



## 9.3 实例：解析法实现一元线性回归

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### ■ 房屋销售记录

序号	面积 (平方米)	销售价格 (万元)	序号	面积 (平方米)	销售价格 (万元)
1	137.97	145.00	9	106.69	62.00
2	104.50	110.00	10	138.05	133.00
3	100.00	93.00	11	53.75	51.00
4	124.32	116.00	12	46.91	45.00
5	79.20	65.32	13	68.00	78.50
6	99.00	104.00	14	63.02	69.65
7	124.00	118.00	15	81.26	75.69
8	114.00	91.00	16	86.21	95.30

### ■ 待评估的房屋面积

[128.15, 45.00, 141.43, 106.27, 99.00, 53.84, 85.36, 70.00]

□ 加载样本数据:  $x, y$

□ 学习模型: 计算  $w, b$

$$w = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^n (x_i - \bar{x})^2}$$
$$b = \bar{y} - w\bar{x}$$

□ 预测房价

$$\hat{y} = wx + b$$



## 9.3 实例：解析法实现一元线性回归

- 导入库，设置字体
- 加载样本数据

```
In [1]: import numpy as np
import tensorflow as tf
import matplotlib.pyplot as plt

plt.rcParams['font.sans-serif'] = ['SimHei']
```

```
In [2]: x=tf.constant([137.97, 104.50, 100.00, 124.32, 79.20, 99.00, 124.00, 114.00,
                        106.69, 138.05, 53.75, 46.91, 68.00, 63.02, 81.26, 86.21])
y=tf.constant([145.00, 110.00, 93.00, 116.00, 65.32, 104.00, 118.00, 91.00,
               62.00, 133.00, 51.00, 45.00, 78.50, 69.65, 75.69, 95.30])
```



## 9.3 实例：解析法实现一元线性回归

### □ 学习模型——计算 $w, b$

```
In [3]: meanX=tf.reduce_mean(x)
        meanY=tf.reduce_mean(y)

        sumXY=tf.reduce_sum((x-meanX)*(y-meanY))
        sumX=tf.reduce_sum((x-meanX)*(x-meanX))

        w=sumXY/sumX
        b= meanY-w*meanX
```

```
In [4]: print("权值w=", w.numpy(), "\n偏置值b=", b.numpy())
        print("线性模型:y=", w.numpy(), "*x+", b.numpy())
```

```
权值w= 0.8945604
偏置值b= 5.4108505
线性模型:y= 0.8945604 *x+ 5.4108505
```

$$w = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^n (x_i - \bar{x})^2}$$
$$b = \bar{y} - w\bar{x}$$



### □ 预测房价

```
In [5]: x_test=np.array([128.15, 45.00, 141.43, 106.27, 99.00, 53.84, 85.36, 70.00])  
        y_pred=(w*x_test+b).numpy()
```

```
In [6]: print("面积\t估计房价")  
        n=len(x_test)  
        for i in range(n):  
            print(x_test[i], "\t", round(y_pred[i], 2))
```

面积	估计房价
128.15	120.05
45.0	45.67
141.43	131.93
106.27	100.48
99.0	93.97
53.84	53.57
85.36	81.77
70.0	68.03



### □ 数据和模型可视化

```
In [7]: plt.figure()

plt.scatter(x, y, color="red", label="销售记录")
plt.scatter(x_test, y_pred, color="blue", label="预测房价")
plt.plot(x_test, y_pred, color="green", label="拟合直线", linewidth=2)

plt.xlabel("面积 (平方米)", fontsize=14)
plt.ylabel("价格(万元)", fontsize=14)

plt.xlim((40, 150))
plt.ylim((40, 150))

plt.suptitle("商品房销售价格评估系统v1.0", fontsize=20)

plt.legend(loc="upper left")
plt.show()
```

