STANDARDIZATION & NORMALIZATION EXAMPLE

Q = Find Normalization & Standardization for feature age.

Age: 10 20 30 40 50

Ans = Normalization $= \frac{X - X_{min}}{X_{max} - X_{min}}$

10 $\Rightarrow 10 - 10 \Rightarrow 0$

20 $\Rightarrow \frac{20-10}{50-10} = \frac{10}{40} = 0.25$

30 $\Rightarrow \frac{30-10}{40} = \frac{20}{40} = 0.50$

40 $\Rightarrow \frac{40-10}{40} = \frac{30}{40} = 0.75$

50 $\Rightarrow \frac{50-10}{40} = \frac{40}{40} = 1$

After Normalization

Age: 0 0.25 0.5 0.75 1

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$$Z\,(\text{Standardization}) = \frac{X-\mu}{\sigma}$$

$$\mu = \frac{10+20+30+40+50}{5} = \frac{150}{5} = 30.$$

$$\sigma^2 = \frac{1}{n}\sum (x-\mu)^2$$

$$\sigma^2 = \frac{1}{5}\left[(20)^2 + (10)^2 + (0)^2 + (10)^2 + (20)^2\right]$$

$$\sigma^2 = \frac{1}{5}\left[400 + 200 + 400\right]$$

$$= \frac{1}{5} \times 1\overset{200}{\cancel{000}} = 200$$

$$\sigma = \sqrt{200} = \sqrt{4\times5\times2\times5}$$

$$= 2\times5\sqrt{2}$$

$$= 10\sqrt{2} = 14.14.$$

$$10 \Rightarrow \frac{10-30}{14.14} \Rightarrow -1.414$$

$$20 \Rightarrow \frac{20-30}{14.14} \Rightarrow -0.707$$

$$30 \Rightarrow 0$$

$40 \rightarrow \frac{40-30}{14.14} \Rightarrow 0.707$

$50 \Rightarrow \frac{50-30}{14.14} \Rightarrow 1.414$

After Standardization

↳ Age: $-1.41, -0.71, 0, 0.71, 1.41$