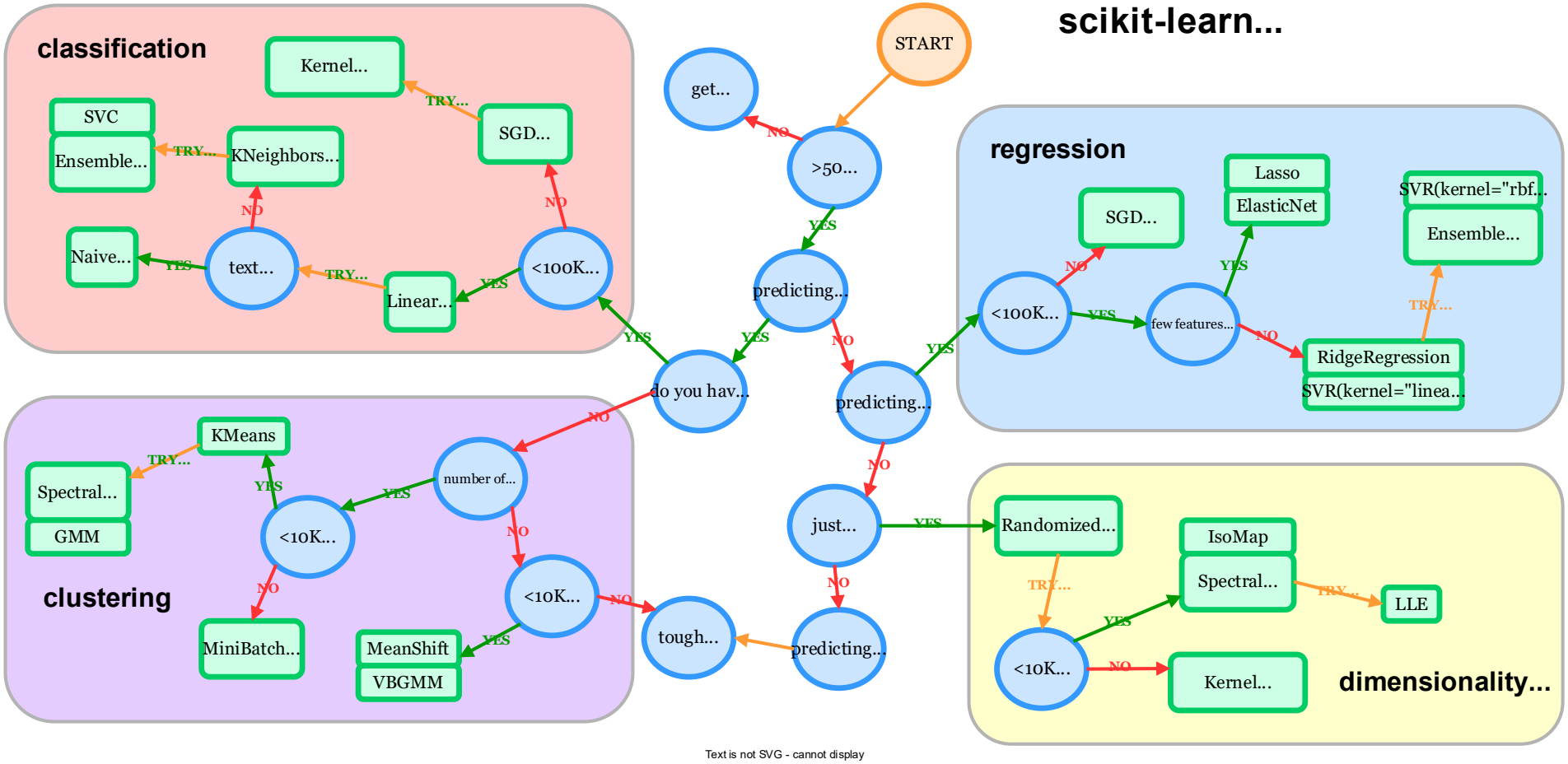
Regression

- Demand Forecasting
- Predict the customer life-time value **(CLV)** of your customers next year.
- predict the price of a new house based on various features of housing price data
- predict the number of bikes being rented at any given hour.

Classification

- Spam Filtering
- Medical Diagnosis
- Determine whether a tumor is benign based on a medical image.
- Discovering whether the value of a stock will go up or go down next week.
- An e-commerce company using labeled customer data to predict whether or not a customer will purchase a particular item.

How to choose the Model(Model Selection)



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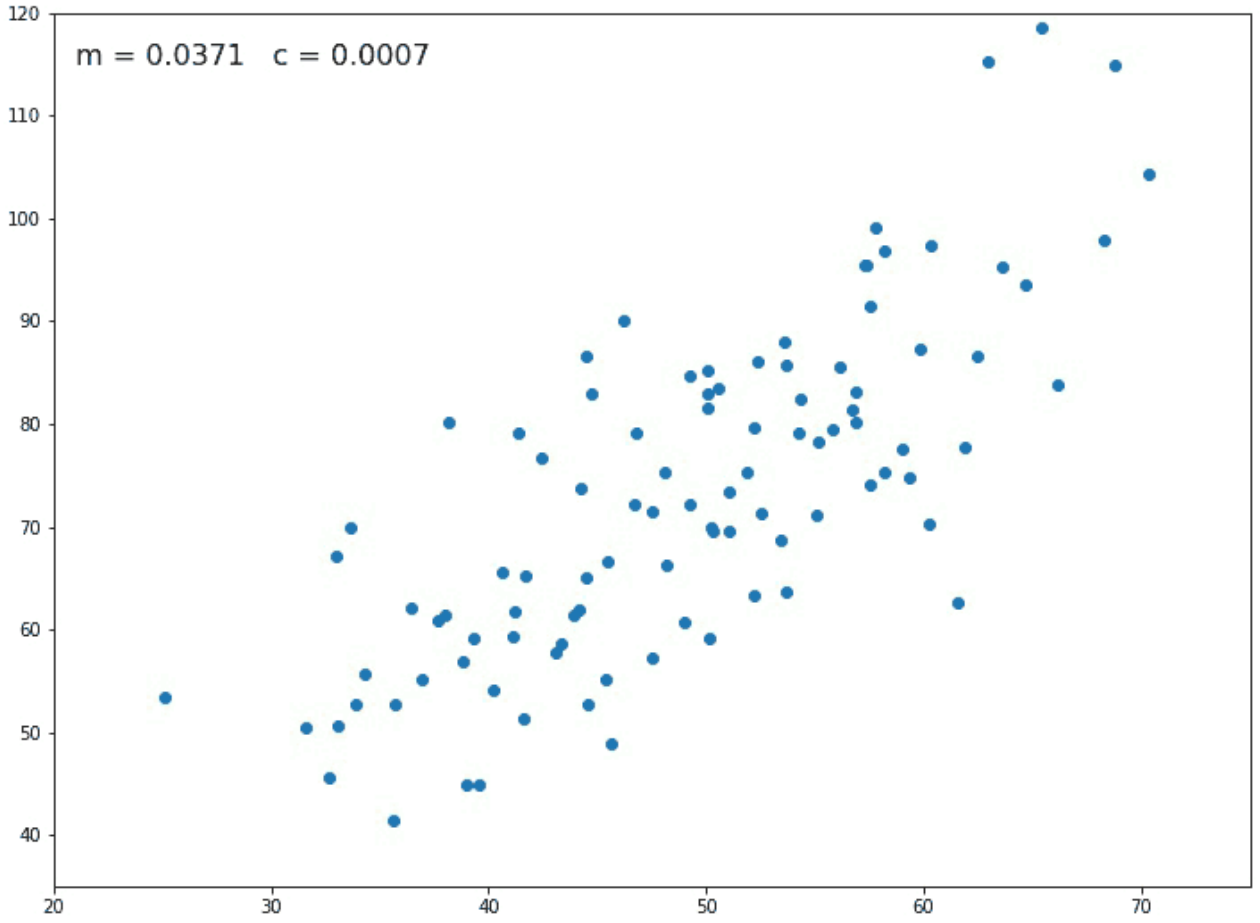
Supervised learning

Classification Regression

Regression : is a **supervised machine learning** model that is used to predict a continuous value based on the labeled dataset (Labeled data means the dataset whose respective target value is already known). The algorithm learns from the labelled datasets and maps the data points to the most optimized linear functions, which can be used for prediction on n

-It is basically finding the '**best fit line**' that pass maximum number of data points in the training d Further we use this line to predict values for our This best fit line is also called regression equatio linear regression, we aim to find a **straight best f equation)** and in case polynomial regression we **best fit line (nonlinear equation)**.



Types of Regression :

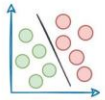
Linear Regression

- Simple Linear Regression
- Multi linear Regression

Polynomial Regression

- **Lasso Regression**
- **Ridge Regression**
- **Decision Trees Regression**
- **Support Vector Regression**
- **Neural Network Regression**

Linear Regression Types



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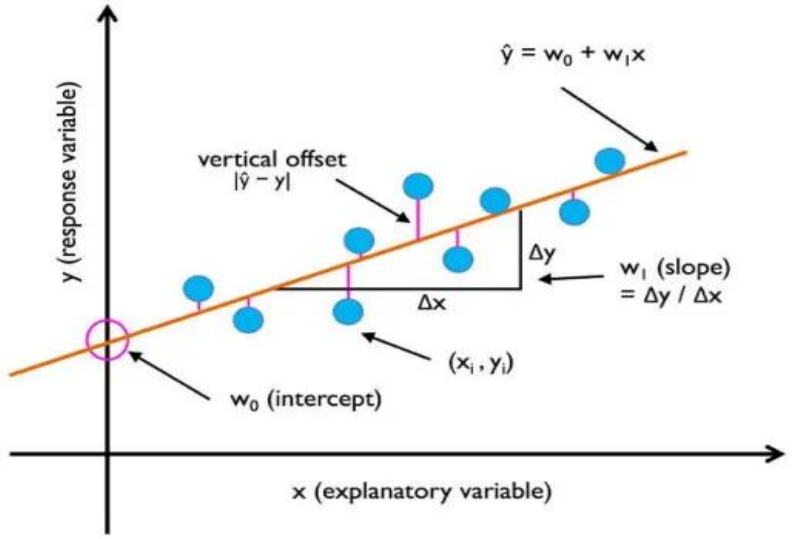
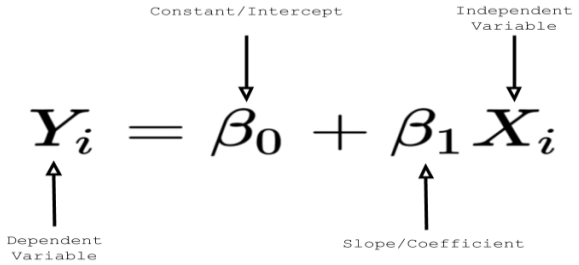
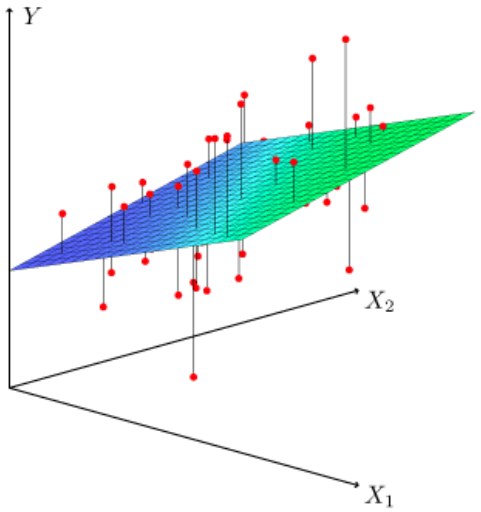
Algorithm	Description	Equation/Loss Function
Simple Linear Regression	One independent (x) and one dependent (y) variable	$\hat{y} = wx + b$
Polynomial Linear Regression	Polynomial features ($x, x^2, \ldots, x^n$) and one dependent (y) variable	$\hat{y} = w_1 x + w_2 x^2 + \cdots + b$
Multiple Linear Regression	Arbitrary features ($x_1, x_2, \ldots, x_n$) and one dependent (y) variable	$\hat{y} = w_1 x_1 + w_2 x_2 + \cdots + b$

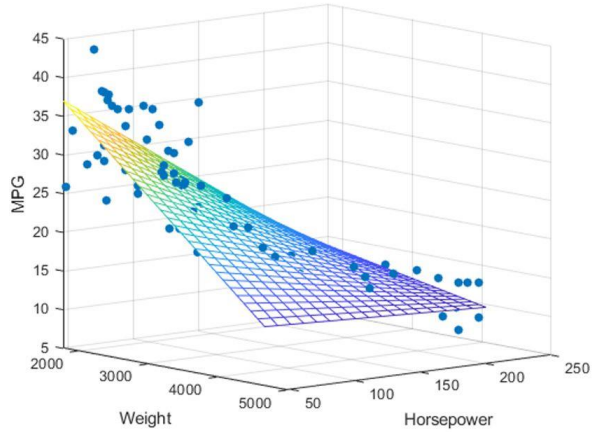


Simple linear regression involves only one dependent and one independent variable. Linear regression is where the we have continuous data with a linear pattern. If there is linearity (i.e., the dependent variable follow the independent variables linearly) in dataset then linear regression works well.



Multiple Linear Regression MLR has multiple independent variable and one dependent variable.





$$\gamma = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \varepsilon$$

Polynomial Regression

Polynomial regression is a form of Linear regression where only due to the Non-linear relationship between dependent and independent variables, we add some polynomial terms to linear regression to convert it into Polynomial Regression in Machine Learning.

The relationship between the dependent variable and the independent variable is modeled as an nth-degree polynomial function. When the polynomial is of degree 2, it is called a quadratic model; when the degree of a polynomial is 3, it is called a cubic model, and so on.

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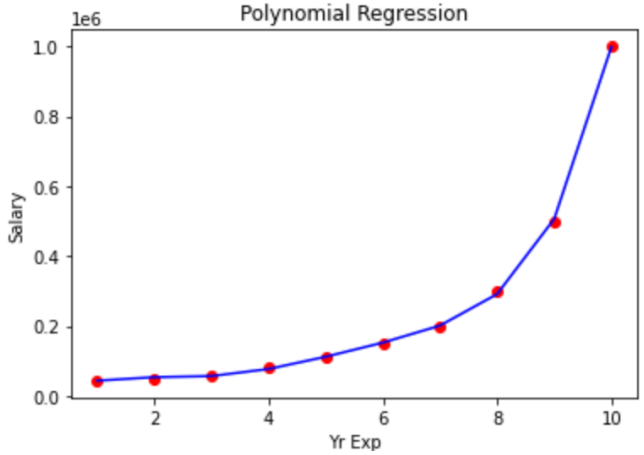
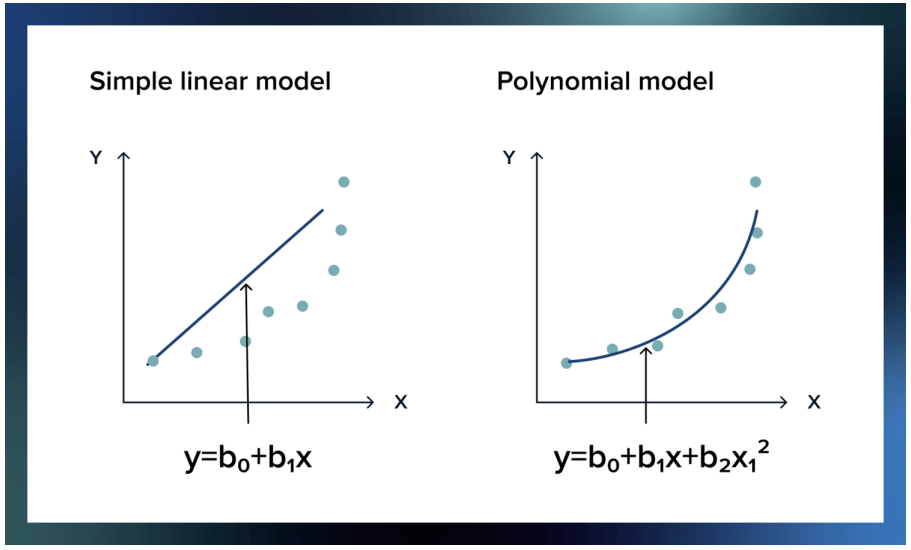
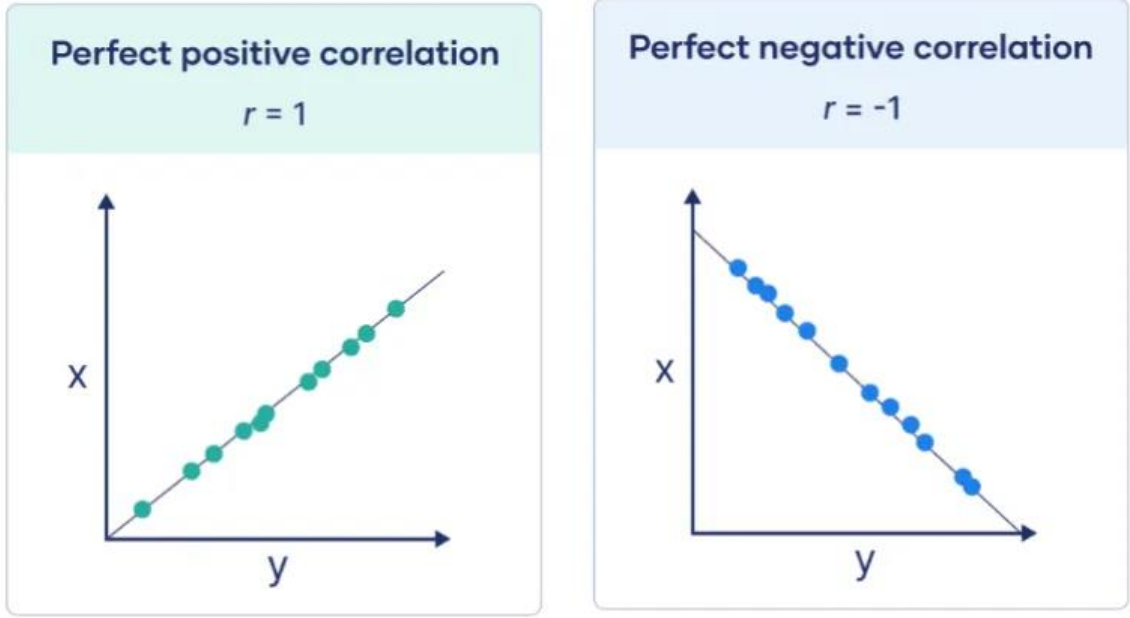


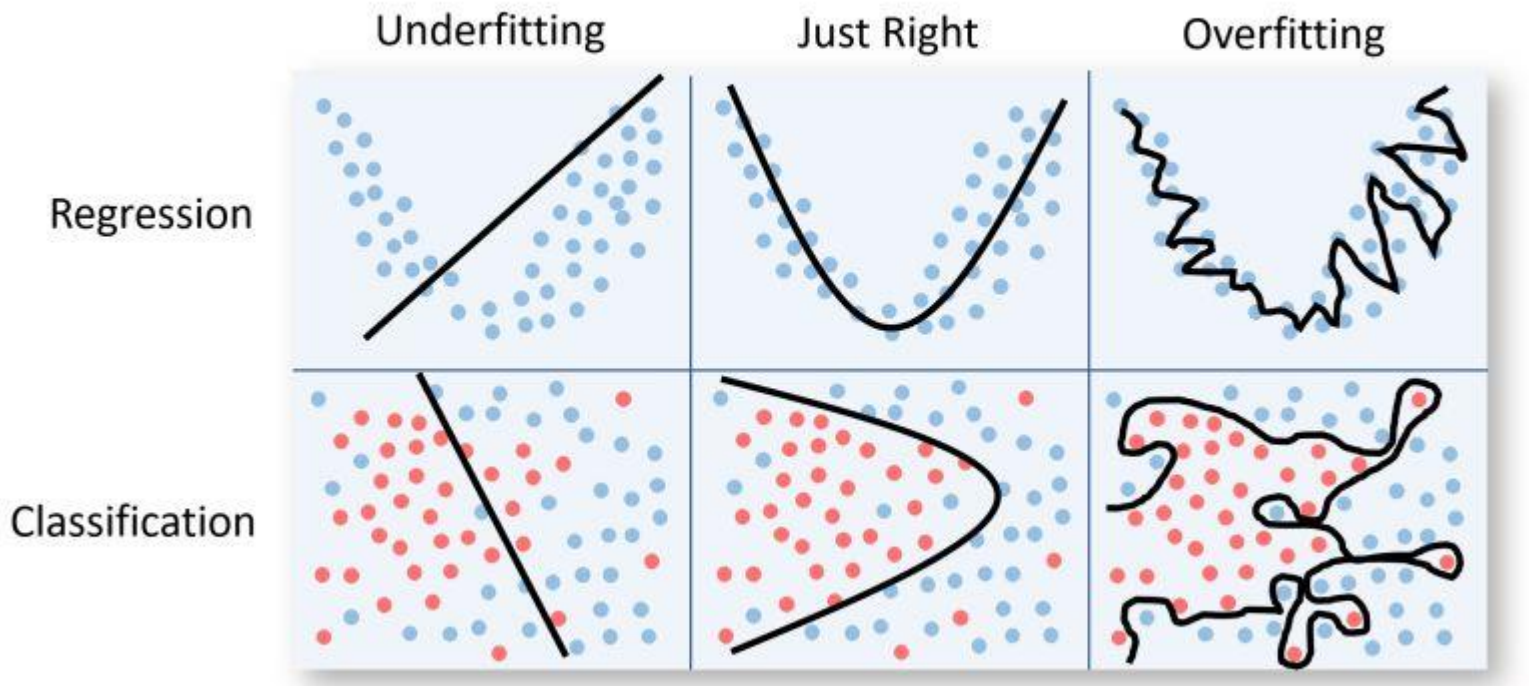


Correlation vs Regression

Correlation quantifies the strength and direction of a linear relationship, while regression aims to predict or explain the value of one variable based on the value of another



Machine Learning Generalization: Finding the Perfect Fit



Jeff Winter

Supervised learning

Classification- Regression

Today Outline :

- Classification Basics
- Classification vs. Clustering
- Classification Algorithms
- Evaluating Classification Model Performance Measures
- Classification Model Selection
- Classification Model Evaluation
- Performance Measures

What’s Classifications ?

Classification is the problem of identifying which of a set of categories an observation belongs to.

- **Classification Types:**
- Binary Classification (Yes/No, +/-)
- Multiclass Classification (High/Medium/Low)
- Classification vs. Clustering
- **Applications:**
- NLP (Text Classification)
- Computer Vision (Image Classification)
- Speech Recognition (Audio Classification)

Classification Algorithms

- Logistic Regression
- K-Nearest Neighbors
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- Support Vector Machines
- Decision Trees & Random Forests

References

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2. https://towardsdatascience.com/introduction-to-linear-regression-and-polynomial-regression-f8adc96f31cb

3- https://github.com/Palak-Bhandari/Linear-vs-Polynomial-Regression/blob/main/Salary%20Prediction.ipynb