Conditional prob with normal distribution:

$$\hat{P}(X_j \mid C=c_i) = \frac{1}{\sqrt{2\pi}\sigma_{ji}} \cdot \exp\left(-\frac{(X_j-\mu_{ji})^2}{2\sigma_{ji}^2}\right)$$

$$\mu_{ji} = \frac{\sum X_j}{n} \quad (\text{mean})$$

$$\sigma_{ji} = \sqrt{\frac{(X_j-\mu_{ji})^2}{n-1}} \quad (\text{sample std})$$

$P(c=\text{apartment}) = 7/20$; $p(c=\text{house}) = 7/20$; $p(c=\text{condo}) = 6/20$

Feature X = Local price

+ Apartment

$$\text{mean} = \frac{4.9176 + 4.5573 + \ldots 9.0384}{7}$$

$$= 7.3327$$

$$\text{std} = \sqrt{\frac{(4.9176-7.3327)^2 + (4.5573-7.337)^2 + \ldots (9.0384-7.3327)^2}{7-1}}$$

$$= 3.6159$$

$\Rightarrow$ Cond prob dist $P(X_j \mid c)$ with c = Apartment

$$P(X_j \mid c) = \frac{1}{\sqrt{2\pi} \times 3.6159} \cdot \exp\left(-\frac{(X_j-7.3327)^2}{2 \times 3.6159^2}\right)$$

+ House

$$\text{mean} = \frac{5.0208 + 5.6039 + \ldots 6.6969}{7}$$

$$= 5.7607$$

$$std = \sqrt{\frac{(5.0208-5.7607)^2 + \cdots (6.6969-5.7607)^2}{7-1}}$$

$$= 0.5701$$

$\rightarrow$ cond prob dist for $c = house$

$$P(x_j|c) = \frac{1}{\sqrt{2\pi} \times 0.5701} \cdot \exp\left(-\frac{(x_j-5.7607)^2}{2\times 0.5701^2}\right)$$

+ Condo :

$$mean = \frac{4.5429 + 3.891 + \cdots + 7.7841}{6}$$

$$= 7.4159$$

$$std = \sqrt{\frac{(4.5429-7.4159)^2 + \cdots (7.7841-7.4159)^2}{6-1}}$$

$$= 4.6112$$

$\rightarrow$ cond prob dist for $c = condo$

$$P(x_j|c) = \frac{1}{\sqrt{2\pi} \times 4.6112} \cdot \exp\left(-\frac{(x_j-7.4159)^2}{2\times 4.6112^2}\right)$$

Feature X = # Bathrooms

+ Apartment:

$$\text{mean} = \frac{(1 + 1 + \dots 1.5 + 1)}{7} = 1.2857$$

$$\text{std} = \sqrt{\frac{(1-1.2857)^2 + \dots (1-1.2857)^2}{6}}$$

$$= 0.5669$$

→ cond prob dist

$$P(x_j|c) = \frac{1}{\sqrt{2\pi} \times 0.5669} \exp\left(-\frac{(x_j - 1.2857)^2}{2 \times 0.5669^2}\right)$$

+ House

$$\text{mean} = \frac{(1 + 1 + \dots 1.5)}{7} = 1.0714$$

$$\text{std} = \sqrt{\frac{(1 - 1.0714)^2 + \dots (1.5 - 1.0714)^2}{6}}$$

$$= 0.1889$$

→ cond prob dist

$$= \frac{1}{\sqrt{2\pi} \cdot 0.1889} \cdot \exp\left(-\frac{(x_j - 1.0714)^2}{2 \times 0.1889^2}\right)$$

+ Condo

$$\text{mean} = \frac{(1 + \dots + 2.5 + \dots 1.5)}{6} = 1.3333$$

$$\text{std} = \sqrt{\frac{(1 - 1.333)^2 + \dots (1.5 - 1.3333)^2}{5}}$$

$$= 0.6055$$

$$\to \text{cond prob dist} = \frac{1}{\sqrt{2\pi} \cdot 0.6055} \cdot \exp\left(-\frac{(x_j - 1.3333)^2}{2 \times 0.6055^2}\right)$$

Similarly, we model $8 \times 3 = 24$ (8 features $\times$ 3 classes) conditional distributions during the training phase:

$$P(x_j | C = c_i) = \frac{1}{\sqrt{2\pi}\,\sigma_{ji}} \cdot \exp\left(-\frac{(x_j - \mu_{ji})^2}{2\sigma_{ji}^2}\right) \quad (1)$$

Please refer to the table mean_std_train in the code for the values σ_{ji} and μ_{ji} used for testing data $X' = (x_1', \ldots x_n')$. Using MAP rule with X' in (1) and $P(c)$, we will compare and assign label c^* to X' if the calculation for c^* is greater than c.