Assignment 4. problem 1

1.

There are 3 classes — Apartment, condo, House

Given all 8 features of the data have numberless values ~~for~~, we need to calculate their conditional probability modeled with the normal distribution.

① For feature — local price

based on the formula $\text{mean} = \frac{1}{n}\sum_{i=1}^{n} X_i$

based on the formula $SD = (\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2)^{\frac{1}{2}}$

△ the mean of ~~attribute values~~ local prices of examples belonging to class of Apartment is 7.33274286

the standard deviation of ~~attribute values~~ local prices of examples belonging to class of Apartment is ~~2.68599824~~ 3.61599724

Then, $P(\text{local price} \mid \text{Apartment}) = \frac{1}{\sqrt{2\pi}\cdot 3.61599724}\exp\left(-\frac{(\text{local price} - 7.33274286)^2}{2(3.61599724)^2}\right)$

△ the mean of ~~attribute values~~ local prices of examples belonging to class of Condo is 7.4159

the standard deviation of ~~attribute values~~ local prices of examples belonging to class of Condo is 4.61124786

So, $P(\text{local price} \mid \text{Condo}) = \frac{1}{\sqrt{2\pi}\cdot 4.61124786}\exp\left(-\frac{(\text{local price} - 7.4159)^2}{2\cdot(4.61124786)^2}\right)$

△ the mean of ~~attribute values~~ local prices of examples belonging to class of House is 5.76074286

the standard deviation of ~~attribute values~~ local prices of examples belonging to class of House is 0.57012127

So, $P(\text{local price} \mid \text{House}) = \frac{1}{\sqrt{2\pi}\cdot 0.57012127}\exp\left(-\frac{(\text{local price} - 5.76074286)^2}{2\cdot(0.57012127)^2}\right)$

② For feature — number of Bathrooms

△ the mean of number of bathrooms of examples belonging to class of ~~Apartment~~ Apartment is: 1.28571429

the ~~mean~~ Standard deviation of number of bathrooms of examples belonging to class of Apartment is: 0.56694671

So, $P(\text{number of bathrooms} \mid \text{Apartment}) = \frac{1}{\sqrt{2\pi}\cdot 0.56694671}\exp\left(-\frac{(\text{number of bathrooms} - 1.28571429)^2}{2\cdot(0.56694671)^2}\right)$

△ the mean of number of bathrooms of examples belonging to class of Condo is: 1.33333333

the standard deviation of number of bathrooms of examples belonging to class of Condo is: 0.60553007

So, $P(\text{number of bathrooms} \mid \text{Condo}) = \frac{1}{\sqrt{2\pi}\cdot 0.60553007}\exp\left(-\frac{(\text{number of bathrooms} - 1.33333333)^2}{2\cdot(0.60553007)^2}\right)$

△ the mean of number of bathrooms of examples belonging to class of House is: 1.07142857

the standard deviation of number bathrooms of examples belonging to class of House is: 0.18898224

So, $P(\text{number of bathrooms} \mid \text{House}) = \frac{1}{\sqrt{2\pi}\cdot 0.18898224}\cdot\exp\left(-\frac{(\text{number of bathrooms} - 1.07142857)^2}{2\cdot(0.18898224)^2}\right)$

③ For feature —— Land Area

△ the mean of examples of class Apartment is 6.10385714

the SD of examples of class Apartment is 3.2585095

$$P(\text{Land area} \mid \text{Apartment}) = \frac{1}{\sqrt{2\pi}\cdot 3.2585095}\cdot \exp\left(-\frac{(\text{Land area} - 6.10385714)^2}{2\cdot(3.2585095)^2}\right)$$

△ for examples of class Condo

the mean is 6.0246667 ; the SD is 2.54477737

$$P(\text{Land area} \mid \text{Condo}) = \frac{1}{\sqrt{2\pi}\cdot 2.54477737}\cdot \exp\left(-\frac{(\text{Land area} - 6.0246667)^2}{2\cdot(2.54477737)^2}\right)$$

△ for examples of class House.

the mean is 6.6309, the SD is 2.2489732

$$P(\text{Land area} \mid \text{House}) = \frac{1}{\sqrt{2\pi}\cdot 2.2489732}\cdot \exp\left(-\frac{(\text{Land area} - 6.6309)^2}{2\cdot(2.2489732)^2}\right)$$

④ For features living area

△ for examples of class Apartment

the mean is 1.505 ; the SD is 0.7041058.

$$P(\text{living area} \mid \text{Apartment}) = \frac{1}{\sqrt{2\pi}\cdot 0.7041058}\cdot \exp\left(-\frac{(\text{living area} - 1.505)^2}{2\cdot(0.7041058)^2}\right)$$

△ for examples of class Condo

the mean is 1.55333333 ; the SD is 0.9234432

$$P(\text{living area} \mid \text{Condo}) = \frac{1}{\sqrt{2\pi}\cdot 0.9234432}\cdot \exp\left(-\frac{(\text{living area} - 1.55333333)^2}{2\cdot(0.9234432)^2}\right)$$

△ for examples of class House

mean is 1.39171429

SD is 0.21292386

$$P(\text{living area} \mid \text{House}) = \frac{1}{\sqrt{2\pi}\cdot 0.21292386}\cdot \exp\left(-\frac{(\text{living area} - 1.39171429)^2}{2\cdot(0.21292386)^2}\right)$$

⑤ For features # garages

△ for examples of class apartment.

the mean is 1.21428571 ; the SD is 0.69863813

$$P(\#\text{ garages} \mid \text{Apartment}) = \frac{1}{\sqrt{2\pi}\cdot 0.69863813}\cdot \exp\left(-\frac{(\#\text{ garages} - 1.21428571)^2}{2\cdot(0.69863813)^2}\right)$$

△ for examples of class Condo

the mean is 1.33333333 ; the SD is 0.5163978

$$P(\#\text{ garages} \mid \text{Condo}) = \frac{1}{\sqrt{2\pi}\cdot 0.5163978}\cdot \exp\left(-\frac{(\#\text{ garages} - 1.33333333)^2}{2\cdot(0.5163978)^2}\right)$$

△ for examples of class House

the mean is 1.07142857 ; the SD is 0.8380817

$$P(\#\text{ garage} \mid \text{House}) = \frac{1}{\sqrt{2\pi}\cdot 0.8380817}\cdot \exp\left(-\frac{(\#\text{ garages} - 1.07142857)^2}{2\cdot(0.8380817)^2}\right)$$

⑥ For feature #Rooms

- for examples of class Apartment
  the mean is 6.85714286 ; the SD is 1.34518542

So, $P(\#\text{Rooms} \mid \text{Apartment}) = \frac{1}{\sqrt{2\pi}\cdot 1.34518542} \cdot \exp\left(-\frac{(\#\text{Rooms} - 6.85714286)^2}{2\cdot(1.34518542)^2}\right)$

- for examples of class Condo
  the mean is 6.83333333 ; the SD is 1.60208188

So, $P(\#\text{Rooms} \mid \text{Condo}) = \frac{1}{\sqrt{2\pi}\cdot 1.60208188} \cdot \exp\left(-\frac{(\#\text{Rooms} - 6.83333333)^2}{2\cdot(1.60208188)^2}\right)$

- for examples of class House
  the mean is 6.14285714 ; the SD is 0.6900 6556

So, $P(\#\text{Rooms} \mid \text{House}) = \frac{1}{\sqrt{2\pi}\cdot 0.6900\,6556} \cdot \exp\left(-\frac{(\#\text{Rooms} - 6.14285714)^2}{2\cdot(0.6900\,6556)^2}\right)$

⑦ For feature # Bedrooms

- for examples of class Apartment
  the mean is 3.42857143 ; the SD is 0.97590007

So, $P(\#\text{Bedrooms} \mid \text{Apartment}) = \frac{1}{\sqrt{2\pi}\cdot 0.97590007} \cdot \exp\left(-\frac{(\#\text{Bedrooms} - 3.42857143)^2}{2\cdot(0.97590007)^2}\right)$

- for examples of class Condo
  the mean is 3.33333333 ; the SD is 0.81649658

So, $P(\#\text{Bedrooms} \mid \text{Condo}) = \frac{1}{\sqrt{2\pi}\cdot 0.81649658} \cdot \exp\left(-\frac{(\#\text{Bedrooms} - 3.33333333)^2}{2\cdot(0.81649658)^2}\right)$

- for examples of class House
  the mean is 3 ; the SD is 0.57735027

So, $P(\#\text{Bedrooms} \mid \text{House}) = \frac{1}{\sqrt{2\pi}\cdot 0.57735027} \cdot \exp\left(-\frac{(\#\text{Bedrooms} - 3)^2}{2\cdot(0.57735027)^2}\right)$

⑧ For feature Age of Home

- for examples of class Apartment
  the mean is 38.71428571 ; the SD is 14.68235082

So, $P(\text{Age of Home} \mid \text{Apartment}) = \frac{1}{\sqrt{2\pi}\cdot 14.68235082} \cdot \exp\left(-\frac{(\text{Age of Home} - 38.71428571)^2}{2\cdot(14.68235082)^2}\right)$

- for examples of class Condo
  the mean is 39.66666667 ; the SD is 13.95229969

So, $P(\text{Age of Home} \mid \text{Condo}) = \frac{1}{\sqrt{2\pi}\cdot 13.95229969} \exp\left(-\frac{(\text{Age of Home} - 39.66666667)^2}{2\cdot(13.95229969)^2}\right)$

- for examples of class House
  the mean is 34.28571429 ; the SD is 12.72418021

So, $P(\text{Age of Home} \mid \text{House}) = \frac{1}{\sqrt{2\pi}\cdot 12.72418021} \cdot \exp\left(-\frac{(\text{Age of Home} - 34.28571429)^2}{2\cdot(12.72418021)^2}\right)$

Also:

$P(\text{Construction type} = \text{Apartment}) = 7/20$

$P(\text{Construction type} = \text{Condo}) = 6/20$

$P(\text{Construction type} = \text{House}) = 7/20$