Feature Transformation:

1. **Normalization**
2. **Standardization**
3. **MaxAbsScaler**
4. **RobustScaler**
5. **Log Transformation**

See in imaqge

Feature Transformation

Data:

Price
110
105
115
120
110
130
150
100
105

$\Rightarrow$

① Normalization:

$$X_{new} = \frac{X_i - min(x)}{max(x) - min(x)}$$

if, $X_i = 110$ when

$min(x) = 100$

$max(x) = 150$

$$X_{110} = \frac{110 - 100}{150 - 100}$$

$$= \frac{10}{50}$$

$$= 0.2$$

$$X_{105} = \frac{\cancel{1}105 - 100}{150 - 100}$$

$$= \frac{05}{50}$$

$$= 0.1$$

similarly,

- - - - - -

Normal Price
0.2
0.1
0.3
0.4
0.2
0.6
1.0
0.0
0.1

② Standardization:

$$X_{new} = \frac{X_i - X_{mean}}{Standard\ Deviation\ (\sigma)}$$

$$\sigma = \sqrt{\frac{\sum (x_i - \mu)^2 + \cdots}{N}}$$

if, $X_i = 110$,

$\mu\ (X_{mean}) = 116.11$

$N = 9\ (Data\ NO.)$

$$\sigma = \sqrt{\frac{\sum (110 - 116.11)^2 + (105 - 116.11)^2 + \cdots}{9}}$$

$$\doteq 14.7$$

$$\therefore X_{110} = \frac{110 - 116.11}{14.7} = -0.416$$

Standard Price
−0.416
−0.757
−0.075
−0.264
−0.416
0.946
2.308
−1.097
−0.757

③ **MaxAbsScaler:**

$$X_{New} = \frac{X_i}{absolute\ X_{max}}$$

$$X_{110} = \frac{110}{150} = 0.73 \qquad X_{105} = \frac{105}{150} = 0.7$$

$$X_{115} = \frac{115}{150} = 0.76 \qquad X_{120} = \frac{120}{150} = 0.8$$

MaxAbs Price
0.733
0.700
0.766
0.800
0.733
0.866
1.000
0.666
0.700

④ **Robust Scaler:**

Price
110 → 11.11%
105 → 22.22%
115
120
110
130
150
100
105

110

125

$$X_{scale} = \frac{X_i - X_{med}}{X_{75} - X_{25}}$$

$$IQR = X_{75} - X_{25}$$

$$= 125 - 110 = 15$$

$$X_{med} = 110$$

$$X_{New} = \frac{105 - 110}{15}$$

$$= \frac{-5}{15} = 0.33$$

$$X_{new} = \frac{115 - 110}{15}$$

$$= \frac{5}{15}$$

$$= 0.33$$

$$X_{New} = \frac{120 - 110}{15} = \frac{10}{15} = 0.66$$

100
105
105
110
110
115
120
130
150

Robust Scaler
0.00
-0.33
0.33
0.66
0.00
1.33
2.66
-0.66
-0.33