互评作业1: 数据探索性分析与数据预处理

一、movies_dataset 数据集

1、数据说明

20548行数据，14个属性

```
%matplotlib inline
import matplotlib
import matplotlib.pyplot as plt
import pandas as pd
from tqdm import tqdm
import numpy as np
from sklearn.linear_model import LinearRegression
import scipy.stats as stats
import re
import warnings
warnings.filterwarnings('ignore')

import pandas as pd
from pandas import DataFrame
import numpy as np
from collections import Counter
```

```
data = pd.read_csv('movies_dataset.csv', index_col=0)
features = data.columns
print('数据属性个数：', len(data.columns))
print('实例总数：', len(data))
print('数据示例：\n', data.head())
```

```
数据属性个数： 14
实例总数： 20548
数据示例：
    IMDb-rating appropriate_for      director downloads      id  \
0          4.8               R     John Swab       304  372092
1          6.4           TV-PG   Paul Ziller        73  372091
2          5.2               R  Ben Wheatley     1,427  343381
3          8.1             NaN  Venky Atluri     1,549  372090
4          4.6             NaN  Shaji Kailas       657  372089

              industry       language   posted_date release_date  run_time  \
0  Hollywood / English        English  20 Feb, 2023  Jan 28 2023       105
1  Hollywood / English        English  20 Feb, 2023  Feb 05 2023        84
2  Hollywood / English  English,Hindi  20 Apr, 2021  Jun 18 2021  1h 47min
3            Tollywood          Hindi  20 Feb, 2023  Feb 17 2023       139
4            Tollywood          Hindi  20 Feb, 2023  Jan 26 2023       122

                                           storyline  \
0  Doc\r\n facilitates a fragile truce between th...
```

```
1  Caterer\r\n Goldy Berry reunites with detectiv...
2  As the world searches for a cure to a disastro...
3  The life of a young man and his struggles agai...
4  A man named Kalidas gets stranded due to the p...

                                 title   views                writer
0                          Little Dixie   2,794             John Swab
1  Grilling Season: A Curious Caterer Mystery   1,002  John Christian Plummer
2                          In the Earth  14,419            Ben Wheatley
3                                Vaathi   4,878            Venky Atluri
4                                 Alone   2,438        Rajesh Jayaraman
```

2、数据摘要

```
missing_data = data.isnull().sum()
missing_data = missing_data[missing_data != 0]
missing_data
```

```
IMDb-rating         841
appropriate_for    9476
director           1938
downloads             1
industry              1
language            546
posted_date           1
release_date          1
run_time           1768
storyline          1701
title                 1
views                 1
writer             2192
dtype: int64
```

```
num_fields = list(data.select_dtypes(include=np.number).columns.values)
nom_fields = list(data.select_dtypes(exclude=np.number).columns.values)
print('标称属性:', nom_fields)
print('数值属性:', num_fields)
```

```
标称属性: ['appropriate_for', 'director', 'downloads', 'industry', 'language',
'posted_date', 'release_date', 'run_time', 'storyline', 'title', 'views',
'writer']
数值属性: ['IMDb-rating', 'id']
```

```
# 经人工检验，‘downloads’、‘run_time’和‘views’为数值属性
nom_fields.remove('downloads')
nom_fields.remove('run_time')
nom_fields.remove('views')
num_fields.append('downloads')
num_fields.append('run_time')
num_fields.append('views')
print('标称属性:', nom_fields)
print('数值属性:', num_fields)
data.dtypes
```

```
标称属性: ['appropriate_for', 'director', 'industry', 'language', 'posted_date',
'release_date', 'storyline', 'title', 'writer']
数值属性: ['IMDb-rating', 'id', 'downloads', 'run_time', 'views']
```

```
IMDb-rating        float64
appropriate_for     object
director            object
downloads           object
id                   int64
industry            object
language            object
posted_date         object
release_date        object
run_time            object
storyline           object
title               object
views               object
writer              object
dtype: object
```

```
# 对数值型属性的类型进行转换，使用-1替换空缺值
data = data.fillna(-1)
# ‘run_time’属性数据为分钟数‘120’，但存在‘1h20min’和‘1h20m’这样的非标准数据，进行转换
for i in range(len(data)):
    run_time = str(data.loc[i,'run_time'])
    if(run_time == -1): continue
    if(re.search('min', run_time) != None):
        if(re.search('h', run_time) != None):
            hour, minute = run_time.split("h")
            data.loc[i,'run_time'] = (60 * int(hour)) + int(minute.strip("min"))
        else:
            data.loc[i,'run_time'] = int(run_time.strip("min"))
        continue
    if(re.search('m', run_time) != None):
        if(re.search('h', run_time) != None):
            hour, minute = run_time.split("h")
            data.loc[i,'run_time'] = (60 * int(hour)) + int(minute.strip("m"))
        else:
            data.loc[i,'run_time'] = int(run_time.strip("m"))
    else:
         if(re.search('h', run_time) != None):
            data.loc[i,'run_time'] = 60 * int(run_time.strip('h'))
```

```
# 'downloads'和'views'属性数据类型为string，进行转换
for i in range(len(data)):
    for field in ['downloads','views']:
        x = data.loc[i,field]
        if(x == -1): continue
        if (re.search(',', str(x)) != None):
            data.loc[i,field] = int(x.replace(',',''))

for field in ['downloads', 'run_time', 'views']:
    data[field] = data[field].astype('int64')

print(data.dtypes)
print('标称属性:', nom_fields)
print('数值属性:', num_fields)
```

```
IMDb-rating        float64
appropriate_for     object
director            object
downloads            int64
id                   int64
industry            object
language            object
posted_date         object
release_date        object
run_time             int64
storyline           object
title               object
views                int64
writer              object
dtype: object
标称属性: ['appropriate_for', 'director', 'industry', 'language', 'posted_date',
'release_date', 'storyline', 'title', 'writer']
数值属性: ['IMDb-rating', 'id', 'downloads', 'run_time', 'views']
```

1）标称属性

对标称属性进行频数估计

```
# 标称属性的频数统计
for field in nom_fields:
    print('频数统计：')
    print(data[field].value_counts())
```

```
频数统计：
appropriate_for
-1                9476
```

```
R                 4384
Not Rated         2142
PG-13             1968
PG                 886
TV-14              694
TV-MA              406
G                  152
Unrated            132
TV-PG              115
TV-G                99
TV-Y7               45
TV-Y                25
Approved             9
NC-17                4
TV-Y7-FV             3
Passed               3
MA-17                1
TV-13                1
Drama                1
Drama, Romance       1
18+                  1
Name: count, dtype: int64
频数统计：
director
-1                 1938
Venky Atluri        405
Simone Stock        403
Xavier Manrique     403
John Swab           205
                   ...
David G. Evans        1
Theresa Rebeck        1
Mark Grentell         1
Nick Searcy           1
Becca Gleason         1
Name: count, Length: 9673, dtype: int64
频数统计：
industry
Hollywood / English    14649
Bollywood / Indian      2645
Tollywood               1172
Anime / Kids            1049
Wrestling                433
Punjabi                  332
Stage shows              129
Pakistani                 92
Dub / Dual Audio          45
-1                         1
3D Movies                  1
Name: count, dtype: int64
频数统计：
language
English                                 12657
Hindi                                    2558
-1                                        546
English,Spanish                           391
```

```
Punjabi                                   310
                                        ...
English,Korean,Spanish                      1
Norwegian,Swedish                           1
Spanish,Chinese,English,Maori,French        1
Urdu,Punjabi,English                        1
Spanish,German,English                      1
Name: count, Length: 1168, dtype: int64
频数统计：
posted_date
13 Feb, 2023    812
20 Feb, 2023    607
15 Feb, 2023    607
10 Feb, 2023    485
16 Feb, 2023    406
               ...
08 Sep, 2009      1
01 Sep, 2009      1
18 Aug, 2009      1
17 Aug, 2009      1
30 Nov, 2011      1
Name: count, Length: 4124, dtype: int64
频数统计：
release_date
Jan 01 1970    962
Feb 03 2023    616
Feb 17 2023    607
Feb 10 2023    410
Feb 11 2023    402
              ...
Jan 10 2018      1
May 10 2018      1
Apr 18 2018      1
Oct 26 2013      1
Mar 28 1958      1
Name: count, Length: 4887, dtype: int64
频数统计：
storyline
-1




                                                            1701
The life of a young man and his struggles against the privatization of education.




                                                            402
Follows\r\n a New York City family hiding out in the Hamptons whose bubble is
\r\npopped when a Bloody Mary-swilling, pot-smoking 'Charlie' comes to bring\r\n
a lifetime of hurt that might heal them all.


                                                                  402
```

```
It follows Kara Robinson as she survives an abduction and ultimately brings down
a serial killer.



                                                               402
Doc\r\n facilitates a fragile truce between the Governor and Cartel, trading
\r\nprosecutorial leniency for finance. With no more truce, Doc is left to
\r\nfend for himself and protect the one untainted thing in his life: his
\r\ndaughter, Little Dixie.


202





                                                             ...
Four waves of increasingly deadly attacks have left most of Earth in ruin.
Against a backdrop of fear and distrust, Cassie is on the run, desperately trying
to save her younger brother. As she prepares for the inevitable and lethal fifth
wave, Cassie teams up with a young man who may become her final hope - if she can
only trust him.
                                                                       1
Yamuna along with her son Laxman locates to Mumbai leaving behind her abusive
husband.She takes shelter in the house of her aunt Chandra whom she calls
Akka.Yamuna's only aim is to give a better education to her son.Chandra finds her
a job as sweeper in a art school.Yamuna finds that Chandra poses as a nude model
to the students of the school.Chandra confines Yamuna to take up the job being
nude out there the students don't look at you in lust but as a project.       1
A young violinist struggles to assert her individuality amidst the intense
pressure of her pianist father, and the weight of her own musical ability.




                                                                       1
A right wing talk show host's life takes a sudden turn when his 16 year old niece
comes crashing into his life.




                                                               1
While driving his car on a rainy night, Anand's car breaks down, and he goes to
seek shelter in a nearby house. He is let into the house by the servant, and he
is permitted to stay until the rains stop be able to get his car fixed. It is
here that he will find out about his previous birth, his true love, Madhumati,
their ill-fated, star-crossed and tragic romance, and how events in his previous
birth are going to effect him in this life-time.                          1
Name: count, Length: 15749, dtype: int64
频数统计：
title
The Girl Who Escaped: The Kara Robinson Story    402
Vaathi                                           402
Who Invited Charlie?                             402
Little Dixie                                     202
```

```
The Inspection                                    202
                                                 ...
Hamid                                               1
Kesari                                              1
Old Boys                                            1
American Exit                                       1
Madhumati                                           1
Name: count, Length: 16573, dtype: int64
频数统计：
writer
-1                                          2192
Nicholas Schutt                              403
Venky Atluri                                 402
Haley Harris                                 402
John Swab                                    205
                                            ...
Barbara Samuels, Joseph Boyden                 1
Maria Allred                                   1
Pia Mechler                                    1
Paul Flannery, David Ryan Keith                1
Khwaja Ahmad Abbas, Khwaja Ahmad Abbas         1
Name: count, Length: 13604, dtype: int64
```

2）数值属性

数值属性的五数概括和缺失值个数

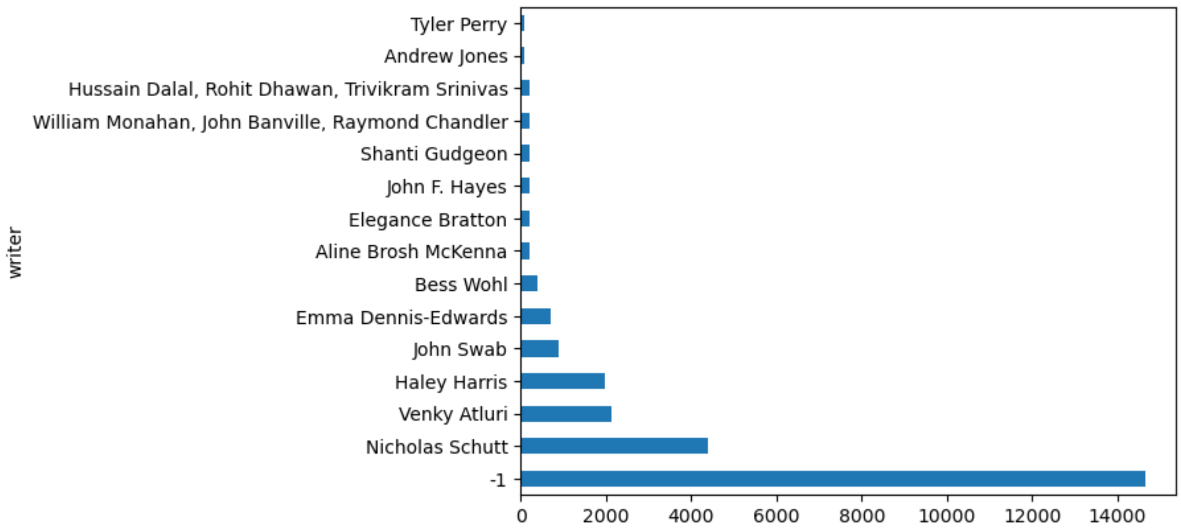
```
def describe_(column):
    num_na = 0
    for i in range(len(column)):
        if column[i] == -1:
            num_na += 1
            column = column.drop(i)
    return column.describe(),  num_na

print('数值属性：')
for field in num_fields:
    print(describe_(data[field]))
```

```
数值属性：
(count    19707.000000
mean         5.762151
std          1.374041
min          1.100000
25%          4.800000
50%          5.700000
75%          6.600000
max          9.900000
Name: IMDb-rating, dtype: float64, 841)
(count     20548.000000
mean     222351.199776
std      138422.327931
min           1.000000
25%       96122.250000
50%      264457.500000
75%      354561.250000
max      372092.000000
Name: id, dtype: float64, 0)
(count      20547.000000
mean       10795.238916
std        23716.181987
min            0.000000
25%          855.500000
50%         2716.000000
75%        10070.000000
max       391272.000000
Name: downloads, dtype: float64, 1)
(count     18780.000000
mean        106.195953
std          23.636432
min           2.000000
25%          90.000000
50%         100.000000
75%         117.000000
max         321.000000
Name: run_time, dtype: float64, 1768)
(count     2.054700e+04
mean      3.559551e+04
std       6.247242e+04
min       6.670000e+02
25%       7.571500e+03
50%       1.522200e+04
75%       3.657100e+04
max       1.638533e+06
Name: views, dtype: float64, 1)
```

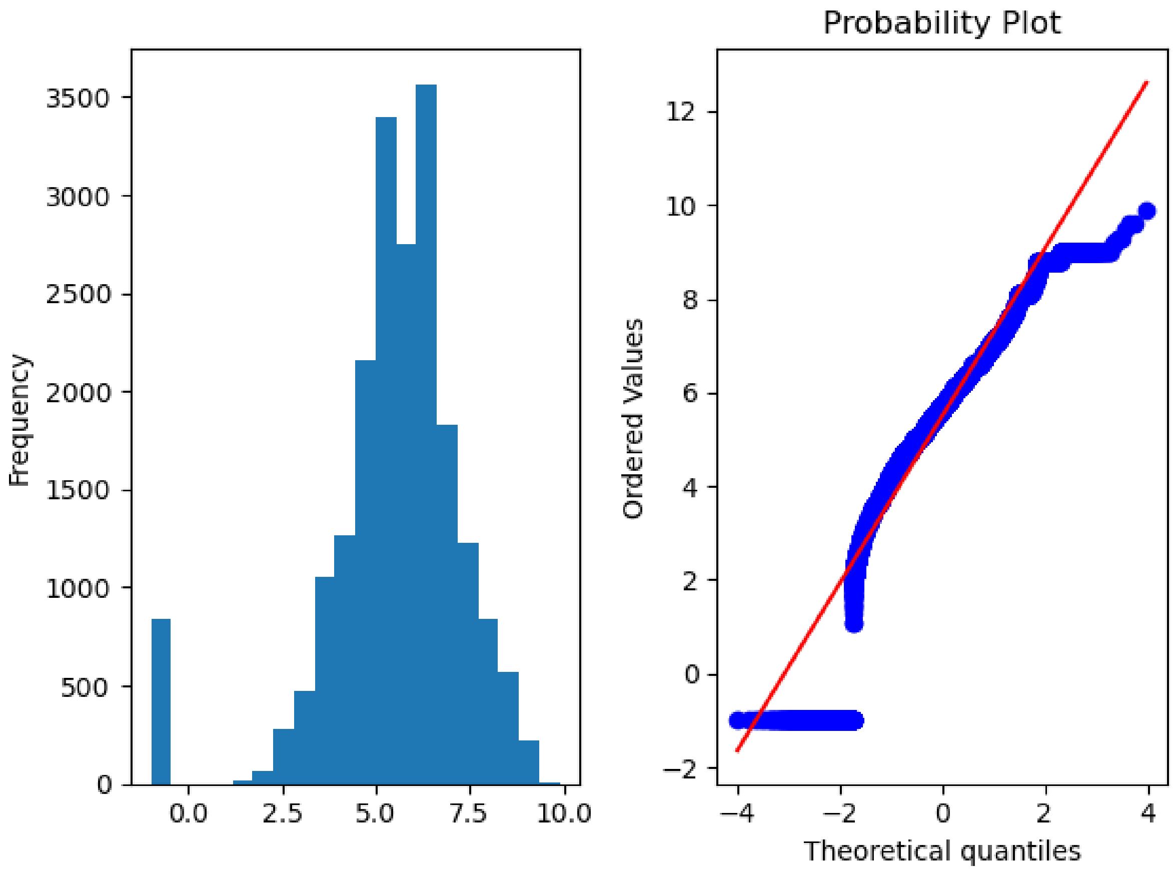
3、数据可视化

```
# 标称属性
for field in nom_fields:
    fig_path = 'fig/'+ field + '.png'
    data[field].value_counts().head(15).plot.barh().figure.savefig(fig_path)
```

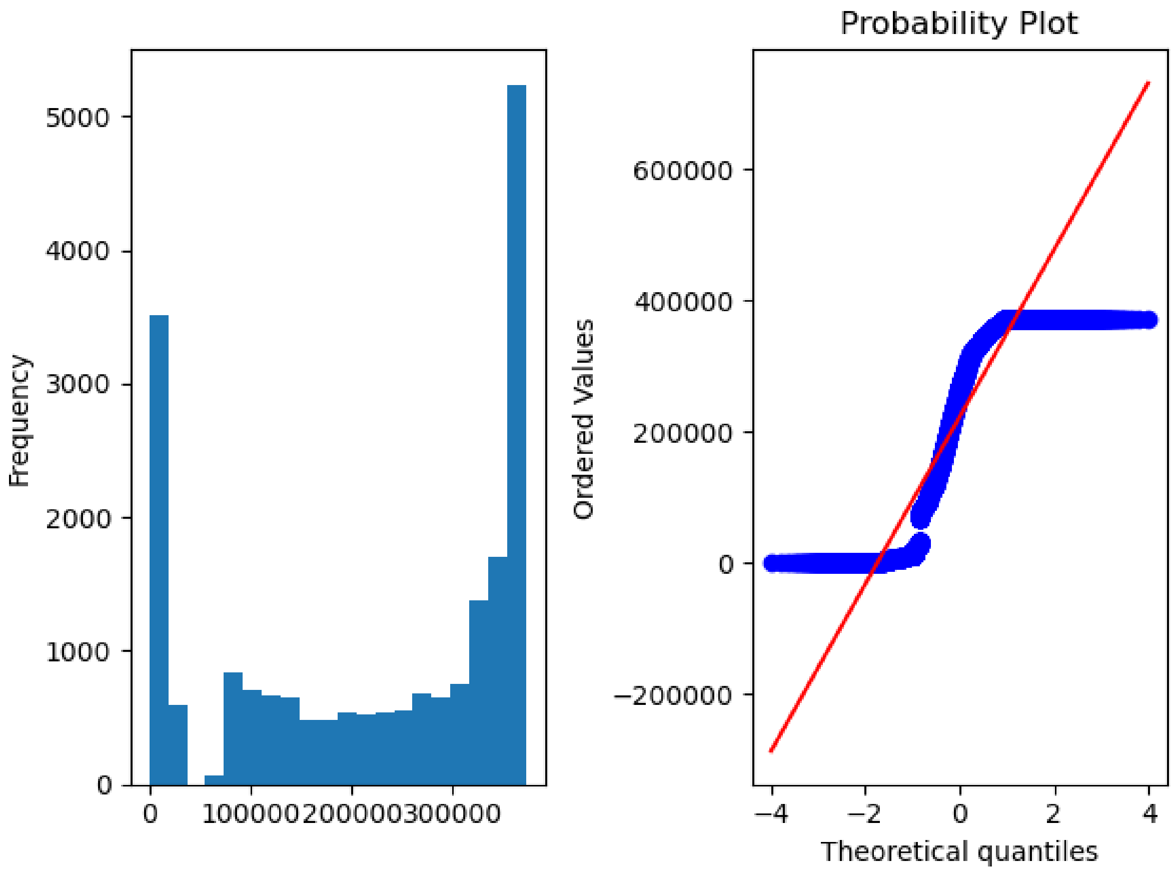


```
# 数值属性
for field in num_fields:
    print(field, '直方图和Q-Q图:')
    plt.subplot(1, 2, 1)
    data[field].plot.hist(bins=20)
    plt.subplot(1, 2, 2)
    stats.probplot(data[field], plot=plt)
    plt.tight_layout()  # 调整整体空白
    plt.show()
```

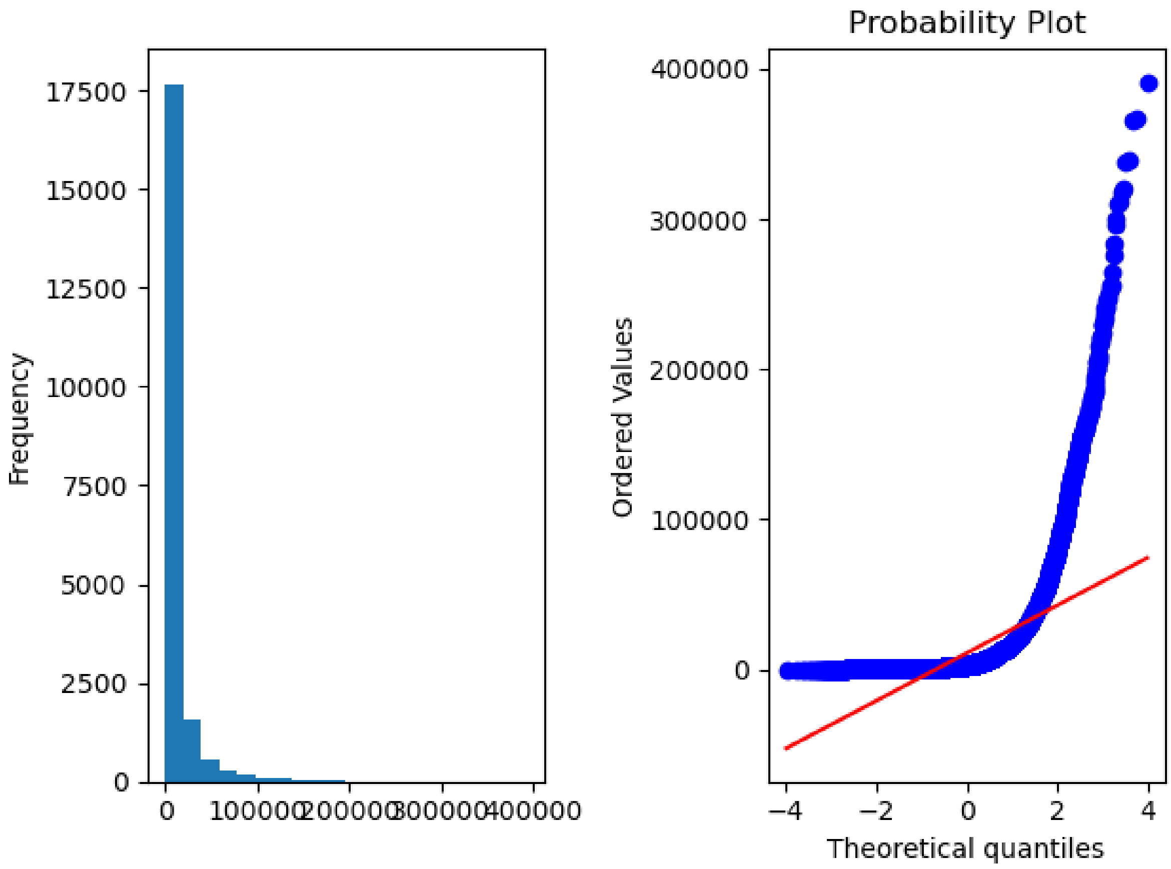
```
IMDb-rating 直方图和Q-Q图:
```


Frequency
3500
3000
2500
2000
1500
1000
500
0
0.0
2.5
5.0
7.5
10.0
Probability Plot
Ordered Values
12
10
8
6
4
2
0
−2
−4
−2
0
2
4
Theoretical quantiles

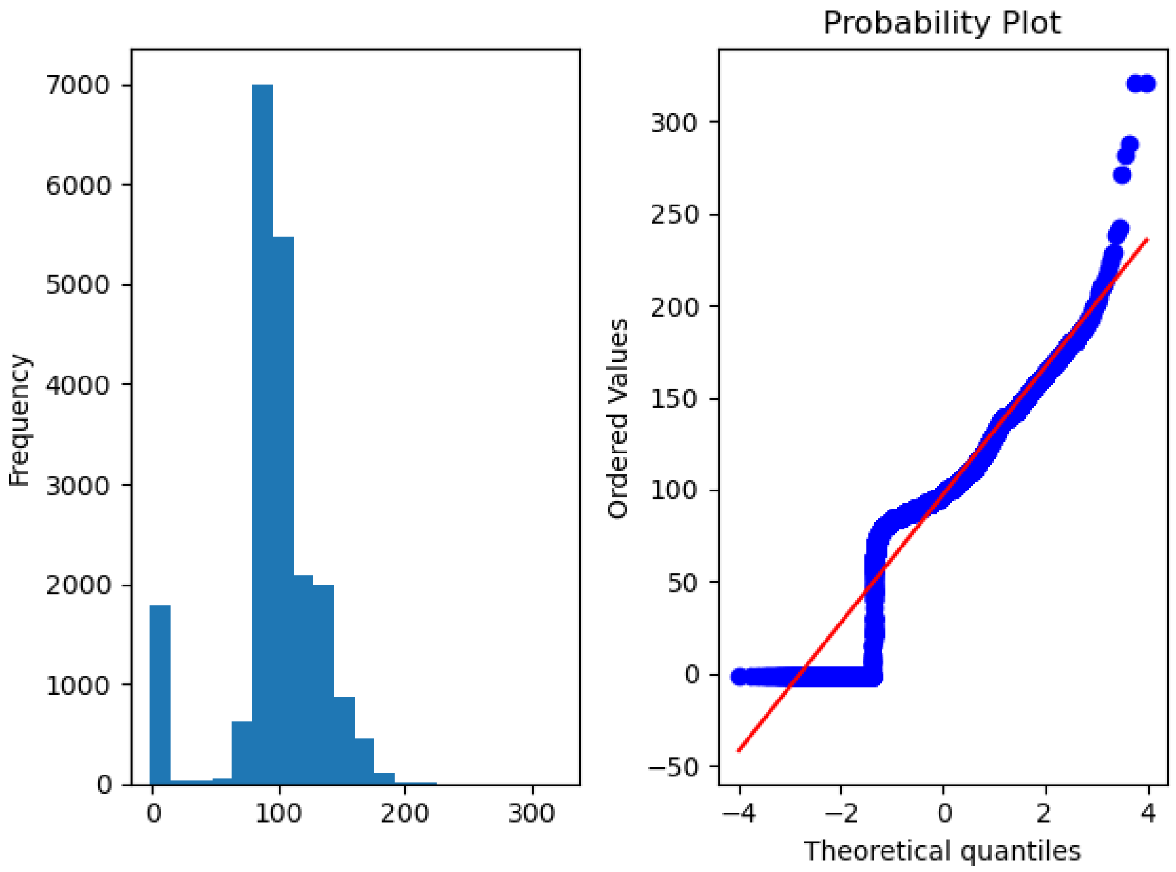
```
id 直方图和Q-Q图:
```


Frequency
5000
4000
3000
2000
1000
0
0
100000200000300000
Probability Plot
Ordered Values
600000
400000
200000
0
−200000
−4
−2
0
2
4
Theoretical quantiles

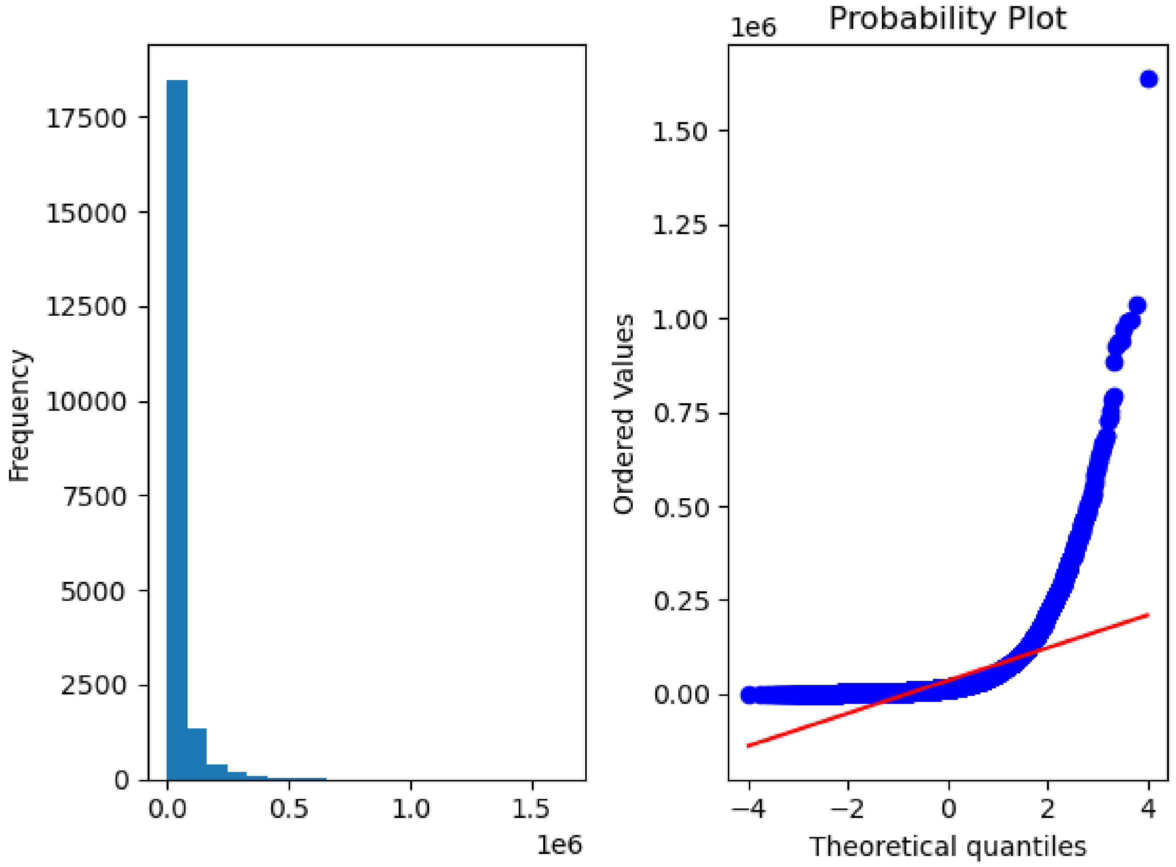
```
downloads 直方图和Q-Q图:
```



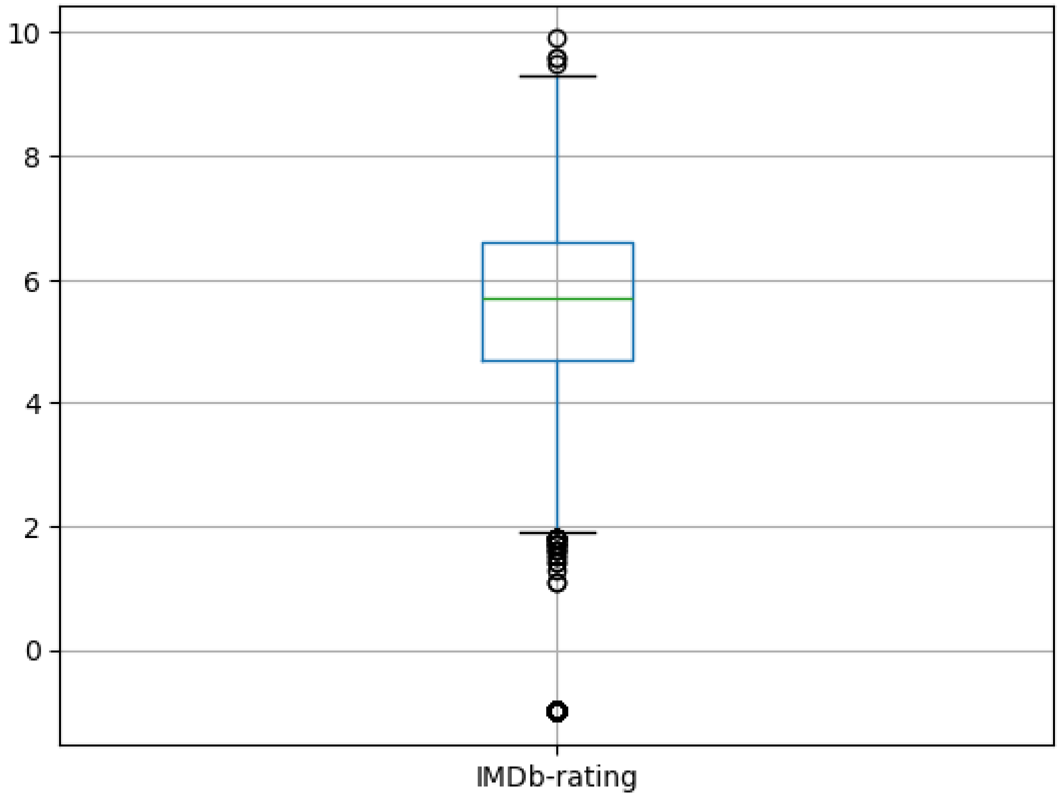
```
run_time 直方图和Q-Q图:
```

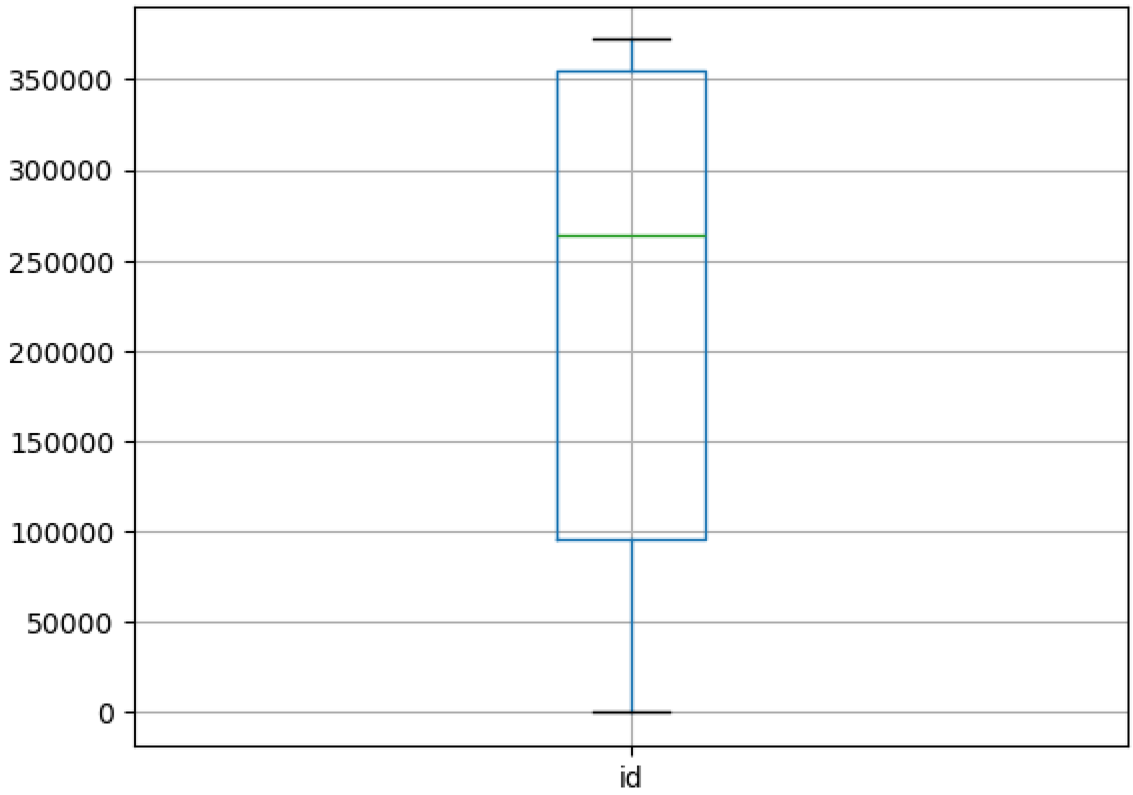


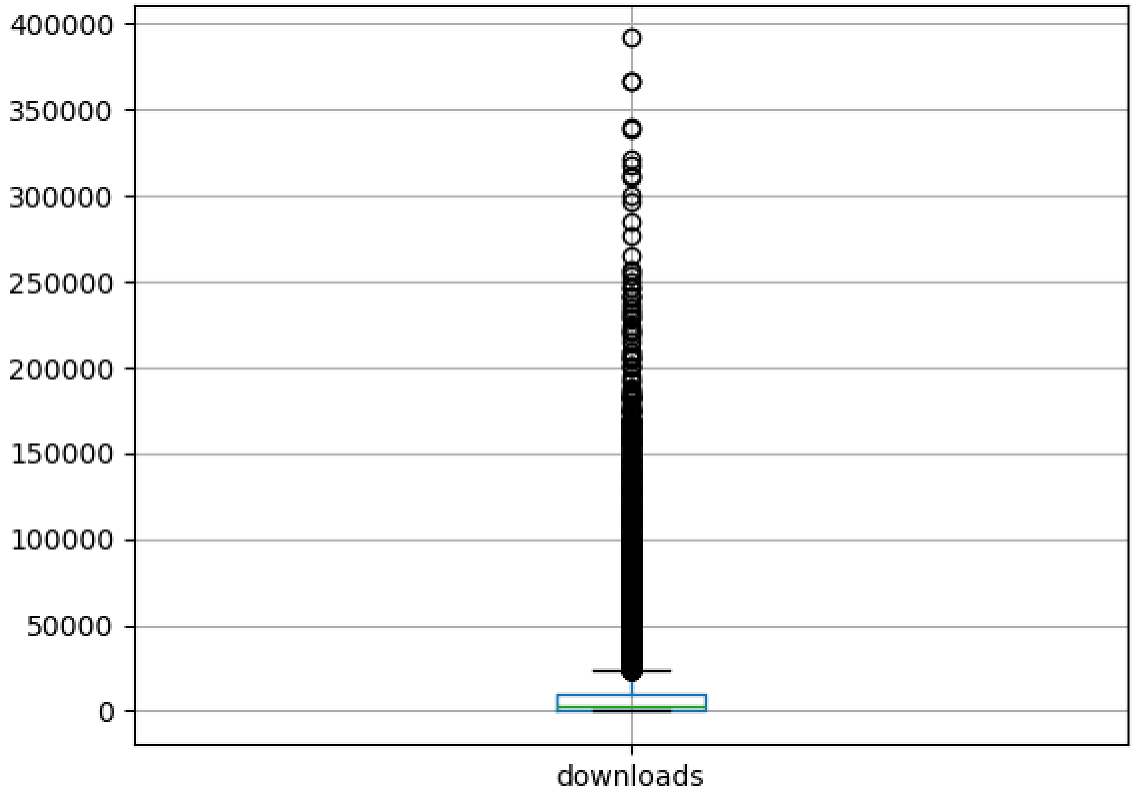
```
views 直方图和Q-Q图:
```

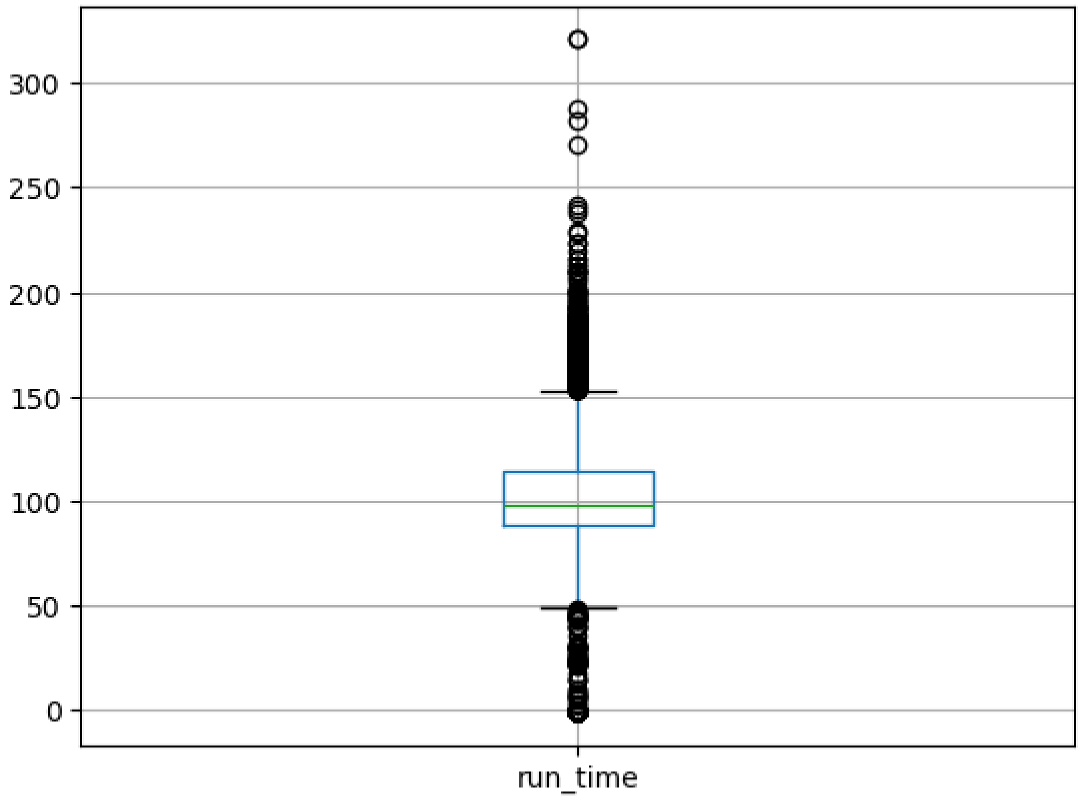


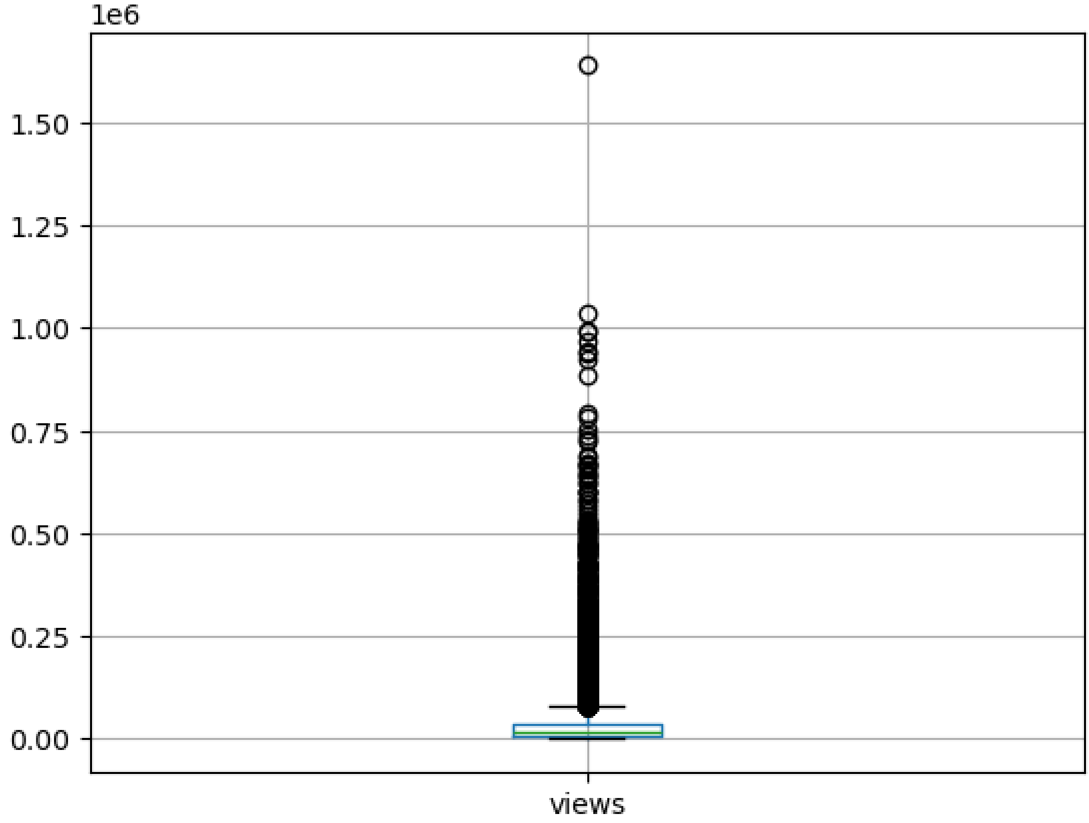
```
for field in num_fields:
    data.boxplot(field)
    plt.show()
```




350000
300000
250000
200000
150000
100000
50000
0
id


400000
350000
300000
250000
200000
150000
100000
50000
0
downloads


300
250
200
150
100
50
0
run_time


1e6
1.50
1.25
1.00
0.75
0.50
0.25
0.00
views

4、缺失值处理

首先对缺失值进行统计

```
# 缺失值处理
data_1 = pd.read_csv('movies_dataset.csv', index_col=0)
missing_data = data_1.isnull().sum()
missing_data = missing_data[missing_data != 0]
print(missing_data)
# 将包含缺失值的整行剔除
print('原始数据行数:', len(data))
drop_data = data_1.dropna(how='any')
print('将缺失部分剔除后数据行数:', len(drop_data))
drop_data.isna().sum()
```

```
IMDb-rating          841
appropriate_for     9476
director            1938
downloads              1
industry               1
language             546
posted_date            1
release_date           1
run_time            1768
storyline           1701
title                  1
views                  1
writer              2192
dtype: int64
原始数据行数: 20548
将缺失部分剔除后数据行数: 9902
```

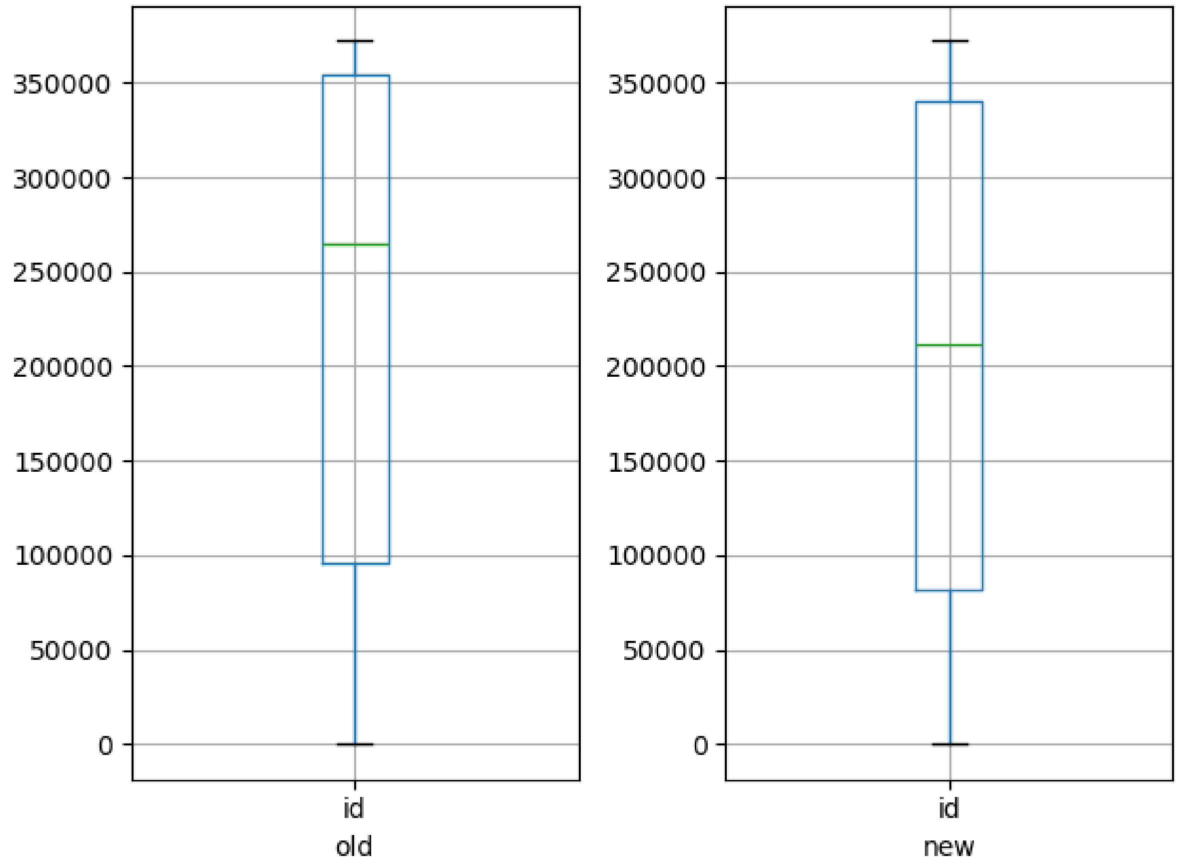
```
IMDb-rating        0
appropriate_for    0
director           0
downloads          0
id                 0
industry           0
language           0
posted_date        0
release_date       0
run_time           0
storyline          0
title              0
views              0
writer             0
dtype: int64
```

1）将缺失部分剔除

```
print('原始数据行数:', len(data))
drop_data = data_1.dropna(how='any')
print('将缺失部分剔除后数据行数:', len(drop_data))
drop_data.isna().sum()
```

```
print('以 id 属性为例，通过盒图对比新旧数据:')
field = 'id'
plt.subplot(1, 2, 1)
data_1.boxplot(field)
plt.xlabel('old')
plt.subplot(1, 2, 2)
drop_data.boxplot(field)
plt.xlabel('new')
plt.tight_layout()  # 调整整体空白
plt.show()
```

```
以 id 属性为例，通过盒图对比新旧数据:
```



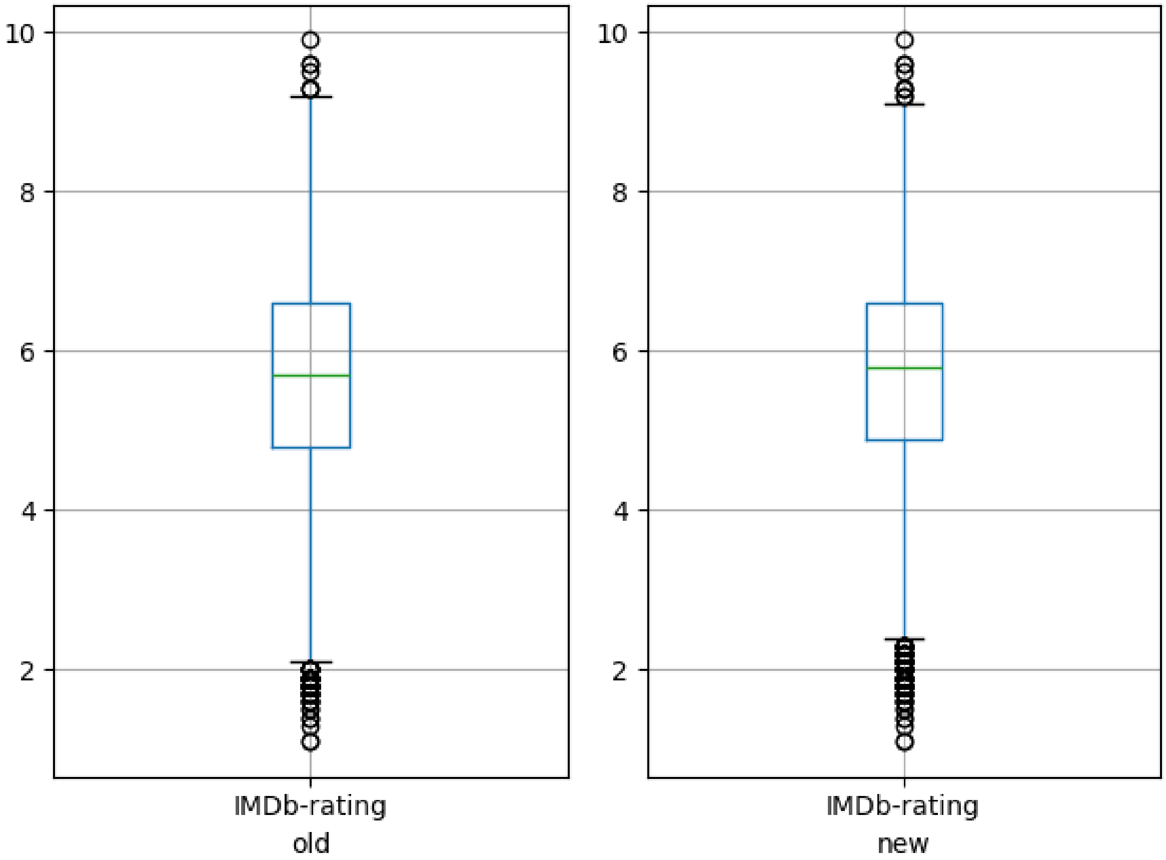
2）用最高频率值来填补缺失值

```
print('以 IMDb-rating 属性为例，通过盒图对比新旧数据:')
field = 'IMDb-rating'
mode = data_1[field].mode()[0]
new_data = data_1.fillna({field: mode})
```

```
print(field, '属性的最高频率值为:', mode)

plt.subplot(1, 2, 1)
data_1.boxplot(field)
plt.xlabel('old')
plt.subplot(1, 2, 2)
new_data.boxplot(field)
plt.xlabel('new')
plt.tight_layout()  # 调整整体空白
plt.show()
```

```
以 IMDb-rating 属性为例，通过盒图对比新旧数据:
IMDb-rating 属性的最高频率值为: 6.6
```



3）通过属性的相关关系来填补缺失值

```
data[num_fields].corr()
```

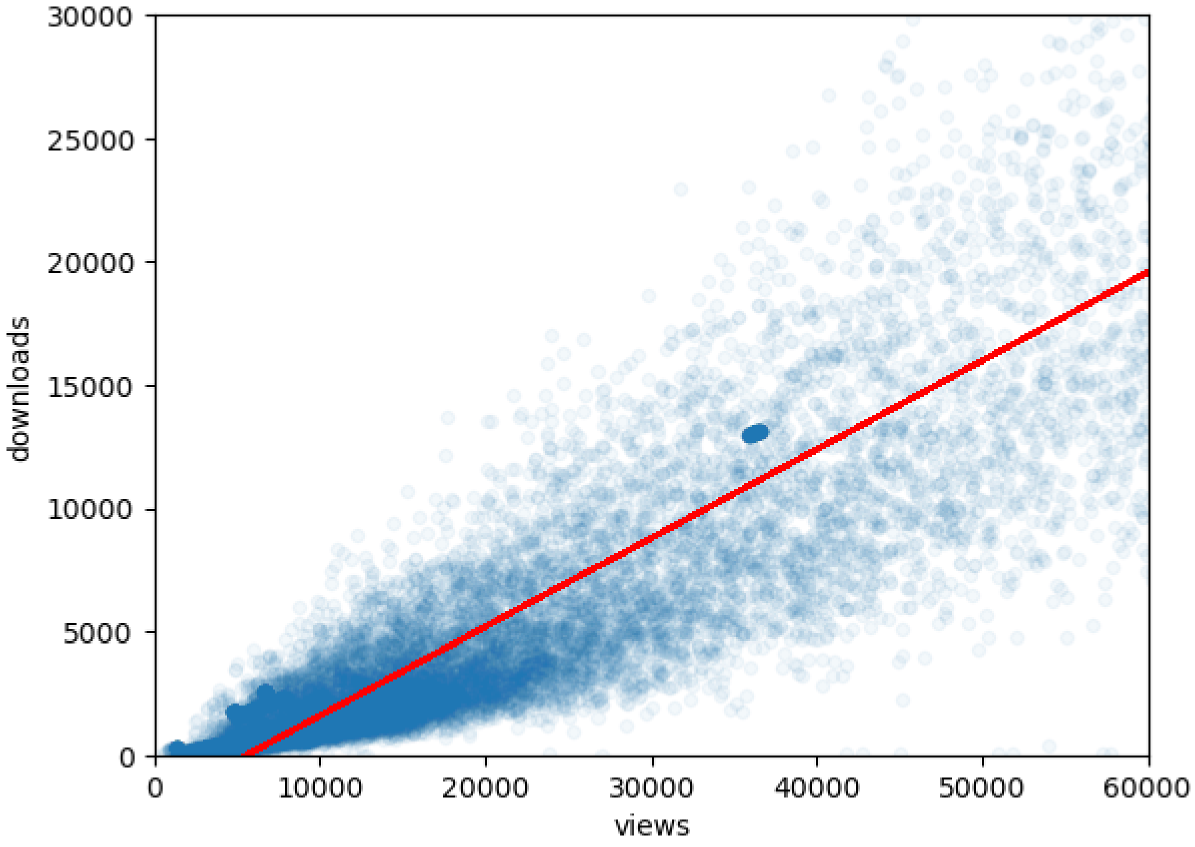
```
.dataframe tbody tr th {
    vertical-align: top;
}

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

	IMDb-rating	id	downloads	run_time	views
IMDb-rating	1.000000	0.002835	0.091868	0.540525	0.099334
id	0.002835	1.000000	-0.246679	-0.116051	-0.183486
downloads	0.091868	-0.246679	1.000000	0.280649	0.947877
run_time	0.540525	-0.116051	0.280649	1.000000	0.282563
views	0.099334	-0.183486	0.947877	0.282563	1.000000

可以看出downloads和views之前存在正相关关系，利用线性回归模型，通过views值预测downloads值

```
drop_data = data.dropna(subset=['downloads'])
x = drop_data['views']
y = drop_data['downloads']
x = np.array(x).reshape(-1, 1)
model = LinearRegression()
model.fit(x, y)
drop_data.plot(kind="scatter", x="views", y="downloads", alpha=0.05)
plt.plot(x, model.predict(x), 'r-')
plt.xlim(0, 60000)
plt.ylim(0,30000)
plt.show()
```



```python
new_data = data_1.copy()
new_data = new_data.dropna(subset=['downloads'])
for index, row in new_data[data_1['downloads'].isna()].iterrows():
    new_data['downloads'][index] = model.predict(np.array(row['views']).reshape(-1, 1))
```

downloads和views缺失值出现在同一行，其他属性对相关性弱

4）通过数据对象之间的相似性来填补缺失值

以填充“IMDb-rating”为例，使用相同“director”的数据对象的“IMDb-rating”均值来填充缺失数据，如果没有相同的“director”，则接下来依次考虑相同的“writer”、“industry”、“downloads”

```python
# 以填充“IMDb-rating”为例，使用相同“director”的数据对象的“IMDb-rating”均值来填充缺失数据，如果没有相同的“director”，
# 则接下来依次考虑相同的“writer”、“industry”、“downloads”
full_data = data_1[data_1['IMDb-rating'].notna()]
new_data = data_1.copy()
consider_fields = ['director','writer','industry','downloads']
for i, row in tqdm(list(new_data[data_1['IMDb-rating'].isna()].iterrows())):
    for field in consider_fields:
        tmp_data = full_data[full_data[field]==row[field]]
        if len(tmp_data) > 0:
            new_data['IMDb-rating'][i] = tmp_data['IMDb-rating'].mean()
            break
```

```
100%|██████████| 841/841 [00:01<00:00, 708.50it/s]
```

```
data_1[data_1['IMDb-rating'].isna()].head(5)['IMDb-rating']
```

```
6     NaN
12    NaN
16    NaN
18    NaN
24    NaN
Name: IMDb-rating, dtype: float64
```

```
new_data[data_1['IMDb-rating'].isna()].head(5)['IMDb-rating']
```

```
6      6.525000
12     6.525000
16     6.269453
18     6.525000
24     6.050348
Name: IMDb-rating, dtype: float64
```

可以看出新数据中缺失的“price”值已经通过相似对象的“price”属性的均值进行填充