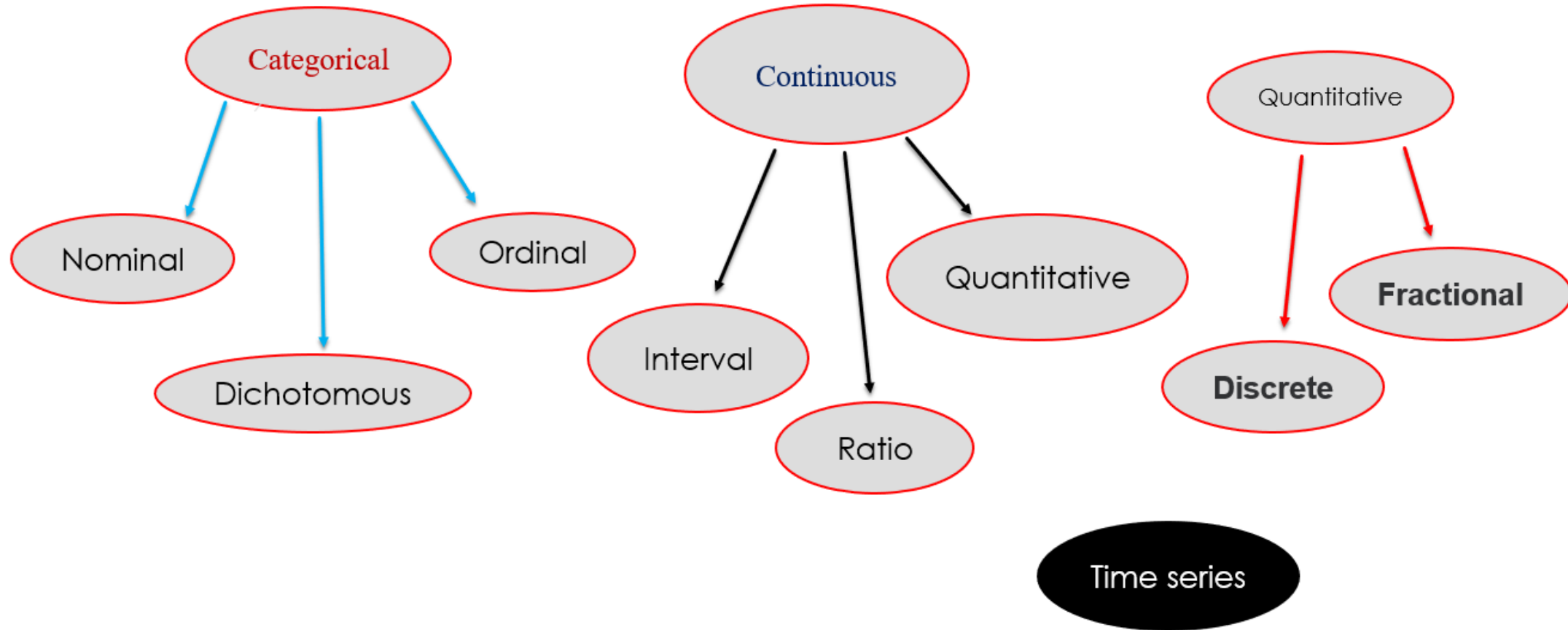


Feature Engineering: Let's talk about-

- Types of Variables
- Measure of Central Tendency
- Encoding Techniques
- Handle NaN Value
- Implementing using Python

# Types of Variables in Data Science



# Categorical & Continuous Variable

Nominal

1. Colors Names
2. Location Names
3. Car Names

Dichotomous

1. Yes, No
2. Male, Female
3. Left, Right

Ordinal

1. Good > Average > Below
2. High > Medium > Low
3. Satisfied > Neutral > Dissatisfied

# Measures of Central Tendency

- **Mean:** The mean is the most popular and well known measure of central tendency.

$$\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

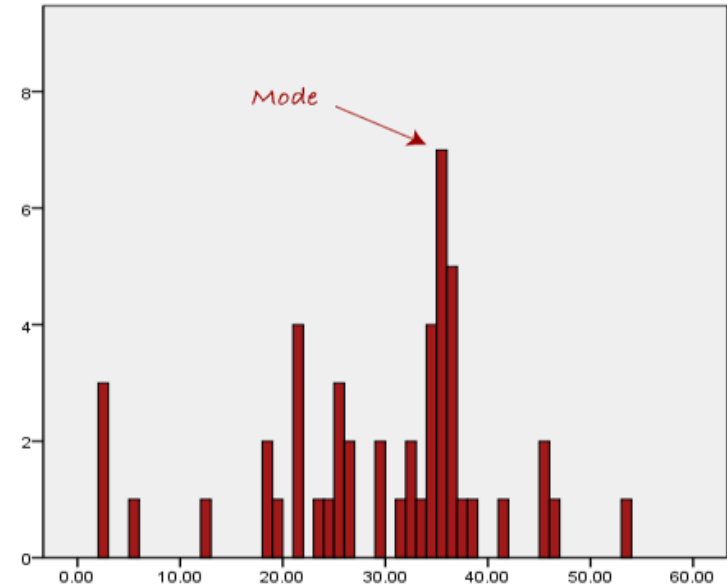
- **Median:** The median is the middle score for a set of data that has been arranged in order of magnitude.

65	55	89	56	35	14	56	55	87	45	92
----	----	----	----	----	----	----	----	----	----	----

We first need to rearrange that data into order of magnitude (smallest first):

14	35	45	55	55	<b>56</b>	56	65	87	89	92
----	----	----	----	----	-----------	----	----	----	----	----

- **Mode:** The mode is the most frequent score in our data set.



## Encoding Techniques in Machine Learning Model

- What is encoding?
- Why it is very important?

## Encoding Techniques in Machine Learning Model

	Marketing Spend	Administration	Transport	Area	Profit
0	114523.61	136897.80	471784.10	Dhaka	192261.83
1	162597.70	151377.59	443898.53	Ctg	191792.06
2	153441.51	101145.55	407934.54	Rangpur	191050.39
3	144372.41	118671.85	383199.62	Dhaka	182901.99
4	142107.34	91391.77	366168.42	Rangpur	166187.94
5	131876.90	99814.71	362861.36	Dhaka	156991.12
6	134615.46	147198.87	127716.82	Ctg	156122.51

Fig: Before Encoding

## Encoding Techniques in Machine Learning Model

	Marketing Spend	Administration	Transport	Area	Profit
0	114523.61	136897.80	471784.10	1	192261.83
1	162597.70	151377.59	443898.53	0	191792.06
2	153441.51	101145.55	407934.54	2	191050.39
3	144372.41	118671.85	383199.62	1	182901.99
4	142107.34	91391.77	366168.42	2	166187.94

Fig: After Encoding

## Encoding Techniques in Machine Learning Model

	Marketing Spend	Administration	Transport	Area	Profit			Marketing Spend	Administration	Transport	Area	Profit
0	114523.61	136897.80	471784.10	Dhaka	192261.83	→	0	114523.61	136897.80	471784.10	1	192261.83
1	162597.70	151377.59	443898.53	Ctg	191792.06	→	1	162597.70	151377.59	443898.53	0	191792.06
2	153441.51	101145.55	407934.54	Rangpur	191050.39	→	2	153441.51	101145.55	407934.54	2	191050.39
3	144372.41	118671.85	383199.62	Dhaka	182901.99	→	3	144372.41	118671.85	383199.62	1	182901.99
4	142107.34	91391.77	366168.42	Rangpur	166187.94	→	4	142107.34	91391.77	366168.42	2	166187.94

Fig: Before Encoding

Fig: After Encoding

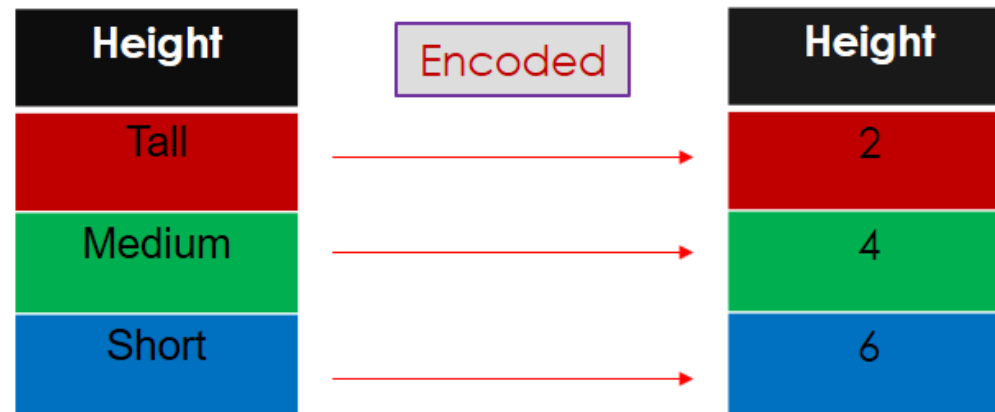


## Encoding Techniques in Machine Learning Model

- Without Use Any Encoding Techniques
- Label Encoding
- One-Hot Encoding
- Ordinal Encoding

## Encoding Techniques in Machine Learning Model

Without Use Any Encoding Techniques



## Label Encoding

	Marketing Spend	Administration	Transport	Area
0	114523.61	136897.80	471784.100000	Dhaka
1	162597.70	151377.59	443898.530000	Ctg
2	153441.51	101145.55	407934.540000	Rangpur
3	144372.41	118671.85	383199.620000	Dhaka
4	142107.34	91391.77	366168.420000	Rangpur
5	131876.90	99814.71	362861.360000	Dhaka
6	134615.46	147198.87	127716.820000	Ctg
7	130298.13	145530.06	323876.680000	Rangpur
8	120542.52	148718.95	311613.290000	Dhaka

	Marketing Spend	Administration	Transport	Area	Profit
0	114523.61	136897.80	471784.100000	1	192261.83
1	162597.70	151377.59	443898.530000	0	191792.06
2	153441.51	101145.55	407934.540000	2	191050.39
3	144372.41	118671.85	383199.620000	1	182901.99
4	142107.34	91391.77	366168.420000	2	166187.94
5	131876.90	99814.71	362861.360000	1	156991.12
6	134615.46	147198.87	127716.820000	0	156122.51
7	130298.13	145530.06	323876.680000	2	155752.60
8	120542.52	148718.95	311613.290000	1	152211.77

## One-Hot Encoding

	Marketing Spend	Administration	Transport	Area
0	114523.61	136897.80	471784.100000	Dhaka
1	162597.70	151377.59	443898.530000	Ctg
2	153441.51	101145.55	407934.540000	Rangpur
3	144372.41	118671.85	383199.620000	Dhaka
4	142107.34	91391.77	366168.420000	Rangpur
5	131876.90	99814.71	362861.360000	Dhaka
6	134615.46	147198.87	127716.820000	Ctg
7	130298.13	145530.06	323876.680000	Rangpur
8	120542.52	148718.95	311613.290000	Dhaka

	Ctg	Dhaka	Rangpur
0	0	1	0
1	1	0	0
2	0	0	1
3	0	1	0
4	0	0	1
5	0	1	0

## Label Encoding

### Problems:

Dhaka = 1

Chittagong = 0

Rangpur = 2

Rangpur = Dhaka + Dhaka

Rangpur > Dhaka > Chittagong

	Marketing Spend	Administration	Transport	Area
0	114523.61	136897.80	471784.100000	Dhaka
1	162597.70	151377.59	443898.530000	Ctg
2	153441.51	101145.55	407934.540000	Rangpur
3	144372.41	118671.85	383199.620000	Dhaka
4	142107.34	91391.77	366168.420000	Rangpur
5	131876.90	99814.71	362861.360000	Dhaka
6	134615.46	147198.87	127716.820000	Ctg
7	130298.13	145530.06	323876.680000	Rangpur
8	120542.52	148718.95	311613.290000	Dhaka

## One-Hot Encoding

	Marketing Spend	Administration	Transport	Area
0	114523.61	136897.80	471784.100000	Dhaka
1	162597.70	151377.59	443898.530000	Ctg
2	153441.51	101145.55	407934.540000	Rangpur
3	144372.41	118671.85	383199.620000	Dhaka
4	142107.34	91391.77	366168.420000	Rangpur
5	131876.90	99814.71	362861.360000	Dhaka
6	134615.46	147198.87	127716.820000	Ctg
7	130298.13	145530.06	323876.680000	Rangpur
8	120542.52	148718.95	311613.290000	Dhaka

	Marketing Spend	Administration	Transport	Dhaka	Rangpur
0	114523.61	136897.80	471784.100000	1	0
1	162597.70	151377.59	443898.530000	0	0
2	153441.51	101145.55	407934.540000	0	1
3	144372.41	118671.85	383199.620000	1	0
4	142107.34	91391.77	366168.420000	0	1
5	131876.90	99814.71	362861.360000	1	0
6	134615.46	147198.87	127716.820000	0	0
7	130298.13	145530.06	323876.680000	0	1
8	120542.52	148718.95	311613.290000	1	0

## Ordinal Encoding

	Marketing Spend	Administration	Transport	Area
0	114523.61	136897.80	471784.100000	Dhaka
1	162597.70	151377.59	443898.530000	Ctg
2	153441.51	101145.55	407934.540000	Rangpur
3	144372.41	118671.85	383199.620000	Dhaka
4	142107.34	91391.77	366168.420000	Rangpur
5	131876.90	99814.71	362861.360000	Dhaka
6	134615.46	147198.87	127716.820000	Ctg
7	130298.13	145530.06	323876.680000	Rangpur
8	120542.52	148718.95	311613.290000	Dhaka

	Marketing Spend	Administration	Transport	Area	Profit
0	114523.61	136897.80	471784.10	0.0	192261.83
1	162597.70	151377.59	443898.53	1.0	191792.06
2	153441.51	101145.55	407934.54	2.0	191050.39
3	144372.41	118671.85	383199.62	0.0	182901.99
4	142107.34	91391.77	366168.42	2.0	166187.94

*Now, Let's do it with PYTHON!*