```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sn

```

背景介绍
新型冠状病毒感染的肺炎疫情爆发后，对人们的生活产生很大的影响。
当前感染人数依然在不断变化。每天国家卫健委和各大新闻媒体都会公布疫情的数据，包括累计确诊人数、现有确诊人数等。
本案例使用python对新冠肺炎的数据（韩国）进行分析。

读取数据集

```
patientdata=pd.read_csv("D:360Downloads\PatientInfo.csv")
region=pd.read_csv("D:360Downloads\Region.csv")
```

Task1

数据预处理

查看数据前五行

```
patientdata.head()
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	patient_id	global_num	sex	birth_year	age	country	province	city	disease	infection_case	infe
0	1000000001	2.0	male	1964.0	50s	Korea	Seoul	Gangseo-gu	NaN	overseas inflow	1.0
1	1000000002	5.0	male	1987.0	30s	Korea	Seoul	Jungnang-gu	NaN	overseas inflow	1.0
2	1000000003	6.0	male	1964.0	50s	Korea	Seoul	Jongno-gu	NaN	contact with patient	2.0
3	1000000004	7.0	male	1991.0	20s	Korea	Seoul	Mapo-gu	NaN	overseas inflow	1.0
4	1000000005	9.0	female	1992.0	20s	Korea	Seoul	Seongbuk-gu	NaN	contact with patient	2.0

检测数据缺失值

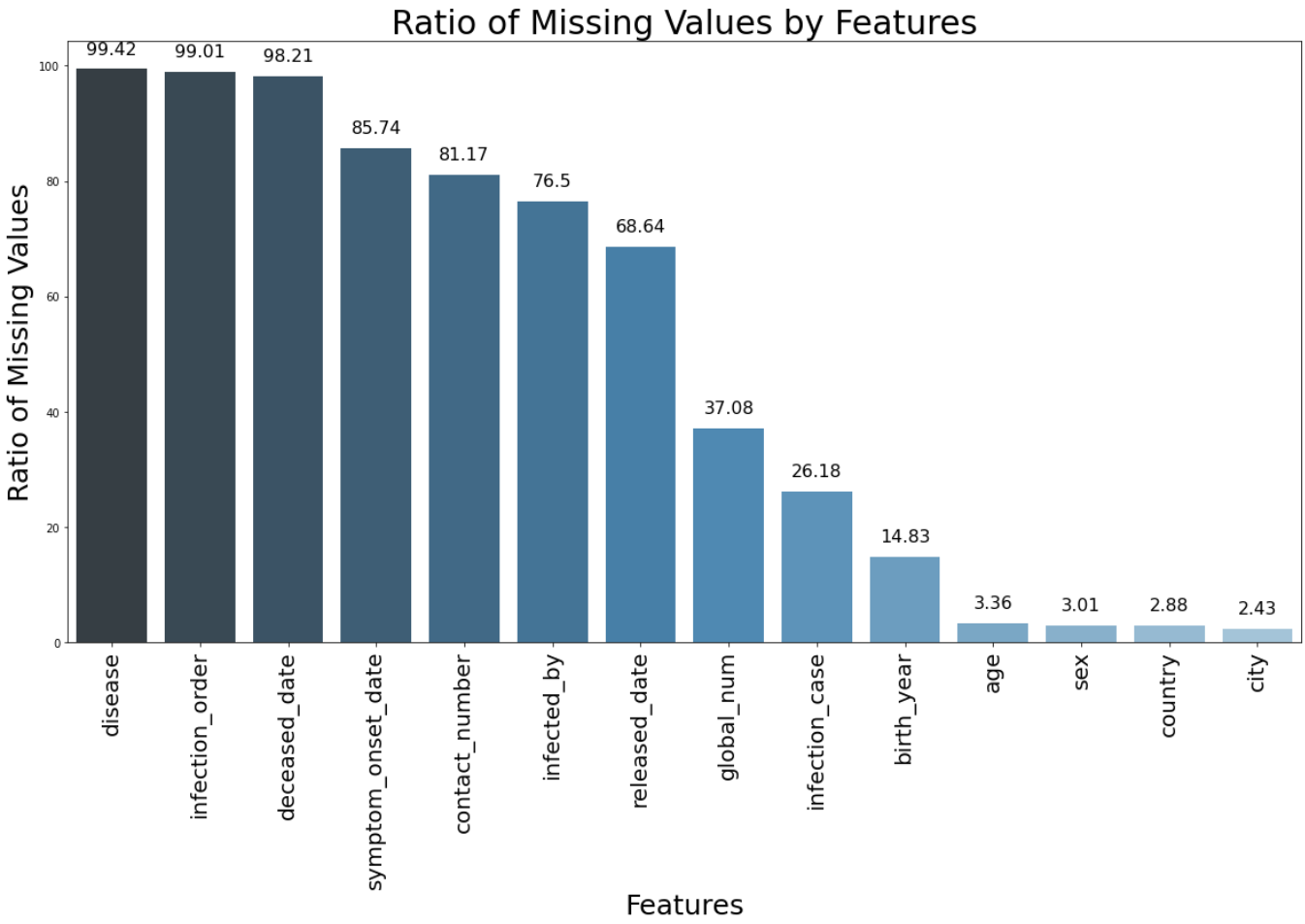
```
patientdata.isnull().sum()

```

```
patient_id              0
global_num           1160
sex                    94
birth_year            464
age                   105
country                90
province                0
city                   76
disease              3110
infection_case        819
infection_order      3097
infected_by          2393
contact_number       2539
symptom_onset_date   2682
confirmed_date          0
released_date        2147
deceased_date        3072
state                   0
```

```
dtype: int64
```

```
na_ratio = pd.DataFrame(patientdata.isnull().sum()/len(patientdata)*100,columns=['NA_Ratio'])
p_na = na_ratio[na_ratio['NA_Ratio']>0].sort_values(by = 'NA_Ratio', ascending=False)
```

```
fig, ax = plt.subplots(figsize=(20,10))
nar = sn.barplot(x=p_na.index, y=p_na['NA_Ratio'],orient='v',palette="Blues_d")
ax.set_xticklabels(p_na.index, rotation=90, fontsize=20)
ax.set_ylabel('Ratio of Missing Values', fontsize=25)
ax.set_xlabel('Features', fontsize=25)
ax.set_title('Ratio of Missing Values by Features', fontsize=30)
for loc, value in zip(ax.patches, p_na.NA_Ratio):
    ax.text(loc.get_x()+loc.get_width()/2, loc.get_height()+2, round(value,2),ha='center', va='bottom',fontsize=16)
plt.show()
```



我们对于图表当中缺失的特征值进行处理

我们对于'disease' 'infected_by''symptom_onset_date''deceased_date''released_date',NaN表示没有这个特征，可以将NaN用None代替。

```
none_col=['disease', 'infected_by','symptom_onset_date','deceased_date','released_date']
patientdata[none_col]=patientdata[none_col].fillna('None')
```

对于'contact_number'用平均值填补

```
patientdata['contact_number'].fillna(patientdata['contact_number'].mean(),inplace=True)
```

对于'country''city''province''infection_case''age''sex''birth_year'采用众数填补

```
patientdata['city'].fillna(patientdata['city'].mode()[0],inplace=True)
patientdata['country'].fillna(patientdata['country'].mode()[0],inplace=True)
patientdata['infection_case'].fillna(patientdata['infection_case'].mode()[0],inplace=True)
patientdata['age'].fillna(patientdata['age'].mode()[0],inplace=True)
patientdata['sex'].fillna(patientdata['sex'].mode()[0],inplace=True)
patientdata['birth_year'].fillna(patientdata['birth_year'].mode()[0],inplace=True)

```

去除无用特征ID,因为global_num以及infection_order缺失的比例过大，考虑删除这两个特征,因为age和bitrhyear有多重共线性，只考虑birthyear，删除age

```
patientdata.drop('patient_id',axis=1,inplace=True)
patientdata.drop('global_num',axis=1,inplace=True)
patientdata.drop('infection_order',axis=1,inplace=True)
patientdata.drop('age',axis=1,inplace=True)

```

再次查看缺失，确认已完成缺失值处理

```
patientdata.isnull().sum()
```

```
sex                   0
birth_year            0
country               0
province              0
city                  0
disease               0
infection_case        0
infected_by           0
contact_number        0
symptom_onset_date    0
confirmed_date        0
released_date         0
deceased_date         0
state                 0
dtype: int64
```

region中，将kindergarden，elementary_school_count,university_count加在一起，用education_healthy_facilities表示

```
region['education_healthy_facilities']=region['kindergarten_count']+region['elementary_school_count']+region['university_count']
region.head()
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	code	province	city	latitude	longitude	elementary_school_count	kindergarten_count	university_count	academy_ra
0	10000	Seoul	Seoul	37.566953	126.977977	607	830	48	1.44
1	10010	Seoul	Gangnam-gu	37.518421	127.047222	33	38	0	4.18
2	10020	Seoul	Gangdong-gu	37.530492	127.123837	27	32	0	1.54
3	10030	Seoul	Gangbuk-gu	37.639938	127.025508	14	21	0	0.67
4	10040	Seoul	Gangseo-gu	37.551166	126.849506	36	56	1	1.17

将region的数据导入patientdata中，作为patient新的特征列

```

def getRegion(dataframe,dR):

    dataframe['education_healthy_facilities']=0
    dataframe['latitude']=0
    dataframe['longitude']=0
    dataframe['academy_ratio']=0
    dataframe['elderly_population_ratio']=0
    for i in dataframe.index:
        for j in dR.index:

            if dataframe.loc[i,'city']==dR.loc[j,'city']:
                dataframe.loc[i,'latitude']=dR.loc[j,'latitude']
                dataframe.loc[i,'longitude']=dR.loc[j,'longitude']
                dataframe.loc[i,'education_healthy_facilities']=dR.loc[j,'education_healthy_facilities']
                dataframe.loc[i,'academy_ratio']=dR.loc[j,'academy_ratio']
                dataframe.loc[i,'elderly_population_ratio']=dR.loc[j,'elderly_population_ratio']

```

```
    return dataframe
```

```
getRegion(patientdata,region)

```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	sex	birth_year	country	province	city	disease	infection_case	infected_by	contact_number	symptom_onset_da
0	male	1964.0	Korea	Seoul	Gangseo-gu	None	overseas inflow	None	75.0	2020-01-22
1	male	1987.0	Korea	Seoul	Jungnang-gu	None	overseas inflow	None	31.0	None
2	male	1964.0	Korea	Seoul	Jongno-gu	None	contact with patient	2.002e+09	17.0	None
3	male	1991.0	Korea	Seoul	Mapo-gu	None	overseas inflow	None	9.0	2020-01-26
4	female	1992.0	Korea	Seoul	Seongbuk-gu	None	contact with patient	1e+09	2.0	None
...	...	...	...	...	...	...	...	...	...	...
3123	female	1995.0	Korea	Jeju-do	Jeju-do	None	overseas inflow	None	20.0	None
3124	male	1995.0	United States	Jeju-do	Jeju-do	None	overseas inflow	None	23.0	None
3125	female	1996.0	Korea	Jeju-do	Jeju-do	None	overseas inflow	None	26.0	None
3126	female	1995.0	Korea	Jeju-do	Jeju-do	None	overseas inflow	None	25.0	None
3127	female	1995.0	Korea	Jeju-do	Jeju-do	None	overseas inflow	None	14.0	None

3128 rows × 19 columns

查看特征类型

```
type_p=patientdata.columns.groupby(patientdata.dtypes)
[(i,len(type_p[i]),type_p[i]) for i in type_p]
```

```
[(dtype('int64'), 1, Index(['education_healthy_facilities'], dtype='object')),
 (dtype('float64'),
  6,
  Index(['birth_year', 'contact_number', 'latitude', 'longitude',
         'academy_ratio', 'elderly_population_ratio'],
        dtype='object')),
 (dtype('O'),
  12,
  Index(['sex', 'country', 'province', 'city', 'disease', 'infection_case',
         'infected_by', 'symptom_onset_date', 'confirmed_date', 'released_date',
         'deceased_date', 'state'],
        dtype='object'))]
```

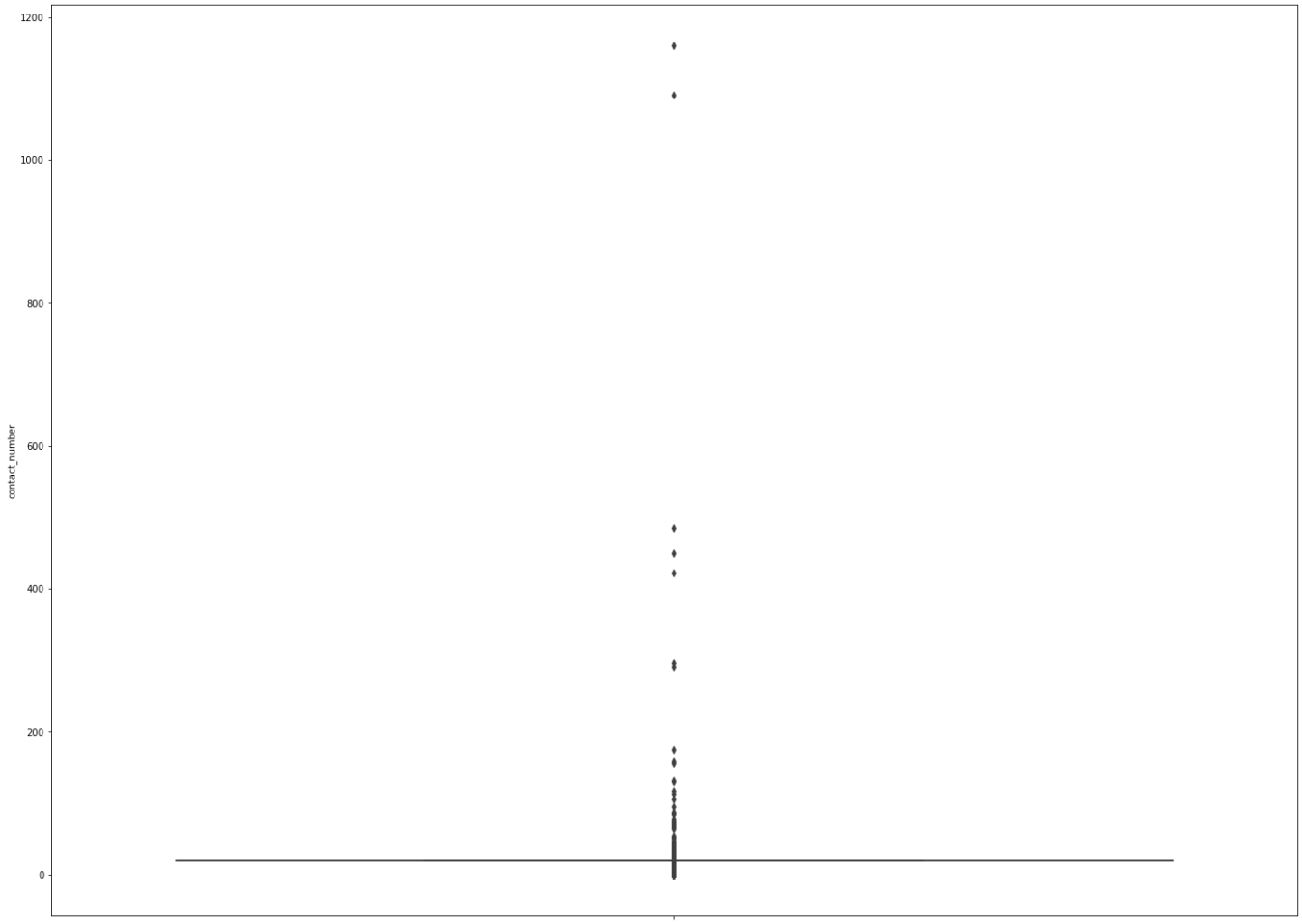
可以知道数值特征有6个，非数值特征有12个

首先对数值型特征去除异常值

首先，对异常值进行查看

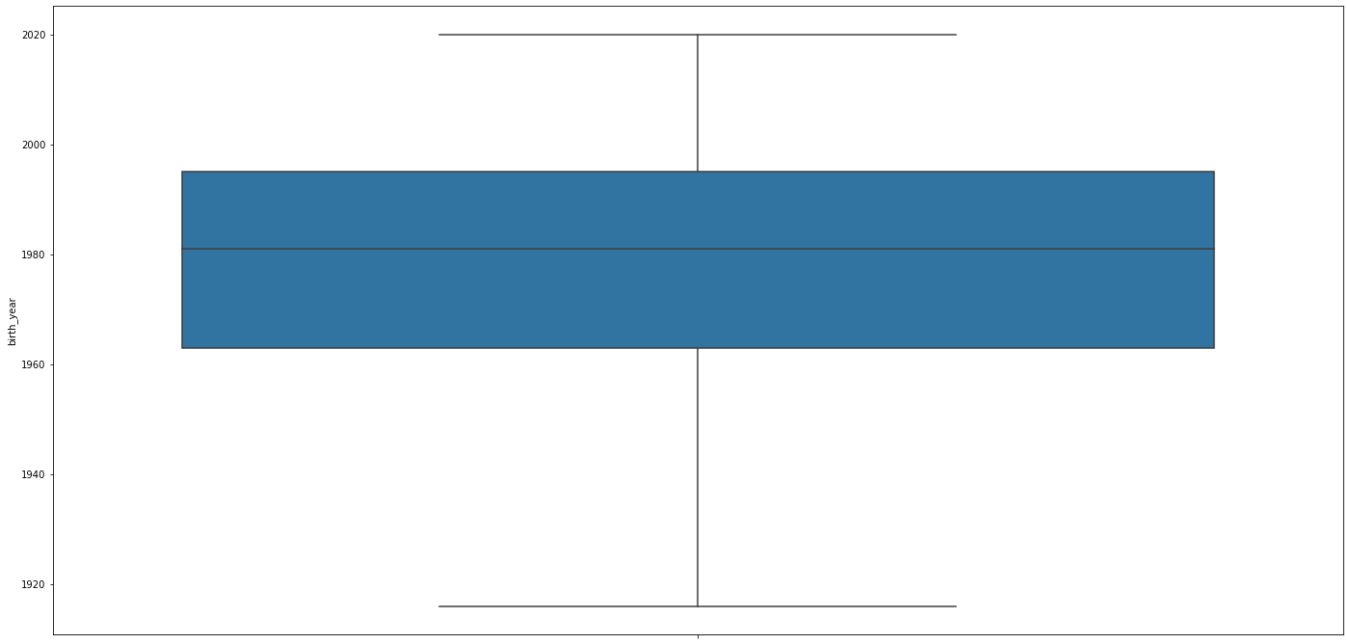
```
fig, axes = plt.subplots(1,1)
fig.set_size_inches(24,18)
sn.boxplot(data=patientdata, y="contact_number")

```

```
<matplotlib.axes._subplots.AxesSubplot at 0x180cb7ea2e0>
```




```
fig, axes = plt.subplots(1,1)
fig.set_size_inches(24,12)
sn.boxplot(data=patientdata, y="birth_year")

```

```
<matplotlib.axes._subplots.AxesSubplot at 0x180cd9ac490>
```



删除小于contact_number小于0，以及birthyear大于2020，小于1920的数据

```
patientdata.drop(patientdata[patientdata['contact_number']<0].index)
patientdata.drop(patientdata[(patientdata['birth_year']<1920)|(patientdata['birth_year']>2020)].index)
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	sex	birth_year	country	province	city	disease	infection_case	infected_by	contact_number	symptom_onset_da
0	male	1964.0	Korea	Seoul	Gangseo-gu	None	overseas inflow	None	75.0	2020-01-22
1	male	1987.0	Korea	Seoul	Jungnang-gu	None	overseas inflow	None	31.0	None
2	male	1964.0	Korea	Seoul	Jongno-gu	None	contact with patient	2.002e+09	17.0	None
3	male	1991.0	Korea	Seoul	Mapo-gu	None	overseas inflow	None	9.0	2020-01-26
4	female	1992.0	Korea	Seoul	Seongbuk-gu	None	contact with patient	1e+09	2.0	None
...	...	...	...	...	...	...	...	...	...	...
3123	female	1995.0	Korea	Jeju-do	Jeju-do	None	overseas inflow	None	20.0	None
3124	male	1995.0	United States	Jeju-do	Jeju-do	None	overseas inflow	None	23.0	None
3125	female	1996.0	Korea	Jeju-do	Jeju-do	None	overseas inflow	None	26.0	None
3126	female	1995.0	Korea	Jeju-do	Jeju-do	None	overseas inflow	None	25.0	None
3127	female	1995.0	Korea	Jeju-do	Jeju-do	None	overseas inflow	None	14.0	None

3127 rows × 19 columns

数字编码，使用sklearn中的LabelEnconder对有优劣之分或次序关系的分类特征进行数字编码

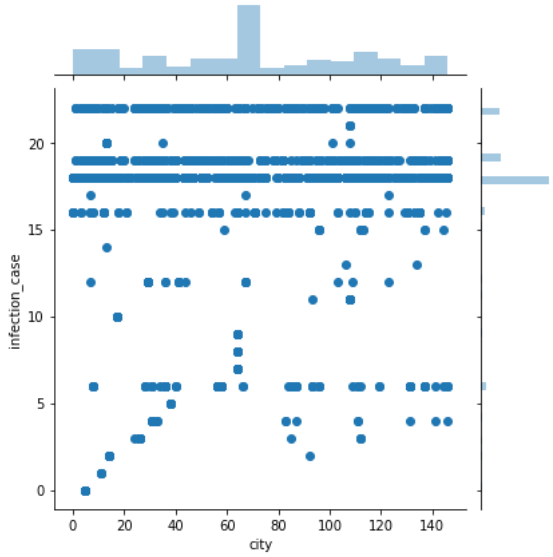
```
#导入LabelEncoder
from sklearn.preprocessing import LabelEncoder
```

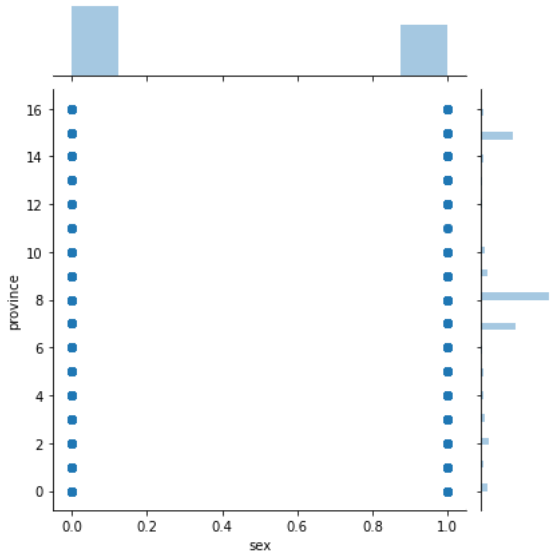
```
column=['sex','country','province','city','infection_case','state']
for col in column:
    le=LabelEncoder()
    patientdata[col]=le.fit_transform(patientdata[col])

```

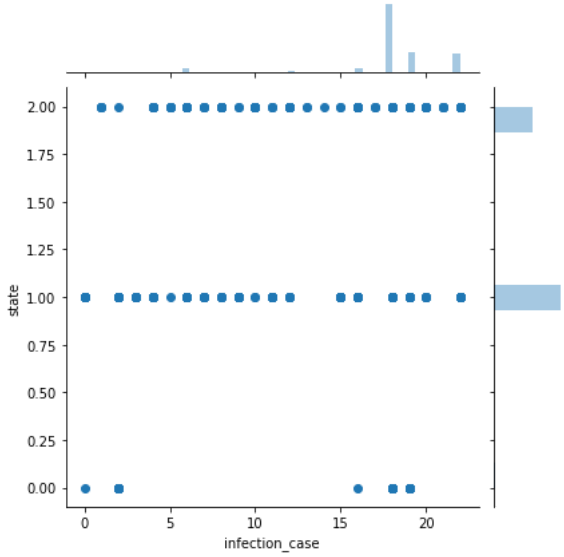
对patientinfo的各个特征进行可视化处理

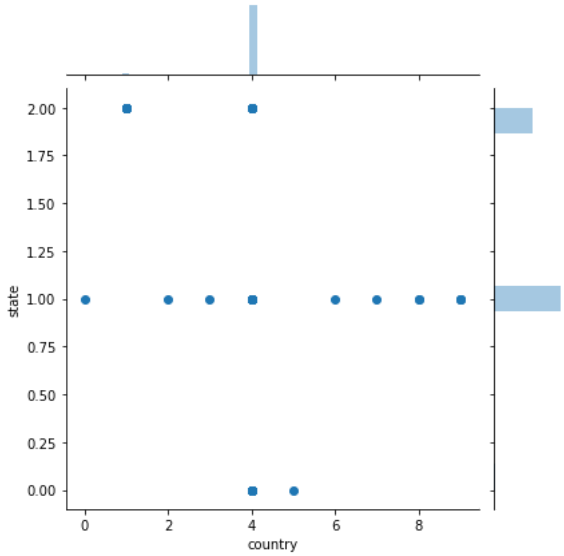
```
sn.jointplot(x="city", y="infection_case", data=patientdata, kind="scatter")
sn.jointplot(x="sex", y="province", data=patientdata, kind="scatter")
sn.jointplot(x="infection_case", y="state", data=patientdata, kind="scatter")
sn.jointplot(x="country", y="state", data=patientdata, kind="scatter")
sn.jointplot(x="birth_year", y="state", data=patientdata, kind="scatter")
```

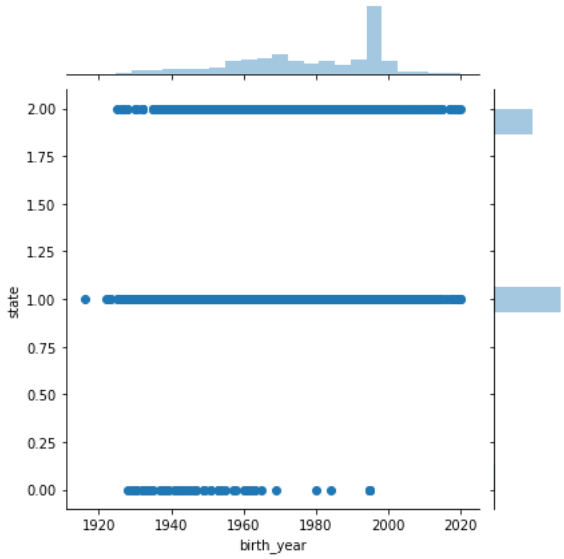
```
<seaborn.axisgrid.JointGrid at 0x180cdd47100>
```












```
1 # 对'time','Timegender','Timeage','Timeprovince'进行可视化处理
```

读取数据集'Time','Timegender','Timeage','Timeprovince'

```
time=pd.read_csv("D:360Downloads\Time.csv")
timeage=pd.read_csv("D:360Downloads\TimeAge.csv")
timegender=pd.read_csv("D:360Downloads\TimeGender.csv")
timeprovince=pd.read_csv("D:360Downloads\TimeProvince.csv")
```

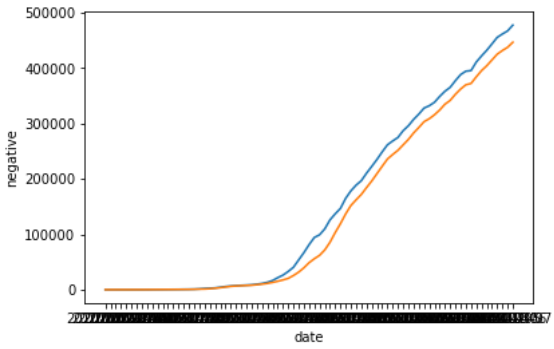
```
time.head()
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

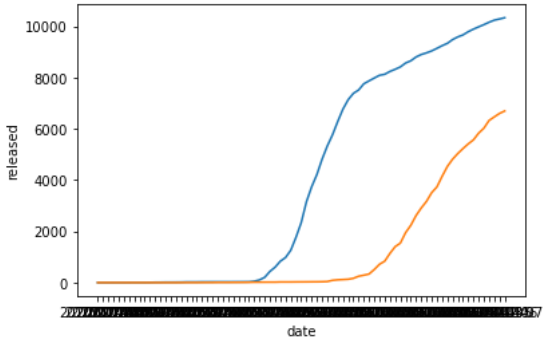
	date	time	test	negative	confirmed	released	deceased
0	2020-01-20	16	1	0	1	0	0
1	2020-01-21	16	1	0	1	0	0
2	2020-01-22	16	4	3	1	0	0
3	2020-01-23	16	22	21	1	0	0
4	2020-01-24	16	27	25	2	0	0

对于time文件里的各项属性进行可视化处理

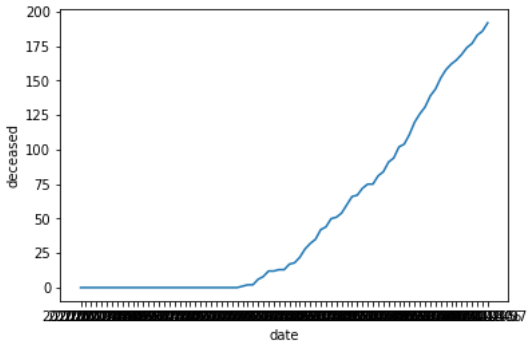
```
ax=sn.lineplot(x='date',y='test',data=time)
ax=sn.lineplot(x='date',y='negative',data=time)

```




```
ax=sn.lineplot(x='date',y='confirmed',data=time)
ax=sn.lineplot(x='date',y='released',data=time)

```




```
ax=sn.lineplot(x='date',y='deceased',data=time)
```



再对timeage的数据进行可视化处理

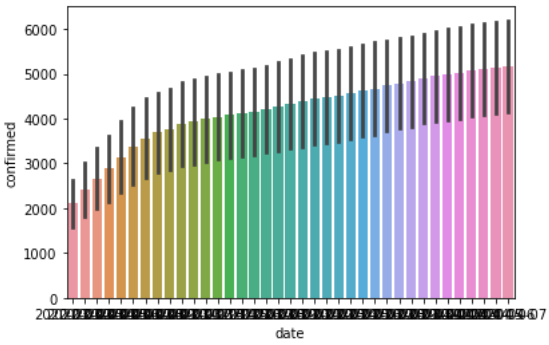
```
timeage.head()
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	date	time	age	confirmed	deceased
0	2020-03-02	0	0s	32	0
1	2020-03-02	0	10s	169	0
2	2020-03-02	0	20s	1235	0
3	2020-03-02	0	30s	506	1
4	2020-03-02	0	40s	633	1

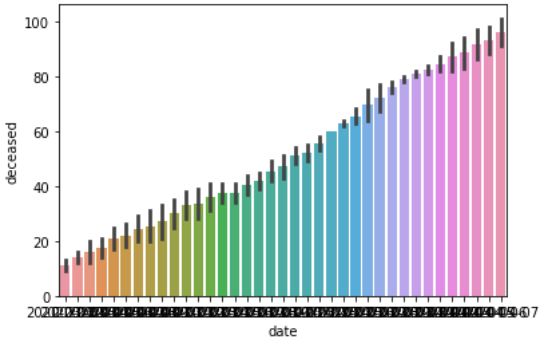
对'confirmed'可视化

```
# age = timeage['age']
# ax =sn.distplot(age)
ax=sn.barplot(x='date',y='confirmed',data=timegender)
```



对deceased可视化

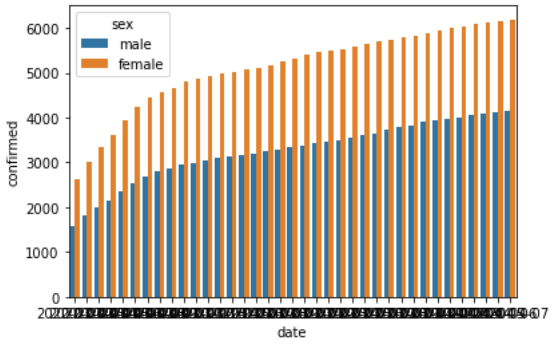
```
# deceased = timeage['deceased']
# ax =sn.distplot(deceased)
ax=sn.barplot(x='date',y='deceased',data=timegender)
```



对timegender进行可视化处理

对'confirmed'和'sex'进行关联可视化

```
# time = timegender['sex']
# ax =sn.distplot(time)
ax=sn.barplot(x='date',y='confirmed',hue = 'sex',data=timegender)
```

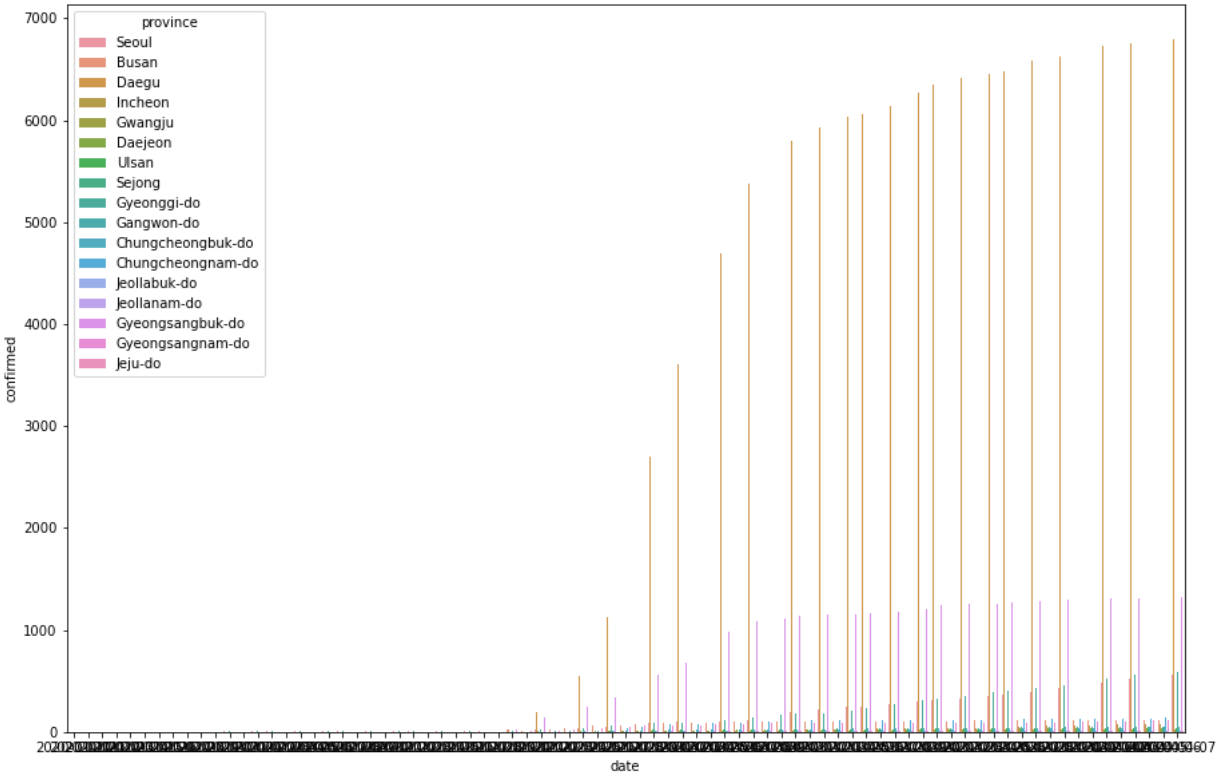


从上表中看出女性确诊数要多于男性

对timeprovince进行可视化处理

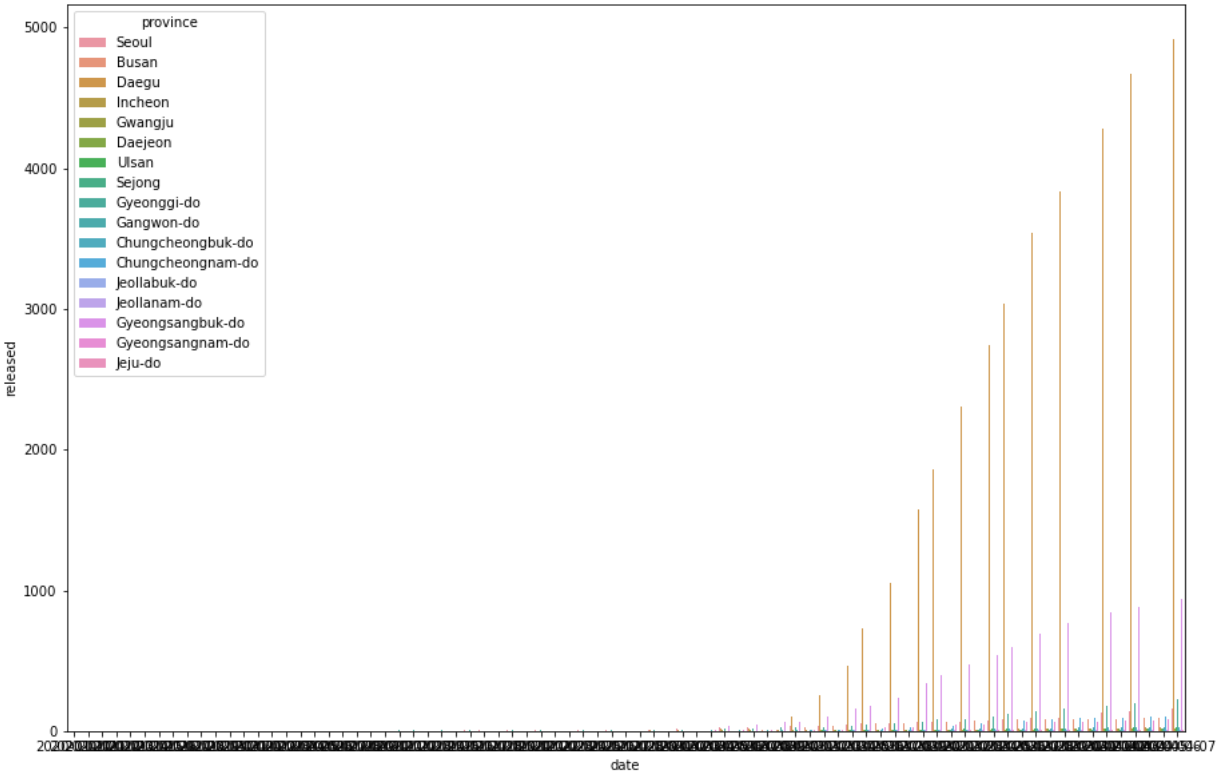
对confirmed和province进行关联可视化处理

```
plt.figure(figsize=(15, 10))
ax=sn.barplot(x='date',y='confirmed',hue = 'province',data=timeprovince)
```



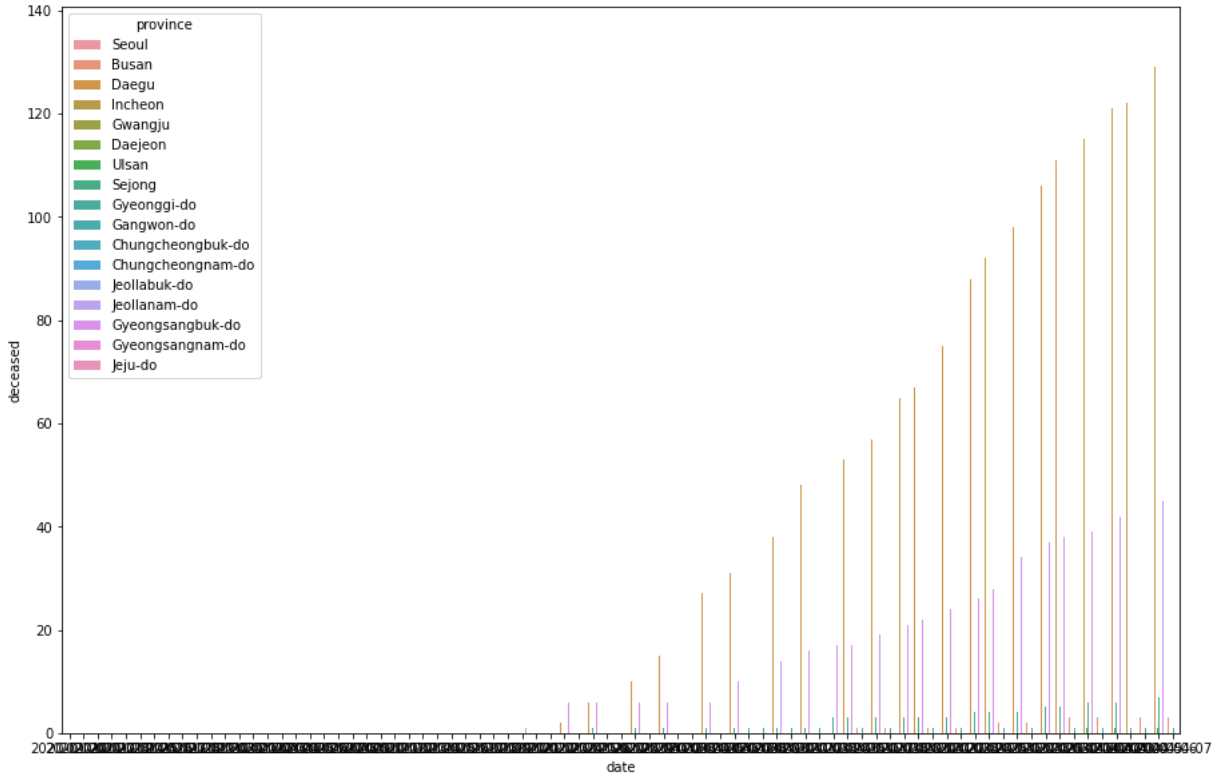
对released和province进行关联可视化处理

```
plt.figure(figsize=(15, 10))
ax=sn.barplot(x='date',y='released',hue = 'province',data=timeprovince)
```



对deceased和province进行关联可视化处理

```
plt.figure(figsize=(15, 10))
ax=sn.barplot(x='date',y='deceased',hue = 'province',data=timeprovince)
```



Task2 预测病人的恢复时间

首先，删除released_date为none的数据

```
list=patientdata[(patientdata['released_date']=='None')].index.tolist()
patientdata=patientdata.drop(list)
```

对confirmed_date和released_date列提取新特征，组成新的列

```
from datetime import datetime
patientdata['confirmed_date'].astype(str)
patientdata["confirm_year"] = patientdata.confirmed_date.apply(lambda x: x.split()[0].split("-")[0])
patientdata["confrim_month"] = patientdata.confirmed_date.apply(lambda x: datetime.strptime(x, "%Y-%m-%d").month)
patientdata["confrim_day"] = patientdata.confirmed_date.apply(lambda x: datetime.strptime(x, "%Y-%m-%d").day)
patientdata['released_date'].astype(str)
patientdata["released_year"] = patientdata.released_date.apply(lambda x: x.split()[0].split("-")[0])
patientdata["released_month"] = patientdata.released_date.apply(lambda x: datetime.strptime(x, "%Y-%m-%d").month)
patientdata["released_day"] = patientdata.released_date.apply(lambda x: datetime.strptime(x, "%Y-%m-%d").day)
patientdata

```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	sex	birth_year	country	province	city	disease	infection_case	infected_by	contact_number	symptom_onset_date	...
0	1	1964.0	4	15	36	None	22	None	75.000000	2020-01-22	...
1	1	1987.0	4	15	85	None	22	None	31.000000	None	...
2	1	1964.0	4	15	83	None	18	2.002e+09	17.000000	None	...
3	1	1991.0	4	15	86	None	22	None	9.000000	2020-01-26	...
4	0	1992.0	4	15	112	None	18	1e+09	2.000000	None	...
...	...	...	...	...	...	...	...	...	...	...	...
3092	1	1971.0	4	9	39	None	19	None	18.908319	None	...
3119	1	1998.0	4	11	78	None	19	None	87.000000	None	...
3120	0	1998.0	4	11	78	None	19	None	84.000000	None	...
3121	0	1972.0	4	11	146	None	19	None	21.000000	None	...
3122	1	1974.0	4	11	78	None	19	None	74.000000	None	...

981 rows × 25 columns

计算confirm_date 和released_date 之间的日子，形成新的列recoverytime

定义函数计算recovertime

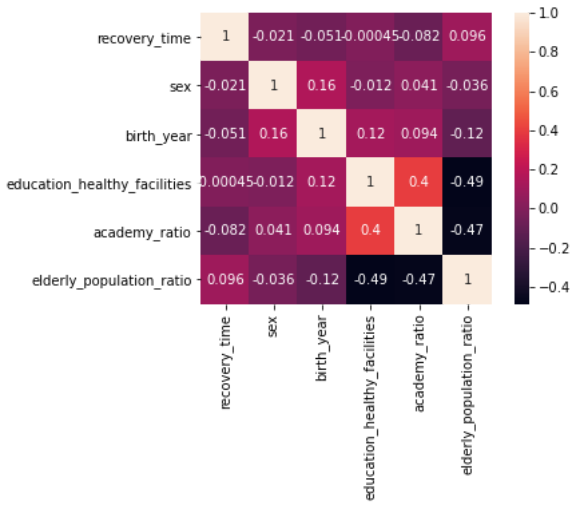
```
def cal_Days(am,ad,fm,fd):
    if am==2 and fm==2:
        return ad-fd
    elif am==3 and fm==2:
        return ad-fd+29
    elif am==4 and fm==2:
        return ad-fd+29+31
    elif am==3 and fm==3:
        return ad-fd
    elif am==4 and fm==3:
        return ad-fd+31
    elif am==4 and fm==4:
        return ad-fd
    elif am==1 and fm==1:
        return ad-fd
    elif am==2 and fm==1:
        return ad-fd+31
    elif am==3 and fm==1:
        return ad-fd+31+29
    elif am==4 and fm==1:
        return ad-fd+31+29+31
```

```
patientdata['recovery_time']=patientdata.apply(lambda x:
cal_Days(x['released_month'],x['released_day'],x['confrim_month'],x['confrim_day']),axis=1)
```

我们使用seaborn中的热力图来表明recovery_time和其他特征的关系，这里我们绘制recovery_time vs sex，birthyear，province，country，city，infection_case的热力图

```
corrMat = patientdata[["recovery_time",
"sex","birth_year",'education_healthy_facilities','academy_ratio','elderly_population_ratio']].corr()
sn.heatmap(corrMat, annot=True, square=True)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x180d037d6d0>
```



我们可以看出academy_ratio和education_healthy_ratio之间有很高的相关性，我们关注的是recovery_time和其他各个特征之间的相关性
我们看出recovery_time和elderly_population_ratio正相关，和academy_ratio,education_healthy_facilities,birthyear

接下来通过这几种特征和线性回归预测病人的恢复时间，首先去除其他无用的特征

```
X=patientdata[['sex','birth_year','education_healthy_facilities','academy_ratio','elderly_population_ratio']]
Ylabel=patientdata['recovery_time']
X.describe()
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	sex	birth_year	education_healthy_facilities	academy_ratio	elderly_population_ratio
count	981.000000	981.000000	981.000000	981.000000	981.000000
mean	0.405708	1979.910296	111.426096	1.497105	15.302691
std	0.491279	18.239453	56.889419	0.451158	4.859581
min	0.000000	1925.000000	0.000000	0.000000	0.000000
25%	0.000000	1966.000000	92.000000	1.340000	12.770000
50%	0.000000	1983.000000	102.000000	1.340000	16.180000
75%	1.000000	1995.000000	111.000000	1.760000	16.180000
max	1.000000	2020.000000	310.000000	4.180000	35.260000

训练集，测试集划分，比例为70，30

```
from sklearn.model_selection import train_test_split
train_x, test_x, train_y, test_y = train_test_split(X, Ylabel, test_size = 0.3, random_state=42)
```

```
# 构建线性回归模型
from sklearn.linear_model import LinearRegression
Model = LinearRegression()
```

```
X.isnull().sum()
```

```
sex                           0
birth_year                    0
education_healthy_facilities    0
academy_ratio                 0
elderly_population_ratio      0
dtype: int64
```

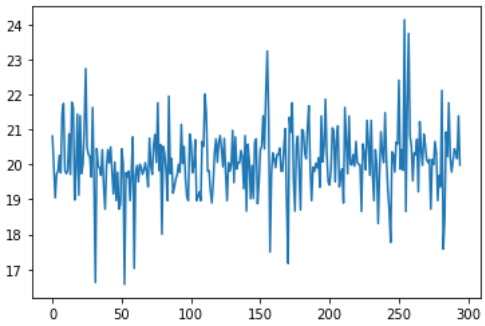
```
# 用训练集训练模型
Model.fit(X= train_x, y = train_y)

# 模型预测
preds = Model.predict(X= test_x)
```

```
from sklearn.metrics import mean_squared_error
print("线性回归的标准差RMSE:", mean_squared_error(test_y, preds))
```

```
线性回归的标准差RMSE: 54.342400462634934
```

```
#结果可视化
plt.plot(preds)
```

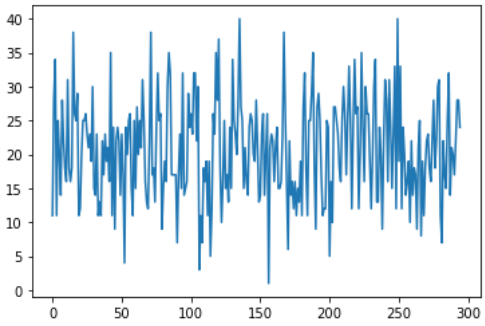
```
[<matplotlib.lines.Line2D at 0x180badff460>]
```



和测试集的recovery_time相比较

```
plt.plot(np.array(test_y))
```

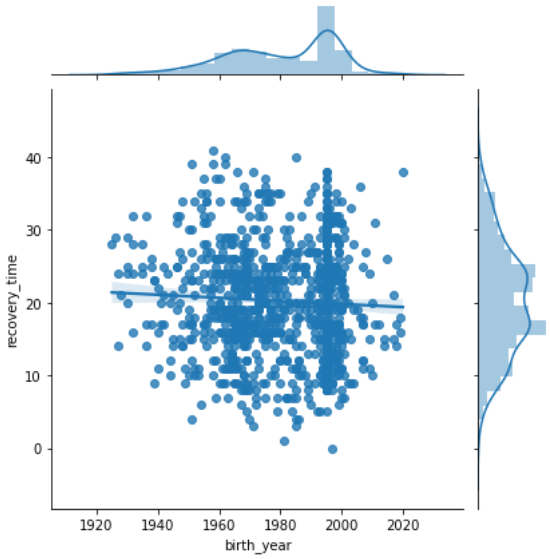
```
[<matplotlib.lines.Line2D at 0x180ce945af0>]
```

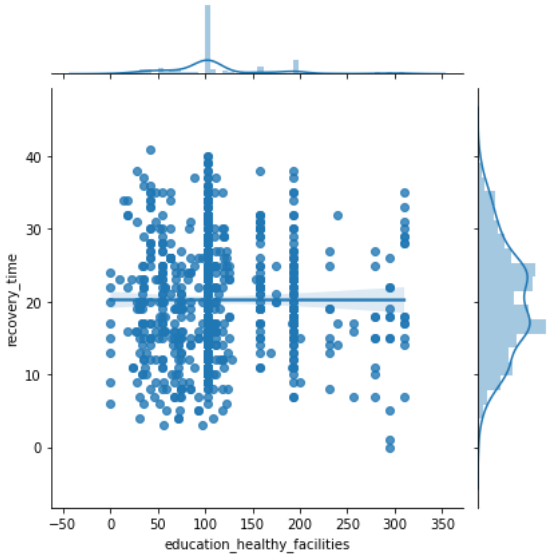


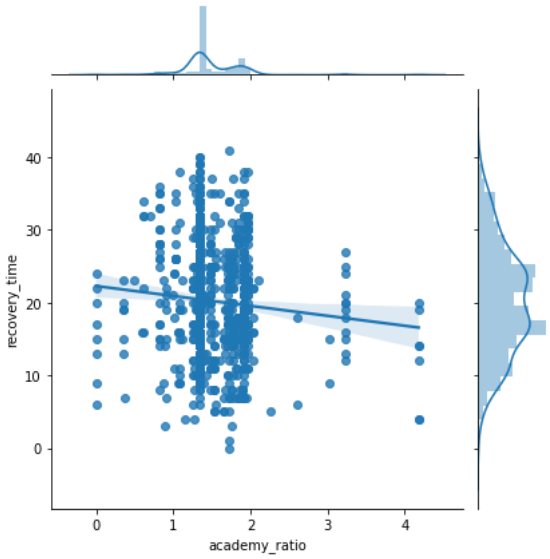
绘制recovery_time vs birth_year education_healthy_facilities academy_ratio elderly_population_ratio的回归图

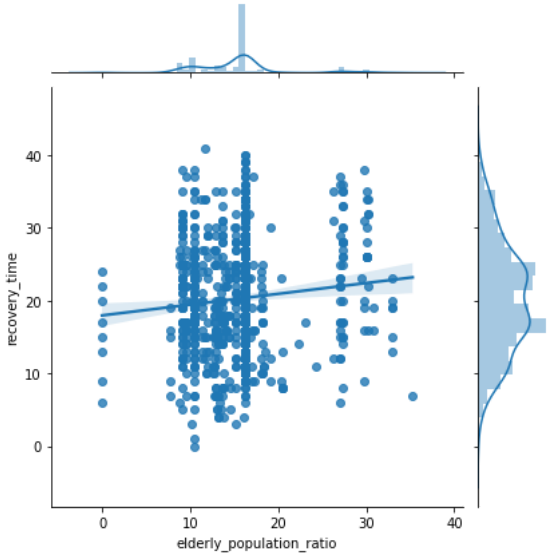
```
sn.jointplot(x="birth_year", y="recovery_time", data=patientdata, kind="reg")
sn.jointplot(x="education_healthy_facilities", y="recovery_time", data=patientdata, kind="reg")
sn.jointplot(x="academy_ratio", y="recovery_time", data=patientdata, kind="reg")
sn.jointplot(x="elderly_population_ratio", y="recovery_time", data=patientdata, kind="reg")
```

```
<seaborn.axisgrid.JointGrid at 0x180ce98c4f0>
```


recovery_time
0
10
20
30
40
1920
1940
1960
1980
2000
2020
birth_year


recovery_time
0
10
20
30
40
−50
0
50
100
150
200
250
300
350
education_healthy_facilities

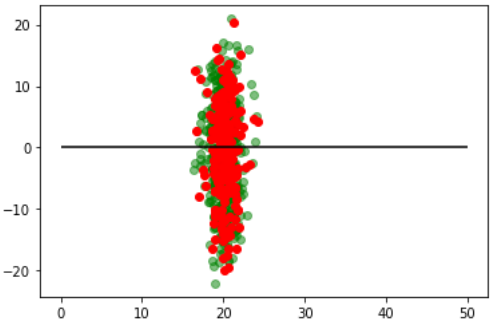

recovery_time
0
10
20
30
40
0
1
2
3
4
academy_ratio



绘制残差图来诊断回归模型的效果，如果随机点分布在0的附近，就说明回归的效果好

```
plt.scatter(Model.predict(train_x), Model.predict(train_x) - train_y, c="g", alpha=0.5)
plt.scatter(Model.predict(test_x), Model.predict(test_x) - test_y, c="r")
plt.hlines(y=0, xmin=0, xmax=50)

```

```
<matplotlib.collections.LineCollection at 0x180cdcc2730>
```



task 3 城市的风险水平评估

1. 数据预处理

读入数据

```
Region=pd.read_csv("D:360Downloads\Region.csv")
TimeProvince=pd.read_csv("D:360Downloads\TimeProvince.csv")
PatientInfo=pd.read_csv("D:360Downloads\PatientInfo.csv")
Case=pd.read_csv("D:360Downloads\Case.csv")s
```

```
  File "<ipython-input-86-e04ca505335d>", line 4
    Case=pd.read_csv("D:360Downloads\Case.csv")s
                                               ^
SyntaxError: invalid syntax
```

只获取最后一天的数据

```
list = TimeProvince[(TimeProvince['date']!='2020-04-07')].index.tolist()
TimeProvince = TimeProvince.drop(list)
TimeProvince.head(5)
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	date	time	province	confirmed	released	deceased
1326	2020-04-07	0	Seoul	567	164	0
1327	2020-04-07	0	Busan	123	91	3
1328	2020-04-07	0	Daegu	6794	4918	134
1329	2020-04-07	0	Incheon	80	27	0
1330	2020-04-07	0	Gwangju	27	15	0

对`Region`文件进行预处理，删除经纬度、编码，添加确诊和死亡数

```
# PatientCity = Region.dropcolomn(Region['latitude'].index.tolist())

PatientCity = Region.drop(labels='latitude',axis=1, index=None, columns=None, inplace=False)
PatientCity = PatientCity.drop(labels='longitude',axis=1, index=None, columns=None, inplace=False)
PatientCity = PatientCity.drop(labels='code',axis=1, index=None, columns=None, inplace=False)
for i in PatientCity.index:
    if PatientCity.loc[i,'province'] == PatientCity.loc[i,'city']:
        if (PatientCity.loc[i,'province'] == 'Sejong')or(PatientCity.loc[i,'province'] == 'Jeju-do')or(PatientCity.loc[i,'province'] == 'Korea'):
            continue
        PatientCity = PatientCity.drop(labels=None,axis=0, index=[i], columns=None, inplace=False)
PatientCity['oversea'] = 0
PatientCity['group'] = 0
PatientCity['confirmed'] = 0
PatientCity['deceased'] = 0
# PatientCity.loc[PatientCity.shape[0]] = [0 for n in range(PatientCity.shape[1])]
# PatientCity.loc[244,'city'] = 'etc'
PatientCity.head(5)
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	province	city	elementary_school_count	kindergarten_count	university_count	academy_ratio	elderly_population_ratio	elde
1	Seoul	Gangnam-gu	33	38	0	4.18	13.17	4.3
2	Seoul	Gangdong-gu	27	32	0	1.54	14.55	5.4
3	Seoul	Gangbuk-gu	14	21	0	0.67	19.49	8.5
4	Seoul	Gangseo-gu	36	56	1	1.17	14.39	5.7
5	Seoul	Gwanak-gu	22	33	1	0.89	15.12	4.9

创建map 用于匹配`PatientCity`里的行号

```
map = {}
for index,row in PatientCity.iterrows():
    city = row['city']
    map[city] = index
```

通过patientinfo获得每个城市的确诊死亡人数

```
for index, row in PatientInfo.iterrows():
    city = row["city"]
    infect = row['infection_case']
```

```
    if city is np.nan:
        continue
    if  city == 'etc':
        continue
    ind = map[city]
    if infect == 'overseas inflow':
        PatientCity.loc[ind,'oversea'] = PatientCity.loc[ind,'oversea'] + 1
    PatientCity.loc[ind,'confirmed'] = PatientCity.loc[ind,'confirmed'] + 1
    if row["deceased_date"] is not np.nan:
        PatientCity.loc[ind,'deceased'] = PatientCity.iloc[ind]['deceased'] + 1


for index, row in Case.iterrows():
    city = row["city"]
    Group = row['group']
    num = row['confirmed'];
    if city is np.nan:
        continue
    if  city == 'etc':
        continue
    if  city == 'from other city':
        continue
    if  city == '-':
        continue
    if  city == 'Jin-gu':
        city = 'Busanjin-gu'
    ind = map[city]
    if Group == True:
        PatientCity.loc[ind,'group'] = PatientCity.loc[ind,'group'] + num;
PatientCity.head()
```

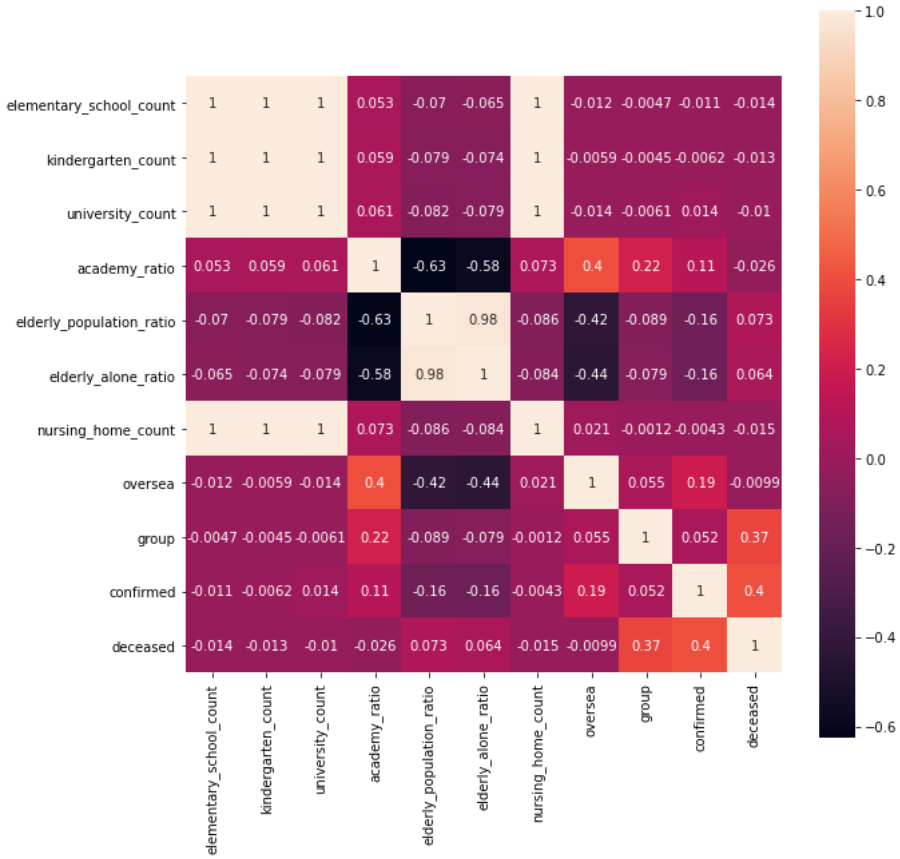
```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	province	city	elementary_school_count	kindergarten_count	university_count	academy_ratio	elderly_population_ratio	elde
1	Seoul	Gangnam-gu	33	38	0	4.18	13.17	4.3
2	Seoul	Gangdong-gu	27	32	0	1.54	14.55	5.4
3	Seoul	Gangbuk-gu	14	21	0	0.67	19.49	8.5
4	Seoul	Gangseo-gu	36	56	1	1.17	14.39	5.7
5	Seoul	Gwanak-gu	22	33	1	0.89	15.12	4.9

用热力图判断相关性

```
plt.figure(figsize=(10,10))
corrMat = PatientCity[["elementary_school_count",
                       "kindergarten_count",
                       "university_count",
                       'academy_ratio',
                       'elderly_population_ratio',
                       'elderly_alone_ratio',
                       'nursing_home_count',
                       'oversea',
                       'group',
                       'confirmed',
                       'deceased']].corr()
sn.heatmap(corrMat, annot=True, square=True)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x180d10e3dc0>
```



发现:

`"elementary_school_count", "kindergarten_count","university_count"`与`'nursing_home_count'`有较高的相关性

`'elderly_population_ratio','elderly_alone_ratio'`之间有较高的相关性。

因此

将`"elementary_school_count", "kindergarten_count","university_count"`与`'nursing_home_count'`四个只保留`nursing_home_count`;

`'elderly_population_ratio','elderly_alone_ratio'`只保留`elderly_population_ratio`

```
PatientCityWithProvince = PatientCity
PatientCity = PatientCity.drop(labels='province',axis=1, index=None, columns=None, inplace=False)
PatientCity.head(10)
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	city	elementary_school_count	kindergarten_count	university_count	academy_ratio	elderly_population_ratio	elderly_alone_
1	Gangnam-gu	33	38	0	4.18	13.17	4.3
2	Gangdong-gu	27	32	0	1.54	14.55	5.4
3	Gangbuk-gu	14	21	0	0.67	19.49	8.5
4	Gangseo-gu	36	56	1	1.17	14.39	5.7
5	Gwanak-gu	22	33	1	0.89	15.12	4.9
6	Gwangjin-gu	22	33	3	1.16	13.75	4.8
7	Guro-gu	26	34	3	1.00	16.21	5.7
8	Geumcheon-gu	18	19	0	0.96	16.15	6.7
9	Nowon-gu	42	66	6	1.39	15.40	7.4
10	Dobong-gu	23	26	1	0.95	17.89	7.2

```
PatientCityWithProvince = PatientCityWithProvince.drop(labels='elementary_school_count',axis=1, index=None, columns=None, inplace=False)
PatientCityWithProvince = PatientCityWithProvince.drop(labels='kindergarten_count',axis=1, index=None, columns=None, inplace=False)
PatientCityWithProvince = PatientCityWithProvince.drop(labels='university_count',axis=1, index=None, columns=None, inplace=False)
PatientCityWithProvince = PatientCityWithProvince.drop(labels='elderly_alone_ratio',axis=1, index=None, columns=None, inplace=False)
PatientCityWithProvince.head(10)
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	province	city	academy_ratio	elderly_population_ratio	nursing_home_count	oversea	group	confirmed	deceased
1	Seoul	Gangnam-gu	4.18	13.17	3088	31	0	53	0
2	Seoul	Gangdong-gu	1.54	14.55	1023	8	0	13	0
3	Seoul	Gangbuk-gu	0.67	19.49	628	1	0	5	0
4	Seoul	Gangseo-gu	1.17	14.39	1080	0	0	0	0
5	Seoul	Gwanak-gu	0.89	15.12	909	10	0	41	0
6	Seoul	Gwangjin-gu	1.16	13.75	723	6	0	7	0
7	Seoul	Guro-gu	1.00	16.21	741	3	138	34	0
8	Seoul	Geumcheon-gu	0.96	16.15	475	1	0	13	0
9	Seoul	Nowon-gu	1.39	15.40	952	5	0	23	0
10	Seoul	Dobong-gu	0.95	17.89	485	4	0	7	0

2.数据处理：

导入数据

```
from sklearn.pipeline import make_pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.cluster import KMeans
import pandas as pd

riskLevels = PatientCity.drop(labels='elementary_school_count',axis=1, index=None, columns=None, inplace=False)
riskLevels = riskLevels.drop(labels='kindergarten_count',axis=1, index=None, columns=None, inplace=False)
riskLevels = riskLevels.drop(labels='university_count',axis=1, index=None, columns=None, inplace=False)
riskLevels = riskLevels.drop(labels='elderly_alone_ratio',axis=1, index=None, columns=None, inplace=False)

df=riskLevels
grain_variety=df['city']
del df['city']
df.head()
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	academy_ratio	elderly_population_ratio	nursing_home_count	oversea	group	confirmed	deceased
1	4.18	13.17	3088	31	0	53	0
2	1.54	14.55	1023	8	0	13	0
3	0.67	19.49	628	1	0	5	0
4	1.17	14.39	1080	0	0	0	0
5	0.89	15.12	909	10	0	41	0

数据标准化和kmeans分析

```
samples=df.values
#标准化
scaler=StandardScaler()
kmeans=KMeans(n_clusters=3)
pipeline=make_pipeline(scaler,kmeans)
pipeline.fit(samples)#训练模型
labels=pipeline.predict(samples)#预测
df=pd.DataFrame({'labels':labels,'city':grain_variety})
ct=pd.crosstab(df['labels'],df['city'])
ct
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

city	Andong-si	Ansan-si	Anseong-si	Anyang-si	Asan-si	Boeun-gun	Bonghwa-gun	Boryeong-si	Boseong-gun	Buan-gun	...	Yeongju-si	Yeongw g
labels													
0	0	0	0	0	0	0	1	0	0	0	...	0	0
1	0	0	0	0	0	1	0	1	1	1	...	1	1
2	1	1	1	1	1	0	0	0	0	0	...	0	0

3 rows × 207 columns

```
# 获取某一行的方法:
def getRow(a,data):
    return data[a:a+1]
```

选择这些列表里三个不同 `label` 的 `city` 查看

结果如下:

label==2

```
for index,row in PatientCity.iterrows():
    if row['city'] == 'Ansan-si':
        print(row)
```

```
city                       Ansan-si
elementary_school_count          54
kindergarten_count               94
university_count                  4
academy_ratio                  1.49
elderly_population_ratio      10.35
elderly_alone_ratio             4.6
nursing_home_count             1024
oversea                           3
group                             0
confirmed                        16
deceased                          0
Name: 97, dtype: object
```

label==1

```
for index,row in PatientCity.iterrows():
    if row['city'] == 'Nam-gu':
        print(row)
```

```
city                       Nam-gu
elementary_school_count        21
kindergarten_count             27
university_count                4
academy_ratio                1.24
elderly_population_ratio    19.13
elderly_alone_ratio           7.9
nursing_home_count            475
oversea                         0
```

```
group                          0
confirmed                      0
deceased                       0
Name: 30, dtype: object
city                      Nam-gu
elementary_school_count       11
kindergarten_count            15
university_count               2
academy_ratio               0.85
elderly_population_ratio   22.49
elderly_alone_ratio         10.4
nursing_home_count           345
oversea                        0
group                          0
confirmed                      0
deceased                       0
Name: 44, dtype: object
city                      Nam-gu
elementary_school_count       23
kindergarten_count            44
university_count               4
academy_ratio               2.63
elderly_population_ratio   16.76
elderly_alone_ratio           7.5
nursing_home_count           427
oversea                        0
group                          0
confirmed                      0
deceased                       0
Name: 54, dtype: object
city                      Nam-gu
elementary_school_count       30
kindergarten_count            44
university_count               1
academy_ratio               3.23
elderly_population_ratio   11.42
elderly_alone_ratio           4.8
nursing_home_count           765
oversea                        5
group                       4508
confirmed                     28
deceased                       1
Name: 76, dtype: object
```

label==1

```
for index,row in PatientCity.iterrows():
    if row['city'] == 'Bonghwa-gun':
        print(row)
```

```
city                      Bonghwa-gun
elementary_school_count            14
kindergarten_count                 17
university_count                    0
academy_ratio                    0.37
elderly_population_ratio        35.26
elderly_alone_ratio                20
nursing_home_count                 47
oversea                             0
group                              68
confirmed                          71
deceased                            1
Name: 207, dtype: object
```

从上边的例子里边 可以看出来，

`label` == 2 时是风险最低的情况；

`label` == 0 时是风险中度的情况

`label` == 1 是的风险最高的情况

高风险地区：

```
high = getRow(1,ct)
city = []
cols=[x for i,x in enumerate(high.columns) if high.iat[0,i]==0]
high=high.drop(cols,axis=1) #利用drop方法将含有特定数值的列删除
print("高风险地区:")

for i,x in enumerate(high.columns):
    city.append(x)
output = PatientCityWithProvince
for index,row in output.iterrows():
    if row['city'] not in city:
        output = output.drop(index,axis=0)
```

```
for index,row in output.iterrows():
    if row['confirmed'] > 20:
        print(row['province'],row['city'])
```

```
高风险地区:
Daejeon Seo-gu
Ulsan Nam-gu
Ulsan Jung-gu
Gyeongsangbuk-do Gimcheon-si
Gyeongsangbuk-do Uiseong-gun
```

中风险地区:

```
mid = getRow(0,ct)
city = []
cols=[x for i,x in enumerate(mid.columns) if mid.iat[0,i]==0]
mid=mid.drop(cols,axis=1) #利用drop方法将含有特定数值的列删除
print("中风险地区:")
for i,x in enumerate(mid.columns):
    city.append(x)
output = PatientCityWithProvince
for index,row in output.iterrows():
    if row['city'] not in city:
        output = output.drop(index,axis=0)
for index,row in output.iterrows():
    print(row['province'],row['city'])
```

```
中风险地区:
Busan Nam-gu
Daegu Nam-gu
Gwangju Nam-gu
Ulsan Nam-gu
Gyeonggi-do Namyangju-si
Gangwon-do Taebaek-si
Gyeongsangbuk-do Gyeongsan-si
Gyeongsangbuk-do Bonghwa-gun
Gyeongsangbuk-do Seongju-gun
Gyeongsangbuk-do Yeongcheon-si
Gyeongsangbuk-do Cheongdo-gun
```

低风险地区:

```
low = getRow(2,ct)
city = []
cols=[x for i,x in enumerate(low.columns) if low.iat[0,i]==0]
low=low.drop(cols,axis=1) #利用drop方法将含有特定数值的列删除
print("低风险地区:")
for i,x in enumerate(low.columns):
    city.append(x)
output = PatientCityWithProvince
for index,row in output.iterrows():
    if row['city'] not in city:
        output = output.drop(index,axis=0)
for index,row in output.iterrows():
    print(row['province'],row['city'])
```

```
低风险地区:
Seoul Gangnam-gu
Seoul Gangdong-gu
Seoul Gangseo-gu
Seoul Gwanak-gu
Seoul Gwangjin-gu
Seoul Guro-gu
Seoul Geumcheon-gu
Seoul Nowon-gu
Seoul Dobong-gu
Seoul Dongdaemun-gu
Seoul Dongjak-gu
Seoul Mapo-gu
Seoul Seodaemun-gu
Seoul Seocho-gu
Seoul Seongdong-gu
Seoul Seongbuk-gu
Seoul Songpa-gu
Seoul Yangcheon-gu
Seoul Yeongdeungpo-gu
Seoul Yongsan-gu
Seoul Eunpyeong-gu
Seoul Jongno-gu
Seoul Jung-gu
Seoul Jungnang-gu
Busan Gangseo-gu
Busan Geumjeong-gu
```

```
Busan Gijang-gun
Busan Nam-gu
Busan Dong-gu
Busan Dongnae-gu
Busan Busanjin-gu
Busan Buk-gu
Busan Saha-gu
Busan Seo-gu
Busan Suyeong-gu
Busan Yeonje-gu
Busan Jung-gu
Busan Haeundae-gu
Daegu Nam-gu
Daegu Dalseo-gu
Daegu Dalseong-gun
Daegu Dong-gu
Daegu Buk-gu
Daegu Seo-gu
Daegu Suseong-gu
Daegu Jung-gu
Gwangju Gwangsan-gu
Gwangju Nam-gu
Gwangju Dong-gu
Gwangju Buk-gu
Gwangju Seo-gu
Incheon Gyeyang-gu
Incheon Michuhol-gu
Incheon Namdong-gu
Incheon Dong-gu
Incheon Bupyeong-gu
Incheon Seo-gu
Incheon Yeonsu-gu
Incheon Jung-gu
Daejeon Daedeok-gu
Daejeon Dong-gu
Daejeon Seo-gu
Daejeon Yuseong-gu
Daejeon Jung-gu
Ulsan Nam-gu
Ulsan Dong-gu
Ulsan Buk-gu
Ulsan Ulju-gun
Ulsan Jung-gu
Sejong Sejong
Gyeonggi-do Goyang-si
Gyeonggi-do Gwacheon-si
Gyeonggi-do Gwangmyeong-si
Gyeonggi-do Gwangju-si
Gyeonggi-do Guri-si
Gyeonggi-do Gunpo-si
Gyeonggi-do Gimpo-si
Gyeonggi-do Bucheon-si
Gyeonggi-do Seongnam-si
Gyeonggi-do Suwon-si
Gyeonggi-do Siheung-si
Gyeonggi-do Ansan-si
Gyeonggi-do Anseong-si
Gyeonggi-do Anyang-si
Gyeonggi-do Yangju-si
Gyeonggi-do Osan-si
Gyeonggi-do Yongin-si
Gyeonggi-do Uiwang-si
Gyeonggi-do Uijeongbu-si
Gyeonggi-do Icheon-si
Gyeonggi-do Paju-si
Gyeonggi-do Pyeongtaek-si
Gyeonggi-do Hanam-si
Gyeonggi-do Hwaseong-si
Gangwon-do Gangneung-si
Gangwon-do Donghae-si
Gangwon-do Sokcho-si
Gangwon-do Wonju-si
Gangwon-do Chuncheon-si
Chungcheongbuk-do Jeungpyeong-gun
Chungcheongbuk-do Jincheon-gun
Chungcheongbuk-do Cheongju-si
Chungcheongbuk-do Chungju-si
Chungcheongnam-do Gyeryong-si
Chungcheongnam-do Dangjin-si
Chungcheongnam-do Seosan-si
Chungcheongnam-do Asan-si
Chungcheongnam-do Cheonan-si
Jeollabuk-do Gunsan-si
Jeollabuk-do Iksan-si
Jeollabuk-do Jeonju-si
Jeollanam-do Gwangyang-si
Jeollanam-do Mokpo-si
```

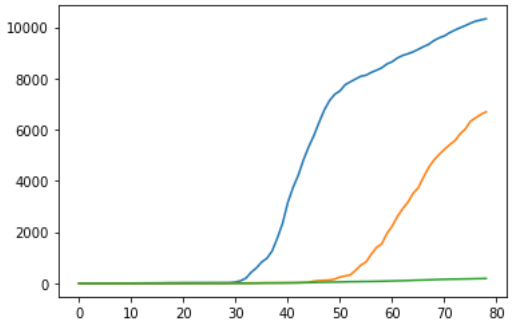
```
Jeollanam-do Muan-gun
Jeollanam-do Suncheon-si
Jeollanam-do Yeosu-si
Gyeongsangbuk-do Gyeongju-si
Gyeongsangbuk-do Gumi-si
Gyeongsangbuk-do Andong-si
Gyeongsangbuk-do Chilgok-gun
Gyeongsangbuk-do Pohang-si
Gyeongsangnam-do Geoje-si
Gyeongsangnam-do Gimhae-si
Gyeongsangnam-do Sacheon-si
Gyeongsangnam-do Yangsan-si
Gyeongsangnam-do Jinju-si
Gyeongsangnam-do Changwon-si
Gyeongsangnam-do Tongyeong-si
Jeju-do Jeju-do
Korea Korea
```

Task4 预测感染人数

我们先来绘制疫情确诊人数的走势图

```
plt.plot(time['confirmed'],label='confirmed')
plt.plot(time['released'],label='released')
plt.plot(time['deceased'],label='deceased')

```

```
[<matplotlib.lines.Line2D at 0x180ce19b820>]
```



我们考虑用逻辑斯蒂函数来预测

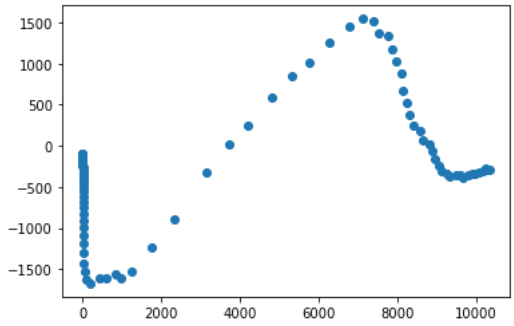
```
#定义逻辑斯蒂函数
def logistic_function(p,t):
    k,b=p
    a=0.1

    value=np.exp(-a*(t-b))
    return k/(1+value)
#定义误差函数
def error_f(p,t,y):
    return logistic_function(p,t)-y
time.info()


```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 79 entries, 0 to 78
Data columns (total 7 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   date       79 non-null     object
 1   time       79 non-null     int64 
 2   test       79 non-null     int64 
 3   negative   79 non-null     int64 
 4   confirmed  79 non-null     int64 
 5   released   79 non-null     int64 
 6   deceased   79 non-null     int64 
dtypes: int64(6), object(1)
memory usage: 4.4+ KB
```

```
from scipy.optimize import leastsq
#参数初始值
```

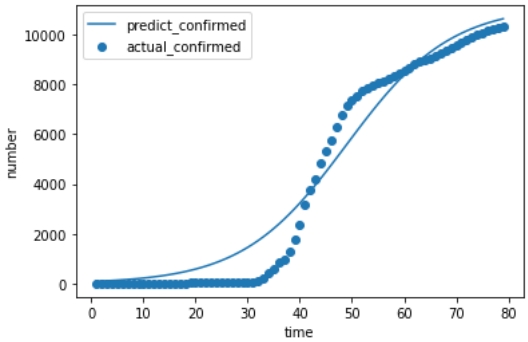
```
logistic_p0=[10000,20]
t=np.array([i+1 for i in range(79)])
y=time['confirmed'].values
#利用最小二乘法求解参数
logistic_paramtr=leastsq(error_f,logistic_p0,args=(t,y))
p=logistic_paramtr[0]
#利用我们定义的逻辑斯蒂函数进行预测
predict_data=logistic_function(p,t)
predict_data
#预测的误差
error=y-predict_data
error
#绘制误差的散点图
plt.scatter(y,error)

```

```
<matplotlib.collections.PathCollection at 0x180ce4ef3a0>
```



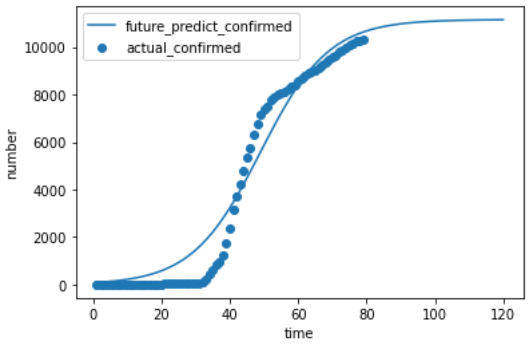

```
#绘图
plt.scatter(t,y,label='actual_confirmed')
plt.plot(t,predict_data,label='predict_confirmed')
plt.xlabel('time')
plt.ylabel('number')
plt.legend(loc='best')

```

```
<matplotlib.legend.Legend at 0x180cd9ac670>
```




```
#预测未来疫情的走势
future_t=[i+1 for i in range(120) ]
future_predict=logistic_function(p,future_t)
future_predict
#绘图
#绘图
plt.scatter(t,y,label='actual_confirmed')
plt.plot(future_t,future_predict,label='future_predict_confirmed')
plt.xlabel('time')
plt.ylabel('number')
plt.legend(loc='best')
```

```
<matplotlib.legend.Legend at 0x180ce58bc40>
```



预测接下来韩国的确诊人数

```
for i in range(81,119):
    print(future_predict[i])

```

```
10760.21409500655
10796.652288496583
10829.836260428989
10860.03864093677
10887.512426223213
10912.491803741863
10935.19306332525
10955.815562195587
10974.542717779608
10991.54300745268
11006.970958800215
11020.968117766812
11033.663985233312
11045.176915189058
11055.614969819364
11065.076728571732
11073.652049658514
11081.422783552653
11088.463438884637
11094.841801795546
11100.619510278748
11105.852585383465
11110.591921383004
11114.883737151555
11118.76999106493
11122.288761757494
11125.474597043065
11128.358833251825
11130.969887156922
11133.333522570134
11135.473093581173
11137.409766304334
11139.16272088227
11140.749335382636
11142.1853531109
11143.485034753186
11144.661296657818
11145.725836463826
```

因此，预测韩国的疫情将于开始后的第120天结束，结束时的累计确诊量到达11145例

从经纬度找到感染的聚集点

```
patientdata.head()
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	sex	birth_year	country	province	city	disease	infection_case	infected_by	contact_number	symptom_onset_date	...	
0	1	1964.0	4	15	36	None	22	None	75.0	2020-01-22	...	1
1	1	1987.0	4	15	85	None	22	None	31.0	None	...	1
2	1	1964.0	4	15	83	None	18	2.002e+09	17.0	None	...	1
3	1	1991.0	4	15	86	None	22	None	9.0	2020-01-26	...	1
4	0	1992.0	4	15	112	None	18	1e+09	2.0	None	...	1

5 rows × 26 columns

```
newpatientdata=patientdata[['latitude','longitude']]
newpatientdata.head()
```

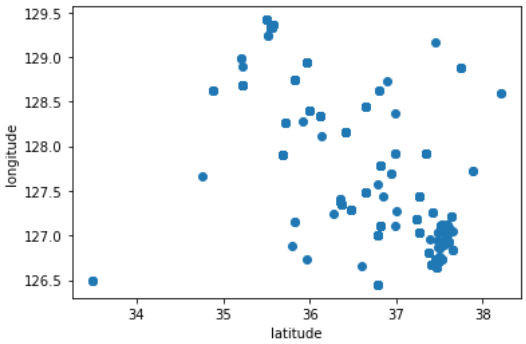
```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	latitude	longitude
0	35.212424	128.980680
1	37.606832	127.092656
2	37.572999	126.979189
3	37.566283	126.901644
4	37.589562	127.016700

用kmeans对该数据进行聚类，找到各个聚集的中心点

```
newpatientdata=newpatientdata[newpatientdata['latitude']!=0]

plt.scatter(newpatientdata['latitude'],newpatientdata['longitude'])
plt.xlabel('latitude')
plt.ylabel('longitude')
```

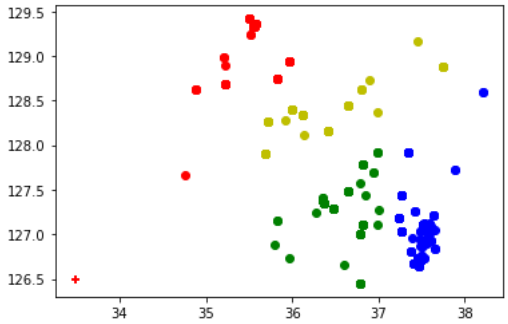
```
Text(0, 0.5, 'longitude')
```




```
from sklearn.cluster import KMeans
#构造聚类器
estimator=KMeans(n_clusters=5)
estimator.fit(newpatientdata)
label_predict=estimator.labels_
```

```
x0=newpatientdata[label_predict==0]
x1=newpatientdata[label_predict==1]
x2=newpatientdata[label_predict==2]
x3=newpatientdata[label_predict==3]
x4=newpatientdata[label_predict==4]
plt.scatter(x0['latitude'],x0['longitude'],c='r',label='x0')
plt.scatter(x1['latitude'],x1['longitude'],c='g',label='x1')
plt.scatter(x2['latitude'],x2['longitude'],c='b',label='x2')
plt.scatter(x3['latitude'],x3['longitude'],c='y',label='x3')
plt.scatter(x4['latitude'],x4['longitude'],c='r',marker='+',label='x4')
```

```
<matplotlib.collections.PathCollection at 0x180ce286c70>
```



task 判断当日确诊人数和当日的天气之间的关系，我们先选择韩国确诊人数最多的Gyeongsangbuk-do进行分析

```
timeprovince=pd.read_csv("D:360Downloads\TimeProvince.csv")
time_gye=timeprovince[timeprovince['province']=='Gyeongsangbuk-do']

weather=pd.read_csv("D:360Downloads\Weather.csv")
weather_gye=weather[weather['province']=='Gyeongsangbuk-do']
#定义函数，将每天Gyeongsangbuk-do的天气数据导入，
def getweather(dataframe,dR):

    dataframe['avg_temp']=0
    dataframe['min_temp']=0
    dataframe['max_temp']=0
    dataframe['max_wind_speed']=0
    dataframe['most_wind_direction']=0
    dataframe['avg_relative_humidity']=0
    for i in dataframe.index:
        for j in dR.index:

            if dataframe.loc[i,'date']==dR.loc[j,'date']:
                dataframe.loc[i,'avg_temp']=dR.loc[j,'avg_temp']
                dataframe.loc[i,'max_temp']=dR.loc[j,'max_temp']
                dataframe.loc[i,'min_temp']=dR.loc[j,'min_temp']
                dataframe.loc[i,'max_wind_speed']=dR.loc[j,'max_wind_speed']
                dataframe.loc[i,'most_wind_direction']=dR.loc[j,'most_wind_direction']
                dataframe.loc[i,'avg_relative_humidity']=dR.loc[j,'avg_relative_humidity']

    return dataframe
getweather(time_gye,weather_gye)
```

```
<ipython-input-105-42a2d71124d3>:9: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  dataframe['avg_temp']=0
<ipython-input-105-42a2d71124d3>:10: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  dataframe['min_temp']=0
<ipython-input-105-42a2d71124d3>:11: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

```
See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  dataframe['max_temp']=0
<ipython-input-105-42a2d71124d3>:12: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  dataframe['max_wind_speed']=0
<ipython-input-105-42a2d71124d3>:13: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  dataframe['most_wind_direction']=0
<ipython-input-105-42a2d71124d3>:14: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  dataframe['avg_relative_humidity']=0
d:\python\lib\site-packages\pandas\core\indexing.py:966: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  self.obj[item] = s
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	date	time	province	confirmed	released	deceased	avg_temp	min_temp	max_temp	max_wind_speed	most_w
14	2020-01-20	16	Gyeongsangbuk-do	0	0	0	3.6	-0.4	6.9	7.5	270.0
31	2020-01-21	16	Gyeongsangbuk-do	0	0	0	2.0	-1.9	7.5	4.8	180.0
48	2020-01-22	16	Gyeongsangbuk-do	0	0	0	5.2	-0.2	8.4	3.4	180.0
65	2020-01-23	16	Gyeongsangbuk-do	0	0	0	6.9	4.2	11.3	3.4	160.0
82	2020-01-24	16	Gyeongsangbuk-do	0	0	0	5.8	1.9	11.9	8.7	20.0
...	...	...	...	...	...	...	...	...	...	...	...
1272	2020-04-03	0	Gyeongsangbuk-do	1309	865	42	14.4	8.6	20.5	8.8	290.0
1289	2020-04-04	0	Gyeongsangbuk-do	1310	881	44	9.6	3.3	16.6	10.8	50.0
1306	2020-04-05	0	Gyeongsangbuk-do	1314	899	44	6.0	0.0	14.0	6.0	180.0
1323	2020-04-06	0	Gyeongsangbuk-do	1316	922	45	10.8	0.9	17.3	5.9	180.0
1340	2020-04-07	0	Gyeongsangbuk-do	1317	934	46	0.0	0.0	0.0	0.0	0.0

79 rows × 12 columns

```
#再去除掉confirmed为0的数据，只查看有感染人数的数据
time_gye=time_gye[time_gye['confirmed']!=0]
new_time_gye=time_gye
new_time_gye.head()
for i in time_gye.index:
    if i>524:
        new_time_gye.loc[i,'confirmed']=time_gye.loc[i,'confirmed']-time_gye.loc[i-17,'confirmed']
new_time_gye.head()
```

```
d:\python\lib\site-packages\pandas\core\indexing.py:966: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  self.obj[item] = s
```

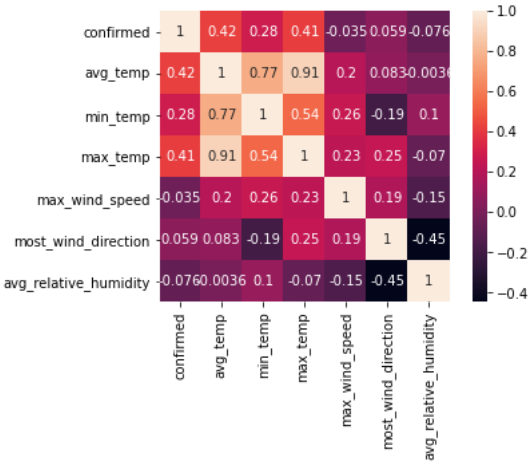
```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	date	time	province	confirmed	released	deceased	avg_temp	min_temp	max_temp	max_wind_speed	most_wi
524	2020-02-19	16	Gyeongsangbuk-do	2	1	0	3.8	-1.1	11.2	10.0	180.0
541	2020-02-20	16	Gyeongsangbuk-do	23	1	1	5.8	1.0	12.2	4.6	180.0
558	2020-02-21	16	Gyeongsangbuk-do	5	1	1	8.3	-0.2	15.2	5.7	180.0
575	2020-02-22	16	Gyeongsangbuk-do	140	1	3	7.9	2.7	11.1	9.9	270.0
592	2020-02-23	16	Gyeongsangbuk-do	30	1	3	5.2	-0.5	10.5	11.5	270.0

用热力图研究确诊数量和天气因素的相关性

```
corrMat = new_time_gye[["confirmed",
"avg_temp","min_temp",'max_temp','max_wind_speed','most_wind_direction','avg_relative_humidity']].corr()
sn.heatmap(corrMat, annot=True, square=True)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x180ce79d190>
```



可以看出确诊数量和avg_temp,min_temp,max_temp，湿度，风速正相关。

```
1
```