SNS COLLEGE OF TECHNOLOGY

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Department of Biomedical Engineering

Course Name: 19ECT303 & Artificial Intelligence and machine learning

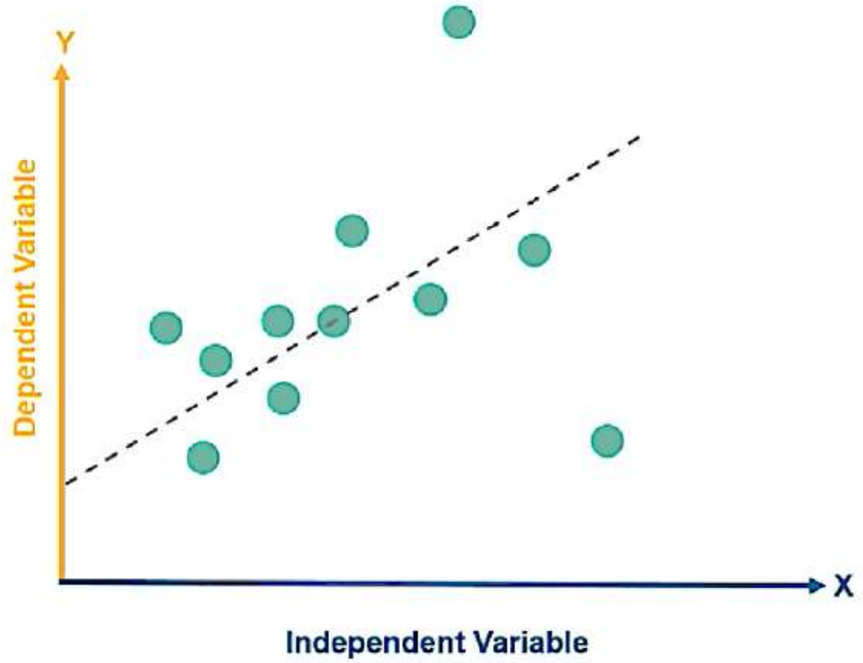
III Year : V Semester

Unit II–SUPERVISED LEARNING

Topic : Types of Regression- Linear Regression

Linear Regression

Linear Regression is a predictive model used for finding the ***linear relationship between a dependent variable and one or more independent variables.***



Linear regression

Here, ‘Y‘ is our dependent variable, which is a continuous numerical and we are trying to understand how does ‘Y‘ change with ‘X‘.

So, if we are supposed to answer, the above question of —What will be the GRE score of the student, if his CCGPA is 8.32?‖ our go-to option should be linear regression.

Examples of Independent & Dependent Variables:

- x is Rainfall and y is Crop Yield
- x is Advertising Expense and y is Sales
- x is sales of goods and y is GDP

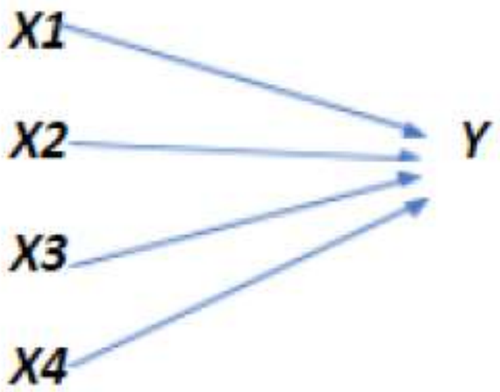
If the relationship with the dependent variable is in the form of single variables, then it is known as Simple Linear Regression

Simple Linear Regression

$$X \longrightarrow Y$$

If the relationship is between one Independent variable and one dependent variable, then it is called Simple Linear Regression

Multiple Linear regression



If the relationship between Independent and dependent variables are multiple in number, then it is called Multiple Linear Regression

Simp

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$$

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Where,

Y_i – Dependent variable

β_0 — Intercept

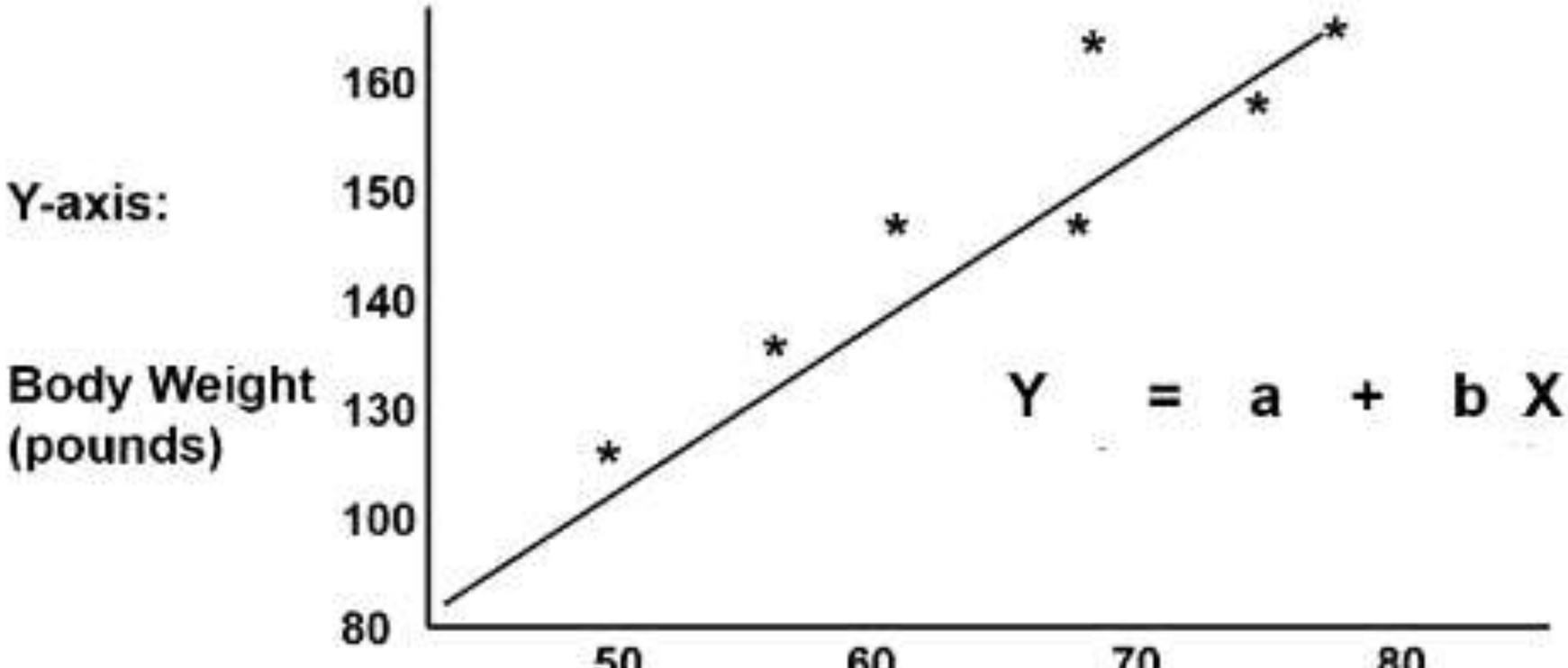
β_1 – Slope Coefficient

X_i – Independent Variable

ε_i – Random Error Term

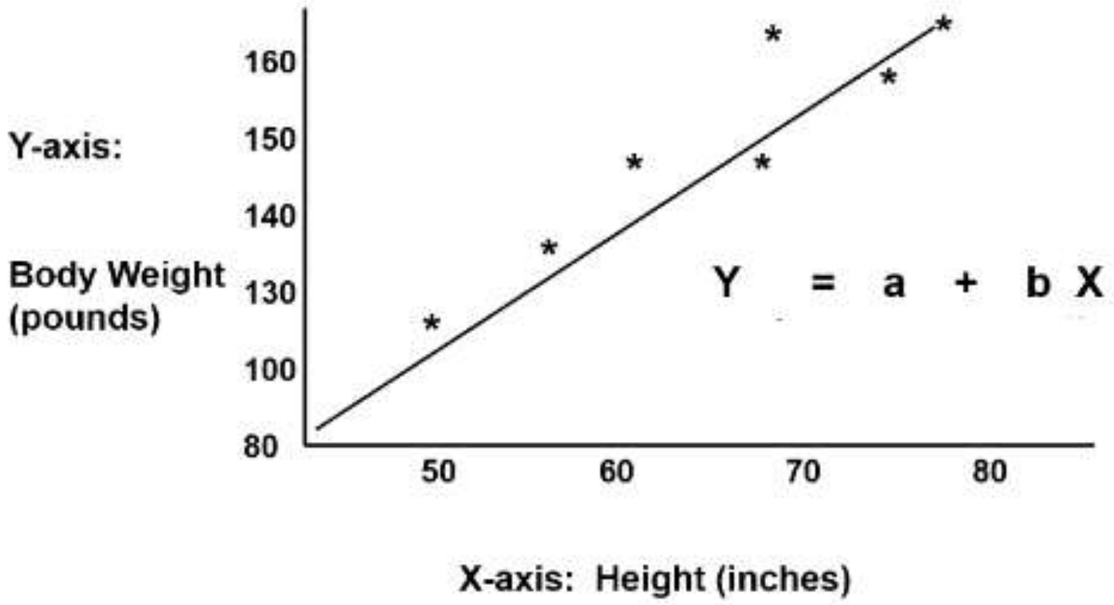
Activity

Identify the type of Simple Linear regression and calculate the weight if the height is 70 inches.



Activity

Identify the type of Simple Linear regression and calculate the weight if the height is 70 inches if slope is 2



Regression analysis

The main factor that is considered as part of Regression analysis is understanding the variance between the variables. For understanding the variance, we need to understand the measures of variation.

$$SST = SSR + SSE$$

Total Sum of Squares	Regression Sum of Squares	Error Sum of Squares

= total sum of squares (Total Variation)

- Measures the variation of the Y i values around their mean Y

= regression sum of squares (Explained Variation)

- Variation attributable to the relationship between X and Y

= error sum of squares (Unexplained Variation)

- Variation in Y attributable to factors other than X

Assumptions of Linear Regression

Since Linear Regression assesses whether one or more predictor variables explain the dependent variable and hence it has 5 assumptions:

1. Linear Relationship
2. Normality
3. No or Little Multicollinearity
4. No Autocorrelation in errors
5. Homoscedasticity

Linear Regression model

- With these assumptions considered while building the model, we can build the model and do our predictions for the dependent variable. For any type of machine learning model, we need to understand if the variables considered for the model are correct and have been analysed by a metric. In the case of Regression analysis, the statistical measure that evaluates the model is called the ***coefficient of determination which is represented as r^2.***

The coefficient of determination is the portion of the total variation in the dependent variable that is explained by variation in the independent variable. A higher value of r^2 better is the model with the independent variables being considered for the model.

$$r^2 = SSR$$

Note: The value of r^2 is the range of $0 \leq r^2 \leq 1$

THANK YOU !!!
HAPPINESS ISN'T OUTSIDE, ITS WITHIN