

# 基于特征价格法的泉州西湖城市湿地公园生态系统服务功能价值评估

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## 一、 评估区域简介

西湖公园位于福建省泉州市区西北部清源山南麓,是西北洋滞洪排涝工程的重要组成部分。该区处于一片低洼的平原地带,以往发生较大洪水时,主要靠自然水面及稻田滞洪,俗称西北洋。由于洪涝灾害严重,从 1996 年 6 月起,投资 1.7 亿元,历时两年多,建成由 3 座名桥、3 片水域和 4 座岛组成的西湖公园。西湖面积达  $100\text{ hm}^2$ ,其中水域面积  $82.28\text{ hm}^2$ ,有效库容为 208 万  $\text{m}^3$ ,最大蓄水容量为 250 万  $\text{m}^3$ 。广场道路面积  $1.72\text{ hm}^2$ ,种植树木达 200 多种,营造出了具有地域特色的景观效果。西湖公园是泉州市城市建设的亮点工程之一,取得了良好的社会效益和环境效益。



图 1. 泉州西湖城市湿地公园

## 二、 西湖公园生态系统服务功能价值评估

### 2.1 方法的选择

特征价格法 (HPM) 方法的主要原理,是将带待估价物品的价格分解,显现出各项特征的隐含价格,固定其特征不变,分解价格变动中的各种恒因素,从价格总变动中剔除特征变动的影响,剩下的就是纯粹的由于供求关系而引起的价格变动。总的来说,多样性的物品具有多方面的不同特征活品质,其价格就是这些所有特征的综合反映和表现。

一般来说，HPM 方法的一般流程可以分为四部分：

第一步：选取合适的变量指标将其量化。对于不同的国家、不同的地区、不同的测量目的和给你的操作这个来说，实际需要的指标和能够获取的指标等都具有一定程度的不确定，因而针对自己的测量目的选取罪恶俄日合适的指标，保证表能够满足案例的实际调查情况和准确描述出去案例的特征是十分必要的。

第二步：数据收集。收集研究区域内的变量指标的数据。

第三步：分析特征价格模型的不同形式，选取适当的方程模型并借助 Eviews 进行多元回归粉笔，比较各种不同的方程模型。一般来说在 HPM 中使用的方程模型有线性模型、对数模型和半对数模型，这三种方程模型较为可靠。

第四步：对模型计算结果进行分析。

2.2 指标的选择与量化

选用特征价格法作为生态价值的的评估时，一般选择房价作为被解释的变量，因为这个属于比较好进行调查，并且针对其进行价值分解的研究比较丰富。在本论文中，我们将房价的影响因素分为一下几点：区位特征、房屋特征、邻里特征和环境特征。具体因素由如下表所示：

变量类别	变量代号	含义
因变量	$P$	房屋成交价格（元/平方米）
房屋特征	$X_1$	房屋所在建筑的总楼层数（层）
	$X_2$	房屋所在的层高（高/中/低）
	$X_3$	房屋拥有的房间数量（个）
	$X_4$	房屋拥有的大厅数量（个）
	$X_5$	房屋拥有的厨房数量（个）
	$X_6$	房屋拥有的卫生间数量（个）
	$X_7$	房屋的总建筑面积（平方米）

	$X_8$	房屋的梯户比例（户数量/梯数量，无单位）
	$X_9$	房屋的装修情况（毛坯/简装/精装/其他）
邻里特征	$X_{10}$	小区周围 2 公里内的幼儿园数量（个）
	$X_{11}$	小区周围 2 公里内的中小学数量（个）
	$X_{12}$	小区周围 2 公里内的大学数量（个）
	$X_{13}$	小区周围 2 公里内的超市数量（个）
	$X_{14}$	小区周围 2 公里内的医院数量（个）
	$X_{15}$	小区周围 2 公里内公交线路的数量（条）
	$X_{16}$	小区周围 2 公里内银行的数量（个）
	$X_{17}$	小区周围 2 公里内公园/体育馆的数量（个）
	$X_{18}$	小区周围 2 公里内电影院的数量（个）
环境特征	$X_{19}$	周围 2 公里内公共开放空间面积（平方米）

### 2.3 数据的采集与预处理

在对指标进行选择与量化后，我们将对开始采集样本。房价样本均来自于链家·泉州（<https://quanzhou.lianjia.com/>），数据的采集范围来自泉州西湖湿地公园所在的泉州市丰泽区。采集样本的代码和最终采集样本的网址详见补充材料。对于收集到的数据我们作如下预处理：

1. 将分类变量转化为 1、2、3、4 等可进行计算的数据。
2. 对所有数据进行二范数的数据标准化，称  $p$  和  $x_i$  是标准化后的  $P$  和  $X_i$ 。

## 2.4 模型的选择与计算分析

在对数据进行采集与预处理之后，我们选用以下模型：

$$p = \alpha_0 + \sum_{i=1}^{19} \alpha_i x_i$$

其中， $p$  和  $x_i$  是标准化后的  $P$  和  $X_i$ ， $\alpha_i$  是他们在模型中的参数， $\alpha_0$  是截距。

我们首先使用最小二乘法进行模型回归，得到以下结果。

```
=====
                        OLS Regression Results
=====
Dep. Variable:          y      R-squared:          0.926
Model:                  OLS    Adj. R-squared:      0.924
Method:                  Least Squares      F-statistic:    418.9
Date:                    Sat, 02 Nov 2019    Prob (F-statistic): 0.00
Time:                    18:50:55    Log-Likelihood:    1460.2
No. Observations:        656    AIC:              -2880.
Df Residuals:            636    BIC:              -2791.
Df Model:                19
Covariance Type:         nonrobust
=====
                        coef      std err      t      P>|t|      [0.025      0.975]
-----
const          1.1124      0.006    196.837    0.000      1.101      1.124
x1             7.1839      2.158     3.329    0.001      2.946     11.422
x2            57.4587     20.478     2.806    0.005     17.246     97.672
x3           124.9894     30.847     4.052    0.000     64.415    185.564
x4             3.4536     41.612     0.083    0.934    -78.261     85.168
x5            81.7449     64.457     1.268    0.205    -44.829    208.319
x6            -0.1911     34.606    -0.006    0.996    -68.146     67.764
x7            -2.6940      0.575    -4.686    0.000     -3.823    -1.565
x8            -5.8823      6.562    -0.896    0.370    -18.769      7.004
x9             1.3799     15.998     0.086    0.931    -30.036     32.796
x10           22.5925      9.002     2.510    0.012      4.915     40.270
x11          -31.0770      5.973    -5.203    0.000    -42.806    -19.348
x12           20.8482      6.482     3.216    0.001      8.120     33.577
x13            6.1117      6.065     1.008    0.314     -5.799     18.022
x14           -1.4019      7.439    -0.188    0.851    -16.010     13.207
x15           37.9120     13.469     2.815    0.005     11.462     64.362
x16           53.3322     10.116     5.272    0.000     33.467     73.198
x17          -34.2271      7.895    -4.335    0.000    -49.731    -18.723
x18          -36.6523     11.617    -3.155    0.002    -59.465    -13.840
x19           -0.6339      0.009   -72.856    0.000     -0.651     -0.617
=====
Omnibus:                242.239    Durbin-Watson:          1.887
Prob(Omnibus):           0.000    Jarque-Bera (JB):        899.220
Skew:                   -1.719    Prob(JB):                5.45e-196
Kurtosis:                7.591    Cond. No.:               7.16e+04
=====

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 7.16e+04. This might indicate that there are
strong multicollinearity or other numerical problems.
```

图 2 OLS 回归结果（Python）

可以看见模型具有比较强的多重共线性问题，F 检验通过说明模型整体的显著性得到保障，但是少量变量没有通过 t 检验，表明我们选择的指标中有一部份是对模型不显著。为了解决这个问题，我们使用向前逐步回归解决多重共线性问题。最终结果如下：

```

OLS Regression Results
=====
Dep. Variable:          y      R-squared:          0.926
Model:                  OLS    Adj. R-squared:       0.924
Method:                 Least Squares  F-statistic:      616.0
Date:                   Sat, 02 Nov 2019  Prob (F-statistic): 0.00
Time:                   18:52:16  Log-Likelihood:   1459.3
No. Observations:      656      AIC:              -2891.
Df Residuals:          642      BIC:              -2828.
Df Model:              13
Covariance Type:       nonrobust
=====
               coef      std err          t      P>|t|      [0.025      0.975]
-----
Intercept      1.1119      0.006     201.761      0.000      1.101      1.123
x19     -0.6338      0.009    -74.059      0.000     -0.651     -0.617
x18    -33.5988     10.257     -3.276      0.001    -53.739    -13.458
x16     53.6608      9.833      5.457      0.000     34.352     72.969
x11    -30.7101      5.841     -5.258      0.000    -42.179    -19.241
x15     40.9837     12.232      3.351      0.001     16.965     65.002
x12     21.4221      6.411      3.342      0.001      8.833     34.011
x17    -33.3710      7.234     -4.613      0.000    -47.576    -19.166
x2      59.4898     20.300      2.931      0.004     19.628     99.351
x5      74.9359     55.510      1.350      0.178    -34.066    183.938
x10     23.7806      8.714      2.729      0.007      6.669     40.893
x1       7.4584      2.111      3.533      0.000      3.313     11.604
x7      -2.6031      0.523     -4.976      0.000     -3.630     -1.576
x3     132.0839     26.885      4.913      0.000     79.292    184.876
=====
Omnibus:          242.403   Durbin-Watson:      1.887
Prob(Omnibus):    0.000   Jarque-Bera (JB):   901.066
Skew:            -1.720   Prob(JB):           2.17e-196
Kurtosis:         7.597   Cond. No.            5.97e+04
=====

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

图 3 逐步向前回归结果（Python）

最终我们发现，多重共线性小时，但是  $X_5$  这个变量在模型中并不显著： $X_5$  表示的是房屋的厨房的数量：这一点很好解释，由于大部分样本属于公寓房，厨房数量基本为 1 个，于是我们剔除该变量再次进行回归。最终结果如下：

```

=====
                        OLS Regression Results
=====
Dep. Variable:          y      R-squared:          0.926
Model:                  OLS    Adj. R-squared:       0.924
Method:                 Least Squares    F-statistic:      666.4
Date:                   Sat, 02 Nov 2019    Prob (F-statistic): 0.00
Time:                   19:06:21    Log-Likelihood:    1458.3
No. Observations:      656    AIC:              -2891.
Df Residuals:          643    BIC:              -2832.
Df Model:              12
Covariance Type:       nonrobust
=====

```

	coef	std err	t	P> t	[0.025	0.975]
Intercept	1.1125	0.005	202.495	0.000	1.102	1.123
x19	-0.6325	0.009	-74.347	0.000	-0.649	-0.616
x18	-33.1128	10.257	-3.228	0.001	-53.254	-12.972
x16	54.5965	9.815	5.563	0.000	35.324	73.869
x11	-30.2389	5.834	-5.183	0.000	-41.695	-18.783
x15	42.4670	12.190	3.484	0.001	18.530	66.404
x12	19.6710	6.282	3.131	0.002	7.335	32.007
x17	-32.4490	7.206	-4.503	0.000	-46.600	-18.298
x2	59.4235	20.312	2.925	0.004	19.537	99.310
x10	23.4460	8.716	2.690	0.007	6.330	40.562
x3	144.1193	25.379	5.679	0.000	94.283	193.956
x7	-2.6891	0.520	-5.176	0.000	-3.709	-1.669
x1	7.4723	2.112	3.538	0.000	3.324	11.620

```

=====
Omnibus:                247.053    Durbin-Watson:          1.893
Prob(Omnibus):           0.000    Jarque-Bera (JB):        948.224
Skew:                    -1.743    Prob(JB):                1.25e-206
Kurtosis:                7.748    Cond. No.:               2.70e+04
=====

```

Warnings:

```

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

```

图 4 剔除不显著变量后的逐步前向回归结果（Python）

从上述结果我们发现,F、t 检验均通过,模型显著。调整的可决系数为0.924,模型表现良好。

最终我们可以计算得到泉州西湖湿地公园的生态功能价值为:

$$P_{bio} = \alpha_{19} \cdot \frac{\sum_{i=1}^{656} P_i}{656} = 9637.88 \text{元} / m^2$$

## 补充材料

### 1. 数据收集代码

```
#!/usr/bin/env python3
# -*- coding: utf-8 -*-
"""
Created on Sun Oct 13 00:27:46 2019
@author: Chonpca
"""

from selenium import webdriver
from bs4 import BeautifulSoup
import time
import random
import urllib.request,urllib.parse,urllib.error
import requests
import ast
from math import radians, cos, sin, asin, sqrt

def geodistance(lng1,lat1,lng2,lat2):
    lng1, lat1, lng2, lat2 = map(radians, [float(lng1), float(lat1), float(lng2), float(lat2)])
    dlon=lng2-lng1
    dlat=lat2-lat1
    a=sin(dlat/2)**2 + cos(lat1) * cos(lat2) * sin(dlon/2)**2
    distance=2*asin(sqrt(a))*6371*1000
    distance=round(distance/1000,3)

    return distance*1000

MyAK='保密'

def get_position(address):
    try:
        url = urllib.parse.quote("http://api.map.baidu.com/geocoding/v3/?address="+
address + "&output=json&ak="+ MyAK +
"&callback=showLocation",safe="/:=&?#+!$,:;'@()*[]")

        req_str = requests.post(url).text[27:-1]
        js = ast.literal_eval(req_str)

        lat=js["result"]["location"]["lat"]
        lng=js["result"]["location"]["lng"]

        return [lng,lat]
```

except:

return 'fuck'

def house\_price(url="https://quanzhou.lianjia.com/ershoufang/105102393069.html"):

try:

driver = webdriver.Firefox()

driver.get(url)

driver.maximize\_window()

#time.sleep(5)

data = driver.page\_source

soup = BeautifulSoup(data,"html.parser")

y = float(soup.find\_all('span',class\_='unitPriceValue')[0].get\_text().replace('元/平米',''))

x1 = float(soup.find\_all('div',class\_='room')[0].find\_all('div',class\_='subInfo')[0].get\_text().split('/')[1].replace('共','').replace('层',''))

x2 = soup.find\_all('div',class\_='room')[0].find\_all('div',class\_='subInfo')[0].get\_text().split('/')[0].replace('楼层','')

x3 = float(soup.find\_all('div',class\_='introContent')[0].find\_all('li')[0].get\_text().replace('房屋户型','').split('室')[0])

x4 = float(soup.find\_all('div',class\_='introContent')[0].find\_all('li')[0].get\_text().replace('房屋户型','').split('室')[1].split('厅')[0])

x5 = float(soup.find\_all('div',class\_='introContent')[0].find\_all('li')[0].get\_text().replace('房屋户型','').split('室')[1].split('厅')[1].split('厨')[0])

x6 = float(soup.find\_all('div',class\_='introContent')[0].find\_all('li')[0].get\_text().replace('房屋户型','').split('室')[1].split('厅')[1].split('厨')[1].split('卫')[0])

x7 = float(soup.find\_all('div',class\_='introContent')[0].find\_all('li')[2].get\_text().replace('建筑面积','').replace('m<sup>2</sup>',''))

x8 = soup.find\_all('div',class\_='introContent')[0].find\_all('li')[9].get\_text().replace('梯户比例','')

x9 = soup.find\_all('div',class\_='introContent')[0].find\_all('li')[8].get\_text().replace('装修情况','')

x10,x11,x12,x13,x14,x15,x16,x17,x18 = 0,0,0,0,0,0,0,0,0



```
driver.find_element_by_xpath(u"(.//*[normalize-space(text()) and normalize-  
space(.)='交通'])[1]/following::li[1]").click()  
time.sleep(random.randint(3,5))  
data = driver.page_source  
soup = BeautifulSoup(data,"html.parser")  
x10 = x10 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))
```

```
driver.find_element_by_xpath(u"(.//*[normalize-space(text()) and normalize-  
space(.)='幼儿园'])[1]/following::div[1]").click()  
time.sleep(random.randint(3,5))  
data = driver.page_source  
soup = BeautifulSoup(data,"html.parser")  
x11 = x11 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))
```

```
driver.find_element_by_xpath(u"(.//*[normalize-space(text()) and normalize-  
space(.)='小学'])[1]/following::div[1]").click()  
time.sleep(random.randint(3,5))  
data = driver.page_source  
soup = BeautifulSoup(data,"html.parser")  
x11 = x11 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))
```

```
driver.find_element_by_xpath(u"(.//*[normalize-space(text()) and normalize-  
space(.)='中学'])[1]/following::div[1]").click()  
time.sleep(random.randint(3,5))  
data = driver.page_source  
soup = BeautifulSoup(data,"html.parser")  
x12 = x12 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))
```

```
driver.find_element_by_xpath(u"(.//*[normalize-space(text()) and normalize-  
space(.)='医疗'])[1]/following::li[1]").click()  
time.sleep(random.randint(3,5))  
data = driver.page_source  
soup = BeautifulSoup(data,"html.parser")  
x13 = x13 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))
```

```
driver.find_element_by_xpath(u"(.//*[normalize-space(text()) and normalize-  
space(.)='商场'])[1]/following::div[1]").click()
```

```

time.sleep(random.randint(3,5))
data = driver.page_source
soup = BeautifulSoup(data,"html.parser")
x13 = x13 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))

driver.find_element_by_xpath(u"(//*[normalize-space(text()) and normalize-
space(.)='超市'])[1]/following::div[1]").click()
time.sleep(random.randint(3,5))
data = driver.page_source
soup = BeautifulSoup(data,"html.parser")
x13 = x13 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))

driver.find_element_by_xpath(u"(//*[normalize-space(text()) and normalize-
space(.)='教育'])[1]/following::li[1]").click()
time.sleep(random.randint(3,5))
data = driver.page_source
soup = BeautifulSoup(data,"html.parser")
x14 = x14 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))

driver.find_element_by_xpath(u"(//*[normalize-space(text()) and normalize-
space(.)='医院'])[1]/following::div[1]").click()
time.sleep(random.randint(3,5))
data = driver.page_source
soup = BeautifulSoup(data,"html.parser")
x14 = x14 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))

driver.find_element_by_xpath(u"(//*[normalize-space(text()) and normalize-
space(.)='PalmCity'])[1]/following::li[1]").click()
time.sleep(random.randint(3,5))
driver.find_element_by_xpath(u"(//*[normalize-space(text()) and normalize-
space(.)='地铁站'])[1]/following::div[1]").click()
time.sleep(random.randint(3,5))
data = driver.page_source
soup = BeautifulSoup(data,"html.parser")
x15 = x15 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))

driver.find_element_by_xpath(u"(//*[normalize-space(text()) and normalize-
space(.)='购物'])[1]/following::li[1]").click()
time.sleep(random.randint(3,5))
data = driver.page_source
soup = BeautifulSoup(data,"html.parser")
x16 = x16 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))

```

```

        driver.find_element_by_xpath(u"(//*[normalize-space(text()) and normalize-
space(.)='生活'])[1]/following::li[1]").click()
        time.sleep(random.randint(3,5))
        data = driver.page_source
        soup = BeautifulSoup(data,"html.parser")
        x17 = x17 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))

```

```

        driver.find_element_by_xpath(u"(//*[normalize-space(text()) and normalize-
space(.)='健身房'])[1]/following::div[1]").click()
        time.sleep(random.randint(3,5))
        data = driver.page_source
        soup = BeautifulSoup(data,"html.parser")
        x17 = x17 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))

```

```

        driver.find_element_by_xpath(u"(//*[normalize-space(text()) and normalize-
space(.)='公园'])[1]/following::div[1]").click()
        time.sleep(random.randint(3,5))
        data = driver.page_source
        soup = BeautifulSoup(data,"html.parser")
        x18 = x18 + len(soup.find_all('div',id = 'mapListContainer')[0].find_all('li'))

```

```

        address =
soup.find_all('div',class_='communityName')[0].find_all('a',class_='info')[0].get_text()

```

```

        pos = get_position('泉州市' + address)

```

```

        if not('fuck' in pos):

```

```

            x19 = geodistance(pos[0],pos[1],118.58153343200685,24.90862481493333)

```

```

        else:

```

```

            x19 = address

```

```

        driver.quit()

```

```

        return [y, x1,x2, x3, x4, x5, x6, x7, x8, x9, x10, x11, x12, x13, x14, x15, x16, x17, x18,
x19]

```

```

    except:

```

```
return [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
```

```
def get_all_list():
```

```
    li = []
```

```
    #global li_tmps
```

```
    #li_tmps=[]
```

```
    driver = webdriver.Firefox()
```

```
    driver.get('https://quanzhou.lianjia.com/ershoufang/rs 丰泽区/')
```

```
    time.sleep(5)
```

```
    driver.maximize_window()
```

```
    data = driver.page_source
```

```
    #print(data)
```

```
    soup = BeautifulSoup(data,"html.parser")
```

```
    li_tmp = soup.find_all('li', class_='LOGCLICKDATA')
```

```
    #li_tmps.append(li_tmp)
```

```
    for j in li_tmp:
```

```
        #print(j.find_all('a')[1].attrs['href'])
```

```
        li.append(j.find_all('a')[1].attrs['href'])
```

```
    for i in range(2,101):
```

```
        print(i)
```

```
        url = "https://quanzhou.lianjia.com/ershoufang/pg" + str(i) + 'rs 丰泽区/'
```

```
        driver.get(url)
```

```
        time.sleep(5)
```

```
        data = driver.page_source
```

```
        #print(data)
```

```
        soup = BeautifulSoup(data,"html.parser")
```

```
        li_tmp = soup.find_all('li', class_='LOGCLICKDATA')
```

```
        #li_tmps.append(li_tmp)
```

```
        for j in li_tmp:
```

```
            #print(j.find_all('a')[1].attrs['href'])
```

```
            li.append(j.find_all('a')[1].attrs['href'])
```

```
driver.quit()
```

```
return li
```

```
house_list = get_all_list()
```

```
f = open('link.txt','a+')
```

```
for i in house_list:
```

```
    f.write(i)
```

```
    f.write('\n')
```

```
f.close()
```

```
for i in house_list:
```

```
    b = house_price(i)
```

```
    a = open('data.txt', 'a+')
```

```
    b = str(b).replace('[', '').replace(']', '').replace(',', '\t')
```

```
    print(b)
```

```
    a.write(b)
```

```
    a.write('\n')
```

```
    a.close()
```

## 1. 选定的房价数据来源（656 个样本）

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<https://quanzhou.lianjia.com/ershoufang/105103223993.html>

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### 3. 数据预处理代码

```
#!/usr/bin/env python3
```

```
# -*- coding: utf-8 -*-
```

```
''''
```

Created on Thu Oct 31 21:49:24 2019

@author: Chonpca

```
''''
```

```
digit = {'一': 1, '二': 2, '三': 3, '四': 4, '五': 5, '六': 6, '七': 7, '八': 8, '九': 9}
```

```
def _trans(s):
```

```
    num = 0
```

```
    if s:
```

```
        idx_q, idx_b, idx_s = s.find('千'), s.find('百'), s.find('十')
```

```
        if idx_q != -1:
```

```
            num += digit[s[idx_q - 1:idx_q]] * 1000
```

```
        if idx_b != -1:
```

```
            num += digit[s[idx_b - 1:idx_b]] * 100
```

```
        if idx_s != -1:
```

```
            # 十前忽略一的处理
```

```
            num += digit.get(s[idx_s - 1:idx_s], 1) * 10
```

```
        if s[-1] in digit:
```

```

        num += digit[s[-1]]
    return num

def trans(chn):
    chn = chn.replace('零', '')
    idx_y, idx_w = chn.rfind('亿'), chn.rfind('万')
    if idx_w < idx_y:
        idx_w = -1
    num_y, num_w = 100000000, 10000
    if idx_y != -1 and idx_w != -1:
        return trans(chn[:idx_y]) * num_y + _trans(chn[idx_y + 1:idx_w]) * num_w +
        _trans(chn[idx_w + 1:])
    elif idx_y != -1:
        return trans(chn[:idx_y]) * num_y + _trans(chn[idx_y + 1:])
    elif idx_w != -1:
        return _trans(chn[:idx_w]) * num_w + _trans(chn[idx_w + 1:])
    return _trans(chn)

f = open('data.txt', 'r')
f = f.readlines()
l = open('link.txt', 'r')
l = l.readlines()
counter = 0
for i in f:
    if i[0] != '0' and not('挂牌时间' in i):
        a = open('data_processing.txt', 'a+')
        a.write(i)
        a.close()
        b = open('link_choosing.txt', 'a+')
        b.write(l[counter])
        b.close()
        counter = counter + 1

f = open('data_processing.txt', 'r')
# 毛: 1 简: 2 精: 3 其他: 4
# 低: 1 中: 2 高: 3

f = f.readlines()
for i in f:

```

```

i = i.split()
print(i)
if i[2] == "低":
    i[2] = '1'
elif i[2] == "中":
    i[2] = '2'
elif i[2] == "高":
    i[2] = '3'

if i[9] == "毛坯":
    i[9] = '1'
elif i[9] == "简装":
    i[9] = '2'
elif i[9] == "精装":
    i[9] = '3'
elif i[9] == "其他":
    i[9] = '4'

ii = i[8].split('梯')
a = ii[0].replace("\",")
b = ii[1].replace('户',").replace("\",")
print(a)
print(b)
if a == '两':
    a = 2
else:
    a = trans(a)
if b == '两':
    b = 2
else:
    b = trans(b)

i[8] = str(b/a)

c = open('data_trans.txt','a+')
for j in i:
    c.write(j)
    c.write("\t")
c.write("\n")
c.close()

```

#### 4. 普通线性回归代码

```
#!/usr/bin/env python3
# -*- coding: utf-8 -*-
"""
Created on Fri Nov 1 13:35:48 2019

@author: Chonpca
"""

import pandas as pd
import numpy as np
import statsmodels.api as sm
from sklearn import preprocessing

data = pd.read_table('data_trans.txt',header=None)
data = np.array(data)
data = data[:,0:20]
data = np.hstack((data[:,0:5],data[:,6:20]))
#min_max_scaler = preprocessing.MinMaxScaler()
#data = min_max_scaler.fit_transform(data)
#data = preprocessing.scale(data)
data = preprocessing.normalize(data, norm='l2')

#tmp = np.array(data)
y = data[:,0:1]
x = data[:,1:20]

#y = np.log(y)

#x= sm.add_constant(x)
x= sm.add_constant(x)
##model = sm.OLS(y,X)
model = sm.OLS(y,x)
results = model.fit()
##print(results.params)
print(results.summary())

data_pd = np.hstack((y,data[:,1:20]))
data_pd = pd.DataFrame(data_pd)
data_pd.columns =
```

```
['y','x1','x2','x3','x4','x6','x7','x8','x9','x10','x11','x12','x13','x14','x15','x16','x17','x18','x19']
```

## 5. 向前逐步回归

```
#!/usr/bin/env python3
# -*- coding: utf-8 -*-
.....
```

Created on Fri Nov 1 00:48:28 2019

```
@author: Chonpca
.....
```

```
import statsmodels.formula.api as smf
import pandas as pd
```

```
def forward_selected(data, response):
```

```
    remaining = set(data.columns)
    remaining.remove(response)
    selected = []
    current_score, best_new_score = 0.0, 0.0
    while remaining and current_score == best_new_score:
        scores_with_candidates = []
        for candidate in remaining:
            formula = "{} ~ {} + 1".format(response,
                                           ' + '.join(selected + [candidate]))

            try:

                score = smf.ols(formula, data).fit().rsquared_adj
                #print(formula)
                scores_with_candidates.append((score, candidate))
            except:

                scores_with_candidates.append((0, candidate))
        scores_with_candidates.sort()
        best_new_score, best_candidate = scores_with_candidates.pop()
        if current_score < best_new_score:
            remaining.remove(best_candidate)
            selected.append(best_candidate)
            current_score = best_new_score
    formula = "{} ~ {} + 1".format(response,
                                    ' + '.join(selected))
    model = smf.ols(formula, data).fit()
    return model
```



```

def main():
    data = pd.read_table('data_trans.txt', header=None)
    data = np.array(data)
    data = data[:, 0:20]
    data = np.hstack((data[:, 0:5], data[:, 6
    data = preprocessing.normalize(data, norm='l2')

    data_pd = np.hstack((y, data[:, 1:20]))
    data_pd = pd.DataFrame(data_pd)
    data_pd.columns =
    ['y', 'x1', 'x2', 'x3', 'x4', 'x6', 'x7', 'x8', 'x9', 'x10', 'x11', 'x12', 'x13', 'x14', 'x15', 'x16', 'x17', 'x18', 'x19']

    model = forward_selected(data_pd, 'y')
    print(model.model.formula)
    print(model.params)
    print(model.summary())

if __name__ == '__main__':
    main()

```