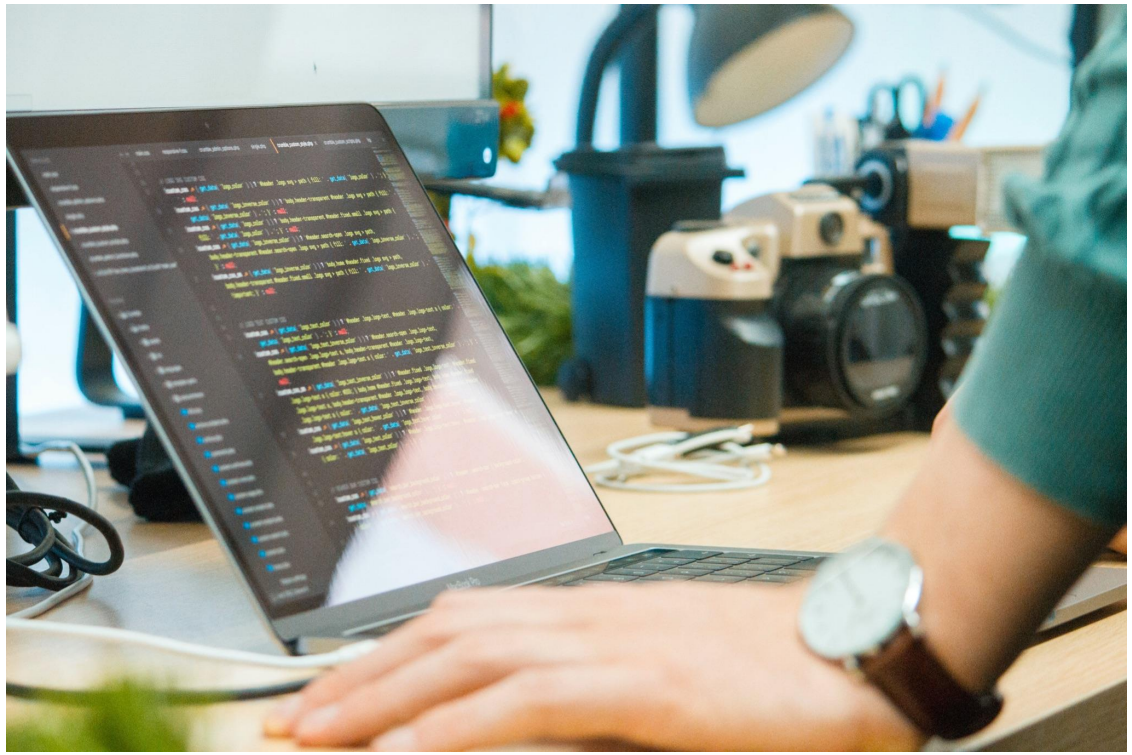

Linear & Logistic Regression

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Objective & Outline

Objective & Outline

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Objective

Understanding two of basic algorithms to easily create a smart system in AI which are linear & logistic regression algorithms.

Outline

- AI, Machine Learning & Deep Learning
- Supervised and Unsupervised Learning
- Linear Regression Algorithm
- Logistic Regression Algorithm

AI, Machine Learning and Deep Learning

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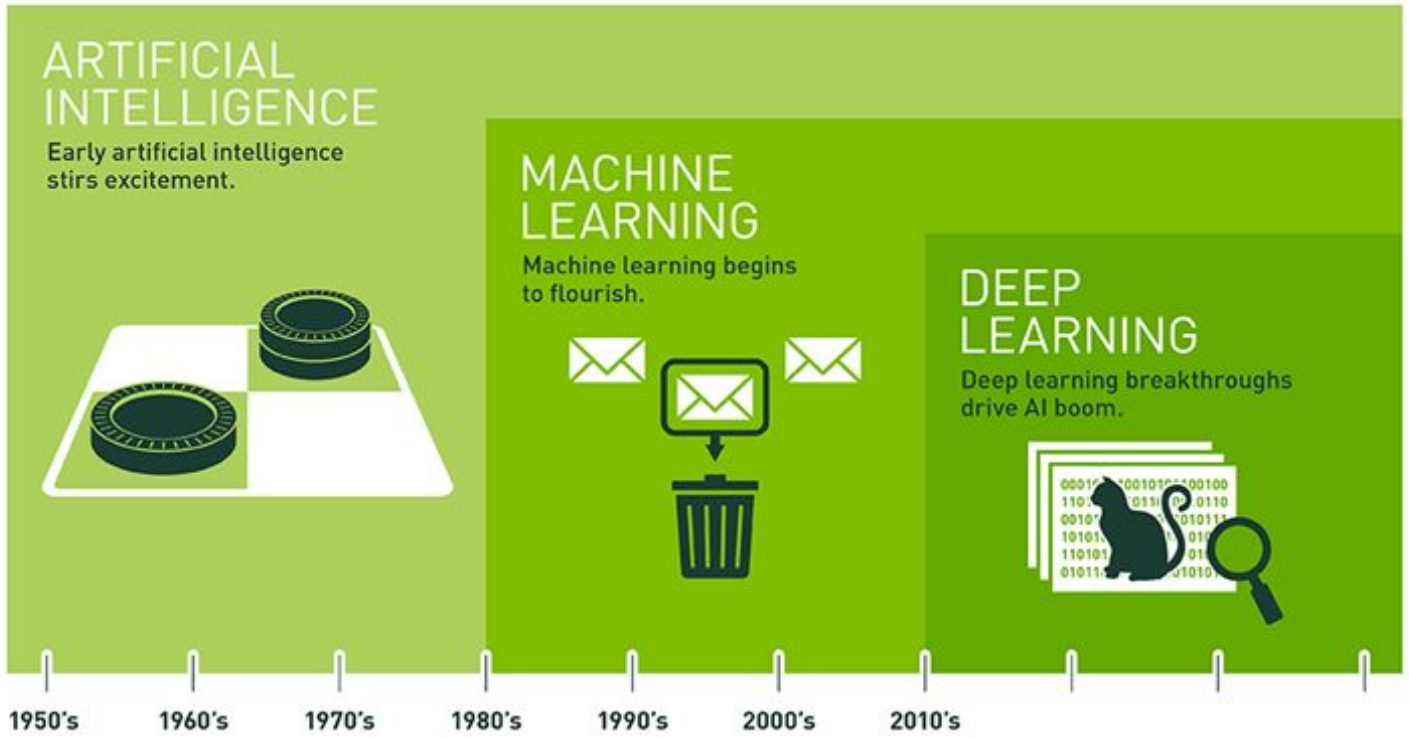
AI, Machine Learning and Deep Learning



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

AI, Machine Learning and Deep Learning

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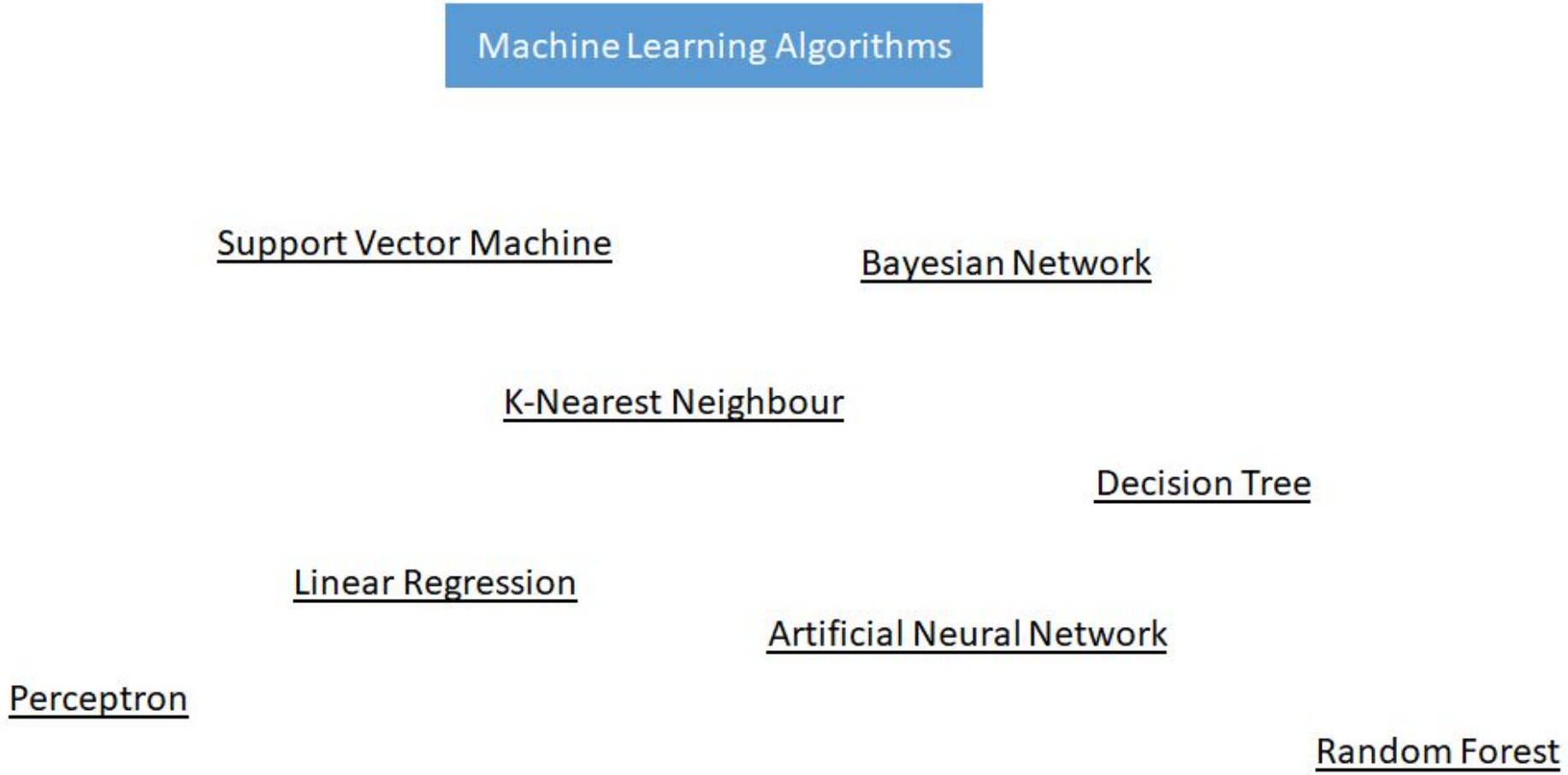
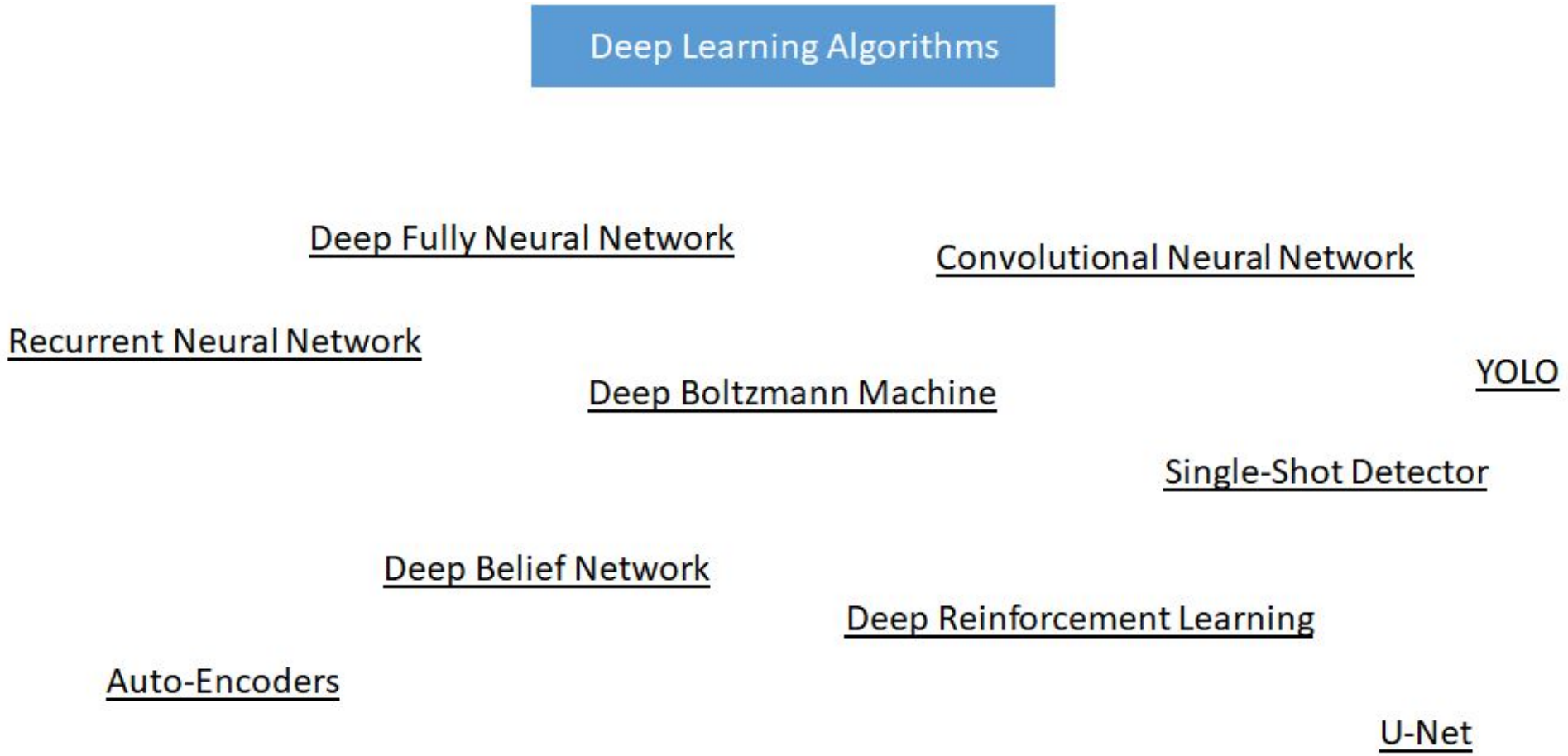


AI, Machine Learning and Deep Learning



Supervised and Unsupervised Learning

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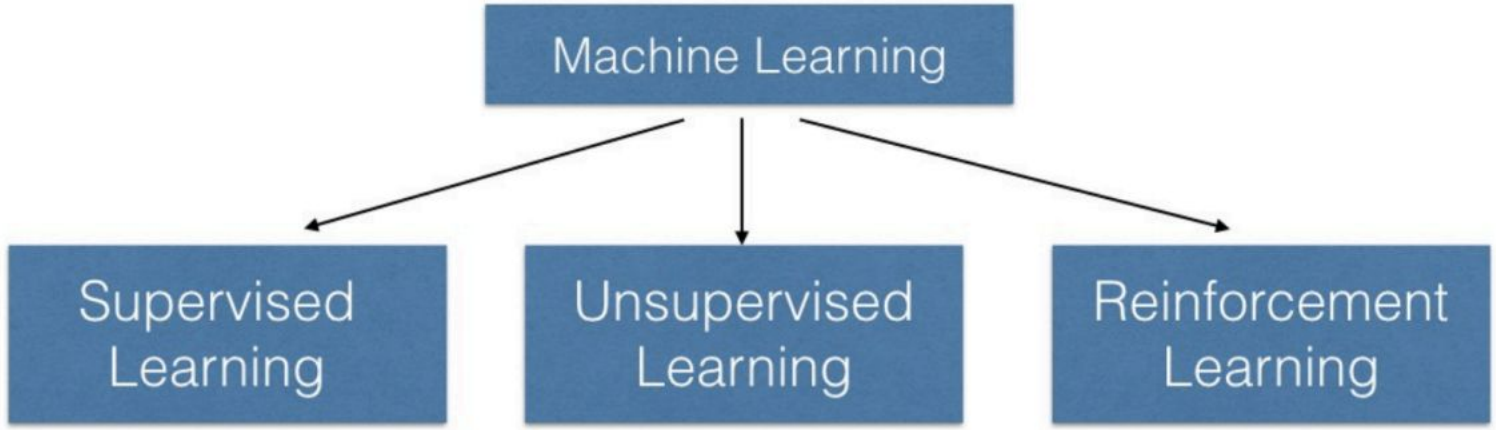
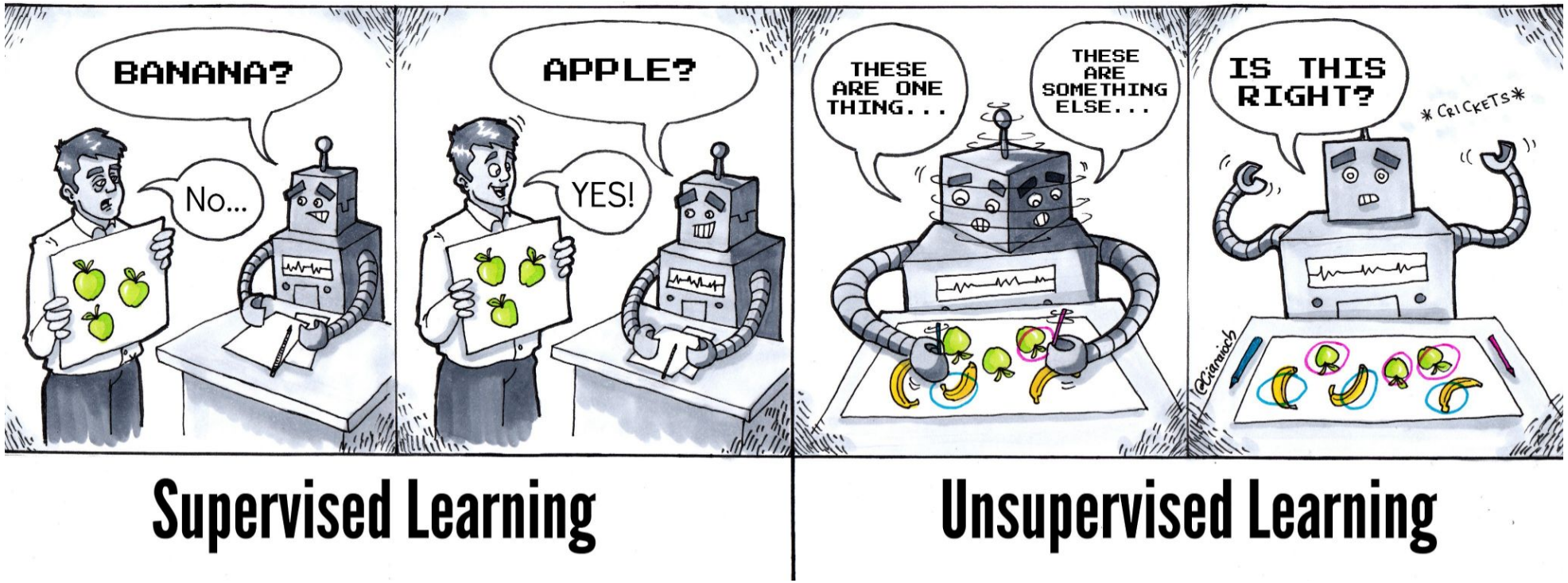
Supervised and unsupervised learning



Supervised and unsupervised learning



Quiz Session

Quiz

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What do you think about the current development of AI and how it affects your life?

***

Linear Regression Algorithm

Linear Regression Algorithm (Concept)

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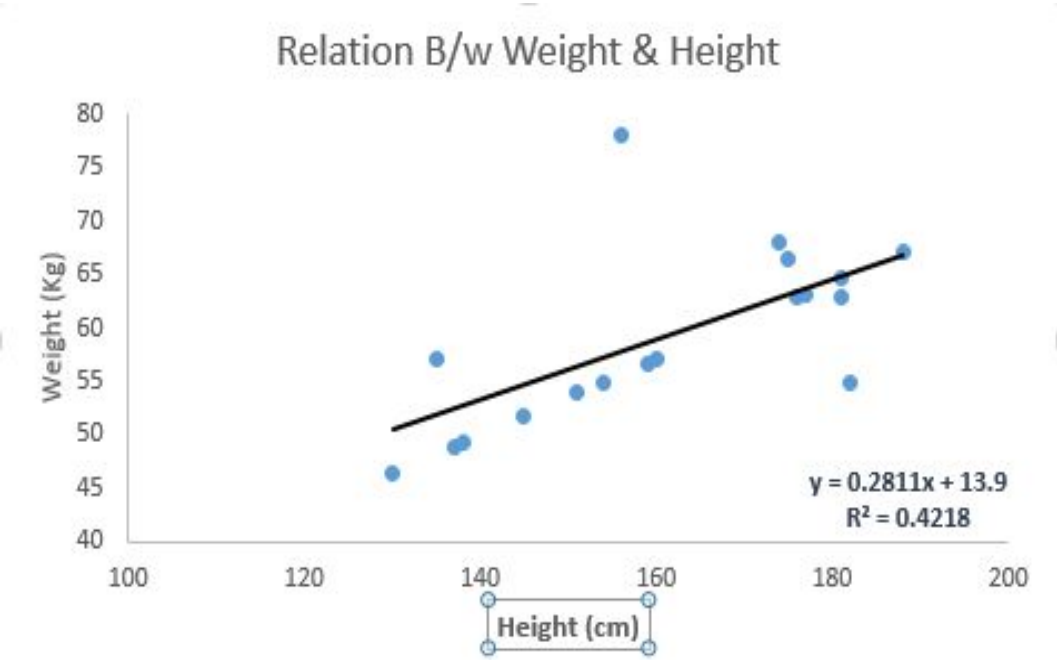
- Linear regression is usually among the first few topics which people pick while learning predictive modelling
- Also called **Hello World** of Machine Learning
- It works for **regression** problem so in this technique the dependent or target variable (weight) is continuous
- Let say we want to make AI to predict what is the weight of patient based on the data of his/her height? So the AI will be supposed to create the **straight line**
- Now, the question is *"How does it obtain the best straight line?"*



Linear Regression Algorithm (Concept)

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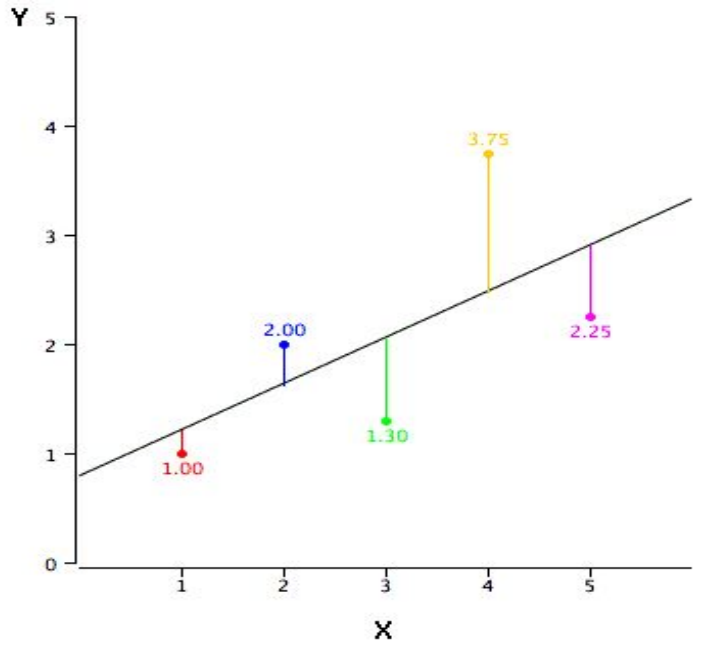
- How to obtain best straight line (value of a and b)?
- This task can be easily accomplished by calculating the **distance error** from all the data points to the straight line (Least Square Method)
- Then slowly but surely it will find the **correct position** of the straight line
- We can evaluate the model performance using the metric in statistic such as R-square or RMSE



Linear Regression Algorithm (Concept)

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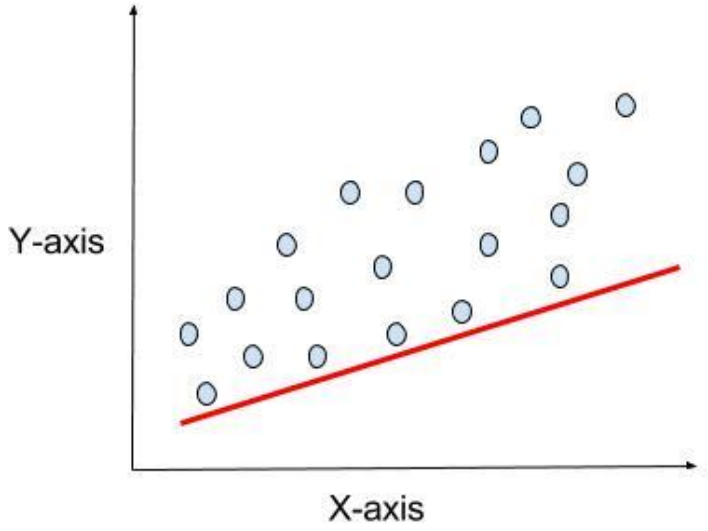
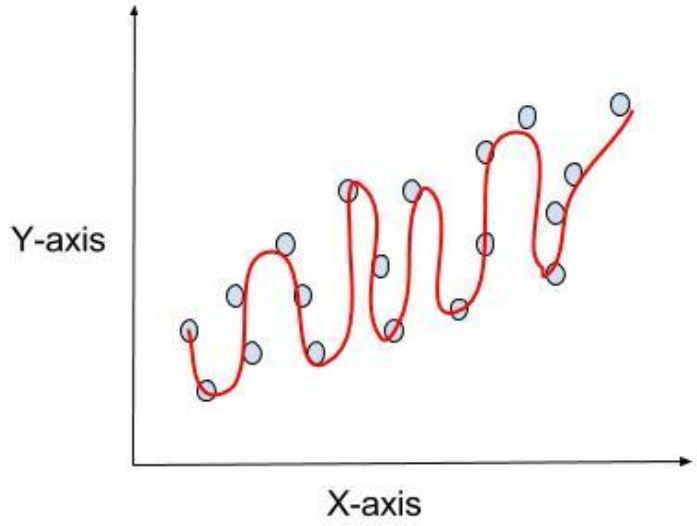
- The model should fit to the data points with the most less error
- We expect the line should follow the trend of the data points called **Good fitting**, No underfitting, no overfitting!



Underfitting



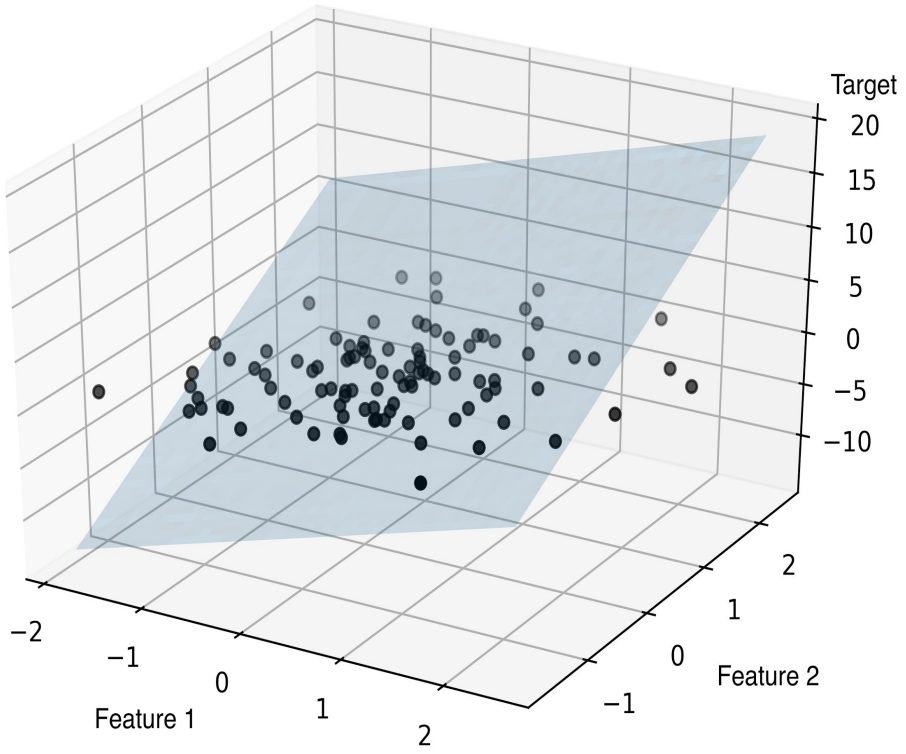
Overfitting

Linear Regression Algorithm (Concept)

- **Simple linear regression**: one-to-one relationship between the input variable and the output variable

- **Multiple linear regression**: many-to-one relationship, instead of just using one input variable, you use several

$$y = w_0 x_0 + w_1 x_1 + \ldots + w_m x_m = \sum_{i=0}^{m} w_i x_i = w^T x$$



Linear Regression Algorithm (Sklearn)

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- **Fit_intercept** : boolean, optional, default True

  Whether to calculate the intercept for this model. If set to False, no intercept will be used in calculations (e.g. data is expected to be already centred).

- **Normalize** : boolean, optional, default False

  This parameter is ignored when fit_intercept is set to False. If True, the regressors X will be normalized before regression by subtracting the mean and dividing by the l2-norm. If you wish to standardize, please use sklearn.preprocessing.StandardScaler before calling fit on an estimator with normalize=False


```
class sklearn.linear_model. LinearRegression (fit_intercept=True, normalize=False, copy_X=True, n_jobs=1)
```

Linear Regression Algorithm (Sklearn)

- **Fit** : Estimates the best representative function for the the data points. With that representation, you can calculate new data points
- **Predict** : Utilizing incoming data points to find the new output based on model representation from the fit method
- **Score:** Returns the coefficient of determination R^2 of the prediction.

Linear Regression Algorithm (Pros & Cons)

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Pros:

1. Easy to understand
2. Easy to implement and achieve good scores
3. The ability to identify outliers or anomalies

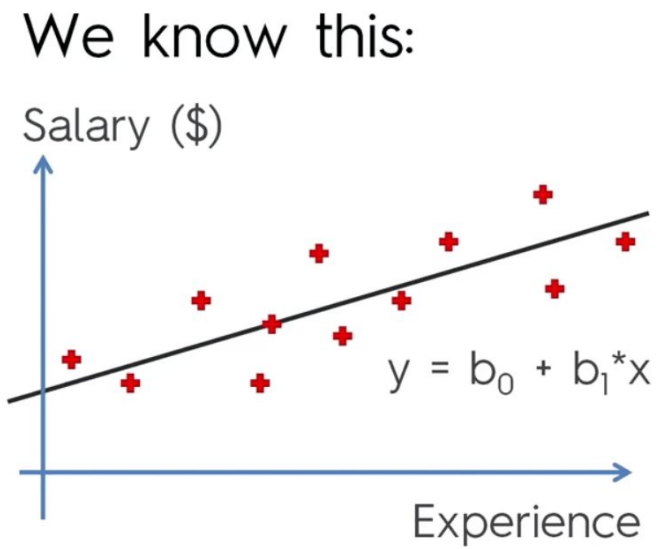
Cons:

1. Linear Regression is limited to linear relationships
2. Linear Regression is sensitive to outliers

Logistic Regression Algorithm

Logistic Regression Algorithm (Concept)

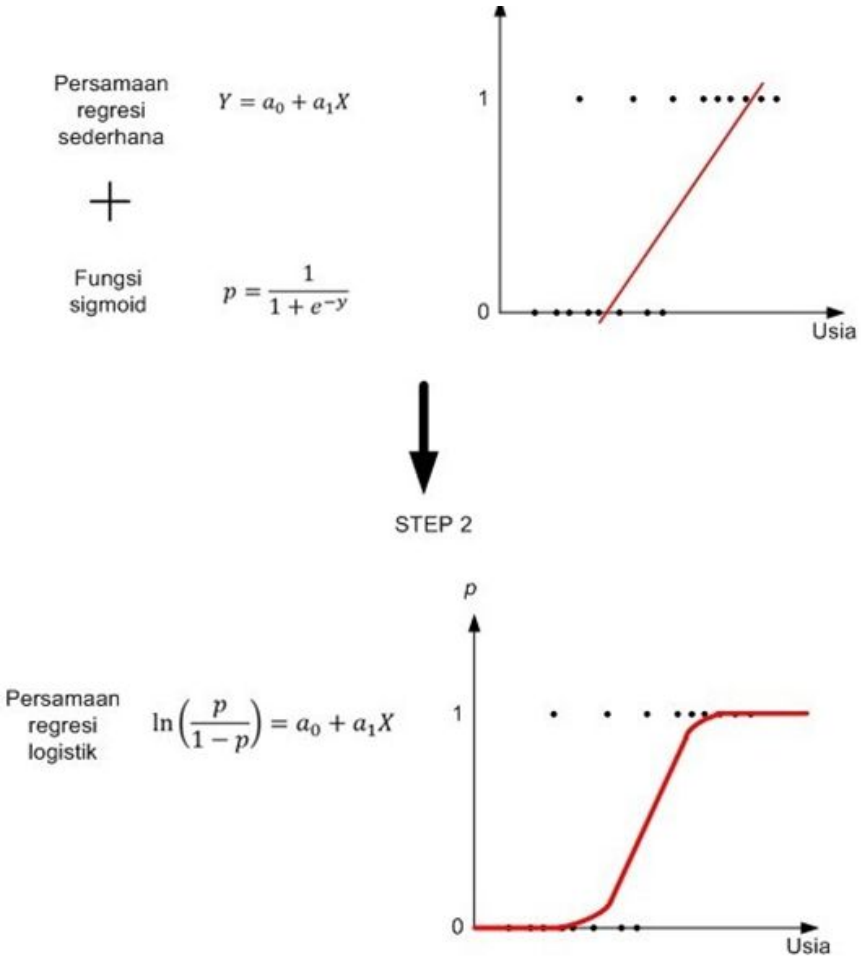
- Why not use Linear Regression algorithm?
- It is not a regression model, it works for **classification** problem instead
- Regression: how much employees should be paid?
-
- Classification: Will employees be paid or not?



Logistic Regression Algorithm (Concept)

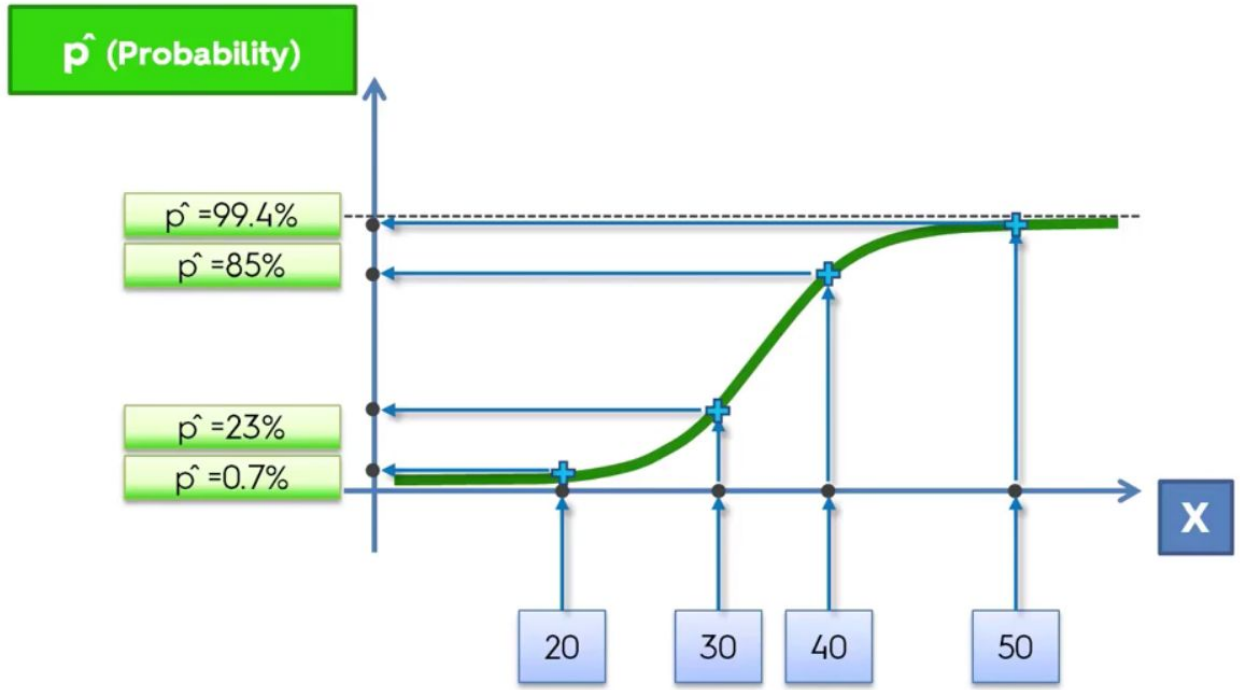
- Logistic regression predicts the probability of occurrences of an event by fitting data to a logit function by using sigmoid function]

- Apply sigmoid function to logistic regression since we have to think of it as probabilities!



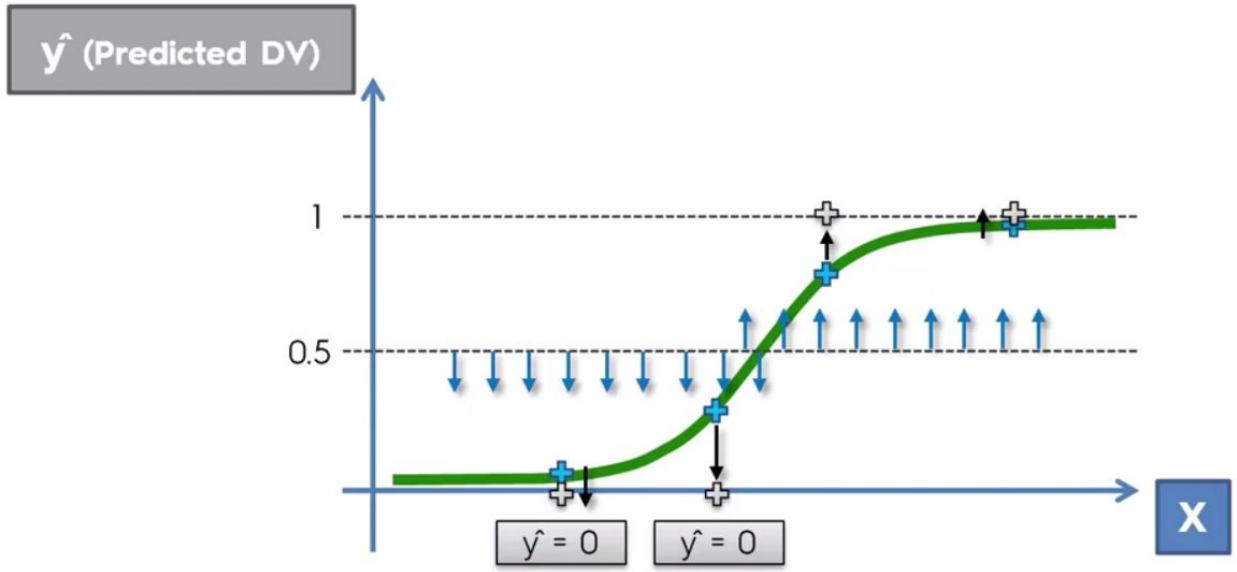
Logistic Regression Algorithm (Concept)

- Logistic regression seen from probabilities point of view
- So it will output the probability of Yes (1) is (let's say) 82% and the probability of No (2) is 18%



Logistic Regression Algorithm (Concept)

- Threshold determine whether one data is considered as one class (Yes) or the other (No)
- By default, almost every machine learning algorithm set the threshold as 0.5
- This has become the fundamental concept of Deep Learning



Quiz Session

Quiz

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You are predicting whether an email is spam or not. Based on the features, you obtained an estimated probability to be **0.75**. What's the meaning of this estimated probability? The **threshold** to differ the classes is **0.5**.

***

Assignment 2

- Lakukan Data Visualization, Data Preprocessing dan Data Modelling dengan menggunakan datasets The Boston Housing Datasets untuk membangun AI yang bisa memprediksi harga rumah

- Setelah melakukan proses *training*, lakukan evaluasi dan kesimpulan dari *accuracy* yang berhasil dicapai

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Terima Kasih!

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