Github Dataset的数据分析与处理

1. 摘要分析和可视化

摘要分析

Github Dataset包含两个csv文件，两个文件中的结构较为相似，因此此处采用较大的文件——repository_data.csv进行分析。首先编写分析数据摘要的函数，如下。其中`calc_5num_abstract()`函数用来计算数值属性的五数概括，`analyze_abstract_github()`用来进行数据摘要的提取，之后`print_abstract()`函数用来在控制台打印分析结果，`save_abstract()`用于将分析结果保存为.csv格式。

In [1]:
```
import pandas as pd
import numpy as np
import os


def calc_5num_abstract(arr: np.ndarray):
    n_max = np.nanmax(arr)
    n_min = np.nanmin(arr)
    q1 = np.percentile(arr, 25)
    median = np.nanmedian(arr)
    q3 = np.percentile(arr, 75)
    return n_min, q1, median, q3, n_max


def analyze_abstract_github(df: pd.DataFrame) -> dict:
    print("analyzing data")
    analyze_results = {}
    for col in df.columns:
        if df[col].dtype == object:
            count = df[col].value_counts()
            df_meta = {col: count.index, "count": count.values}
            analyze_results[col] = pd.DataFrame(df_meta)
        else:
            values = df[col].values
            mask = np.isnan(values)
            n_min, q1, median, q3, n_max = calc_5num_abstract(values[np.logical_
            null_calc = df[col].isnull().sum()
            res = pd.DataFrame(
                {"min": [n_min], "Q1": [q1], "median": [median], "Q3": [q3], "ma
            analyze_results[col] = res
    return analyze_results


def print_abstract(result):
    for k, v in result.items():
        print(k, v.to_string(index=False, max_rows=20), sep="\n")
        print()


def save_abstract(path, result):
    os.makedirs(path, exist_ok=True)
```

```
    for k, v in result.items():
        v.to_csv(os.path.join(path, f"{k}.csv"), index=False)
```

下面的代码用来实现摘要分析。

In [2]:

```
print("Analyzing repository_data.csv")
df_repository_data = pd.read_csv("data/github/repository_data.csv")
res = analyze_abstract_github(df_repository_data)
result_dir = "result/github/repository_data"
print_abstract(res)
save_abstract(result_dir, res)
```

```
Analyzing repository_data.csv
analyzing data
name
                                 name  count
                             dotfiles   5590
                                 blog   2038
                                 docs   1350
                              website   1163
                              scripts    649
                                 core    619
                             examples    615
                            portfolio    579
                                notes    507
                                talks    477
                                  ...    ...
            awesome-harmonica-lessons      1
                        fast-dataview      1
                   Schwarze-Sonne-RAT      1
                       ML-Papers-TLDR      1
                          macports-ci      1
             markdown-to-presentation      1
                        moodle-client      1
                    event-sourcing-graph      1
                  react-native-100-Demos      1
MSI-Z690-Carbon-i7-12700KF-Hackintosh      1

stars_count
 min  Q1  median   Q3    max  blanks
   2 7.0    12.0 30.0 359805       0

forks_count
 min  Q1  median   Q3    max  blanks
   0 1.0     4.0 11.0 242208       0

watchers
 min  Q1  median  Q3  max  blanks
   0 2.0     3.0 6.0 9544       0

pull_requests
 min  Q1  median  Q3    max  blanks
   0 0.0     1.0 6.0 301585       0

primary_language
          primary_language  count
                JavaScript 451954
                    Python 451473
                      Java 202394
                       C++ 150066
                       PHP 116058
                TypeScript 114813
                         C 111473
                        C# 108625
                        Go  93236
                      HTML  93140
                       ...    ...
                    Gradle      1
                    Turtle      1
Velocity Template Language      1
                     Grace      1
             Unity3D Asset      1
```

```
                LoomScript      1
        Ragel in Ruby Host      1
      Edje Data Collection      1
                     Sieve      1
                        Ox      1

languages_used

languages_used  count

['Python'] 257679

['JavaScript'] 157741

['Java'] 117624

['C#']  60299

['PHP']  56333

['Shell']  47143

['Python', 'Shell']  42092

['Go']  40804
                                                                    ['JavaScr
ipt', 'HTML', 'CSS']  39656
                                                                    ['JavaScr
ipt', 'CSS', 'HTML']  35377

...    ...
                ['JavaScript', 'CSS', 'HTML', 'C#', 'TSQL', 'ActionScript', 'Le
ss', 'PHP', 'Shell']      1
                            ['C', 'Assembly', 'Makefile', 'Shell', 'M4', 'Pyt
hon', 'Roff', 'C++']      1
                                        ['Kotlin', 'Java', 'Dockerfile', 'S
hell', 'PowerShell']      1
                              ['TypeScript', 'JavaScript', 'CSS', 'HTML', 'S
hell', 'PowerShell']      1
['Dart', 'Go', 'HTML', 'Makefile', 'Dockerfile', 'Ruby', 'Shell', 'Swift', 'Kot
lin', 'Objective-C']      1
                                   ['Svelte', 'TypeScript', 'JavaScript', 'H
TML', 'CSS', 'Rust']      1
                                            ['Dockerfile', 'Shell', 'JavaSc
ript', 'PowerShell']      1
                                  ['TypeScript', 'HTML', 'Vue', 'JavaScrip
t', 'Python', 'Shell']      1
                                                    ['C++', 'C', 'Pascal',
'Batchfile', 'GDB']      1
                                                   ['HTML', 'C++', 'TypeSc
ript', 'JavaScript']      1

commit_count
 min  Q1  median   Q3       max  blanks
 1.0 9.0    27.0 89.0 4314502.0    1921

created_at
          created_at  count
2017-06-05T20:53:54Z     10
2017-06-05T20:53:58Z      9
```

```
2014-01-17T08:00:09Z      8
2010-05-26T23:38:08Z      7
2019-03-29T08:13:35Z      7
2010-06-10T19:21:23Z      7
2014-01-17T08:00:07Z      7
2015-12-02T08:00:06Z      7
2010-06-10T19:21:22Z      7
2014-01-17T08:00:08Z      6
                    ...    ...
2017-10-13T20:45:53Z      1
2017-09-08T08:31:52Z      1
2017-08-22T13:42:48Z      1
2017-09-04T16:02:45Z      1
2017-09-17T05:36:46Z      1
2017-09-04T07:45:10Z      1
2017-08-21T11:35:16Z      1
2017-08-09T00:50:43Z      1
2017-10-07T13:05:26Z      1
2022-01-22T00:00:12Z      1

licence
```

licence	count
MIT License	784251
Apache License 2.0	210698
Other	167987
GNU General Public License v3.0	159443
BSD 3-Clause "New" or "Revised" License	47078
GNU General Public License v2.0	43297
GNU Affero General Public License v3.0	21554
BSD 2-Clause "Simplified" License	16819
The Unlicense	14400
GNU Lesser General Public License v3.0	14002
...	...
Open Data Commons Open Database License v1.0	57
Educational Community License v2.0	25
Mulan Permissive Software License, Version 2	20
Vim License	20
CeCILL Free Software License Agreement v2.1	19
Microsoft Reciprocal License	15
CERN Open Hardware Licence Version 2 - Permissive	4
CERN Open Hardware Licence Version 2 - Strongly Reciprocal	2
CERN Open Hardware Licence Version 2 - Weakly Reciprocal	2
GNU Free Documentation License v1.3	1

运行结束后，可以在`./result/github/repository_data`目录中找到摘要分析结果。对于标称数据，表格包含两列：可能取值及其频数；对于数值数据，表格中包含6列，分别是`min`（最小值）、`Q1`（第一四分位数）、`median`（中位数）、`Q3`（第三四分位数）、`max`（最大值）、`blanks`（缺失数据个数。

数据可视化

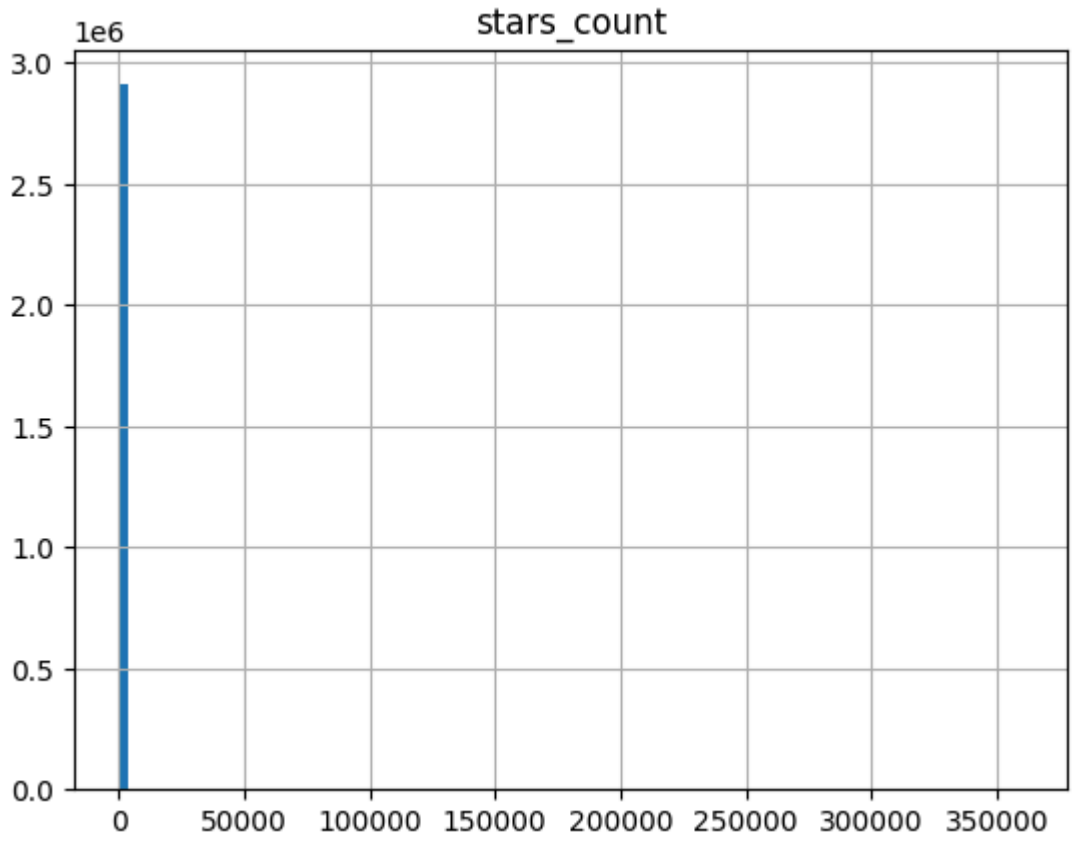
下面对repository_data.csv的数据进行可视化，包含直方图、盒图。下面分别对两种图编写可视化函数。

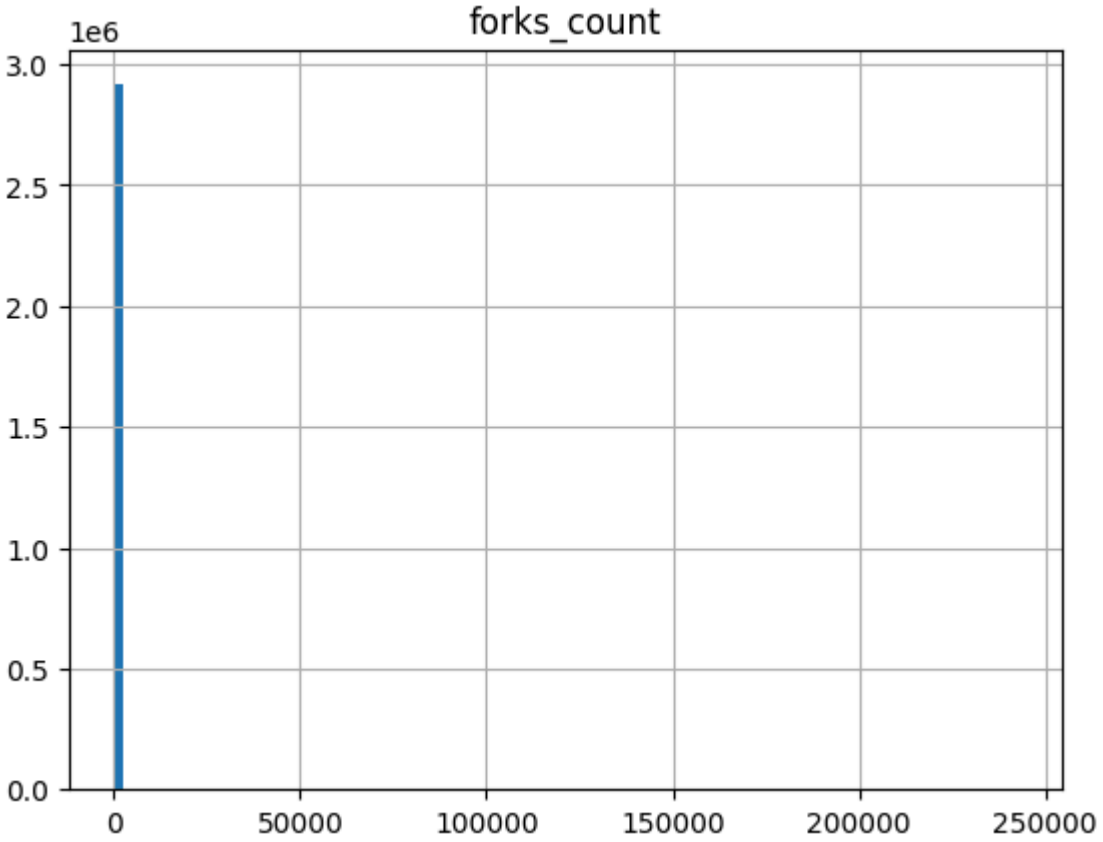
In [3]:
```
def draw_histogram(df: pd.DataFrame):
    for col in df.columns:
```

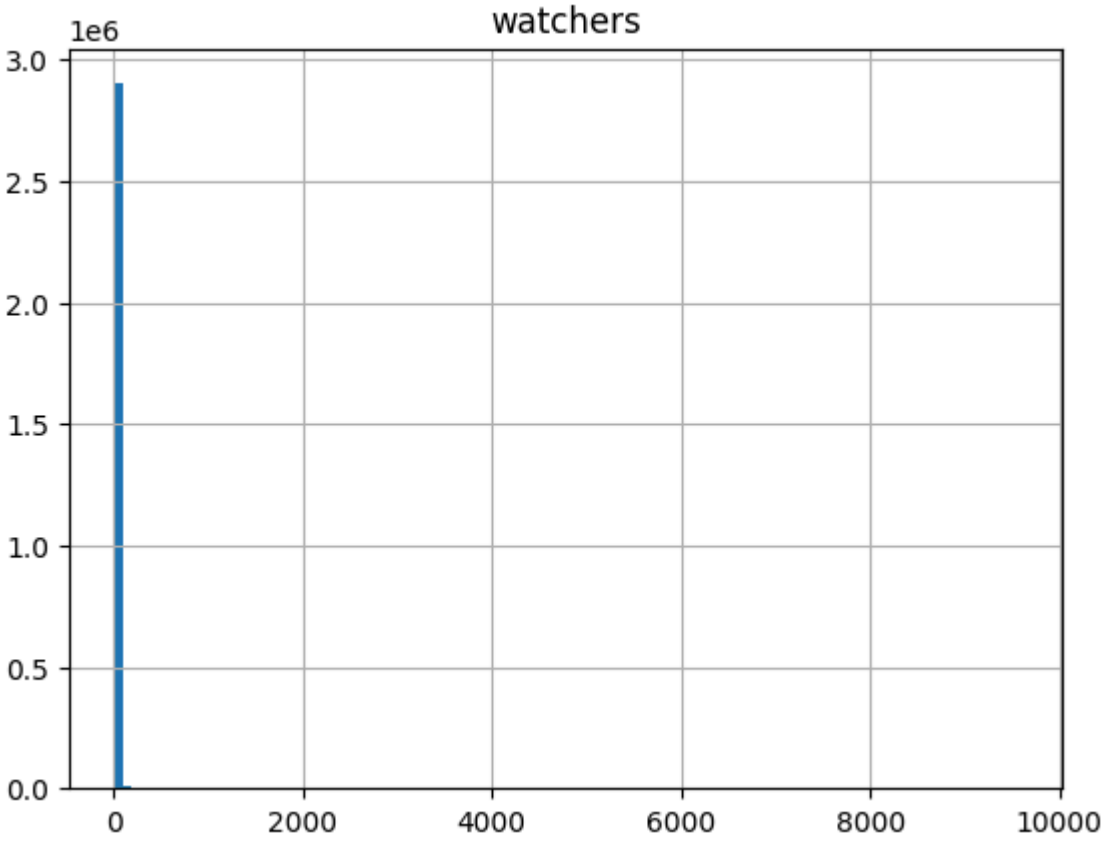
```
        if df[col].dtype != object:
            df.hist(column=col, bins=100)

def draw_boxgram(df: pd.DataFrame):
    df.boxplot()
```

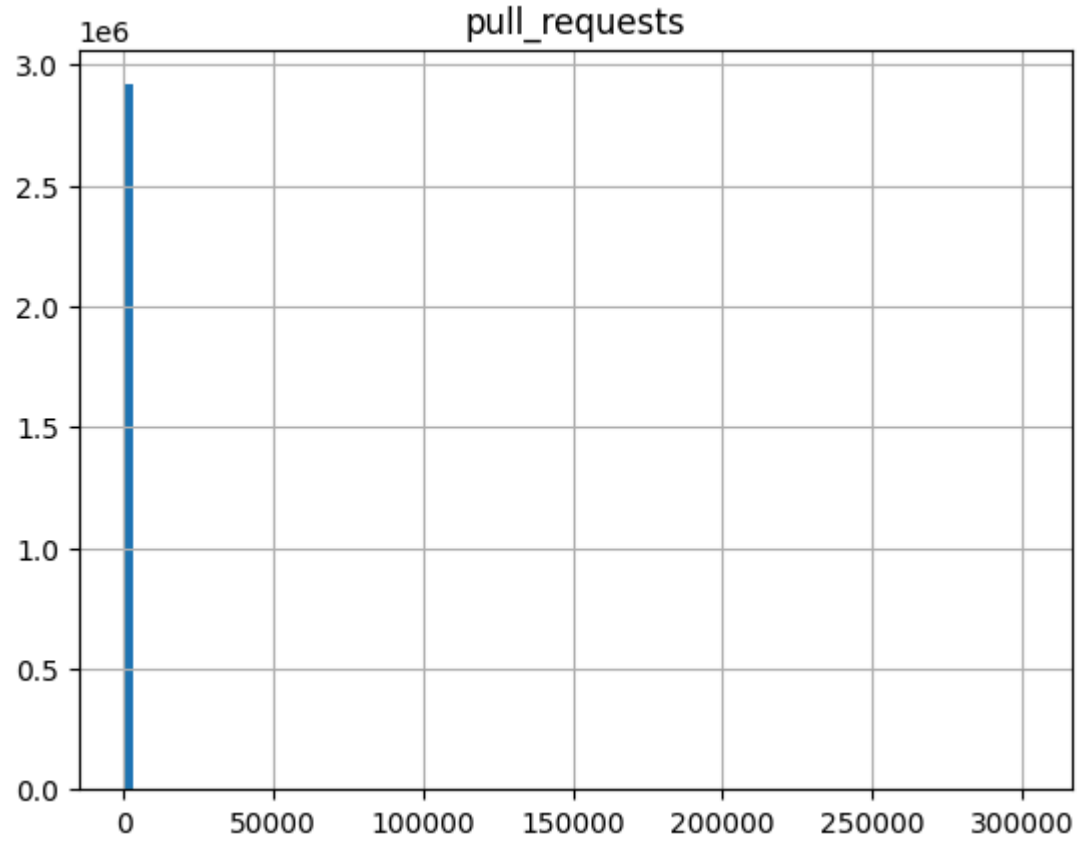
直方图

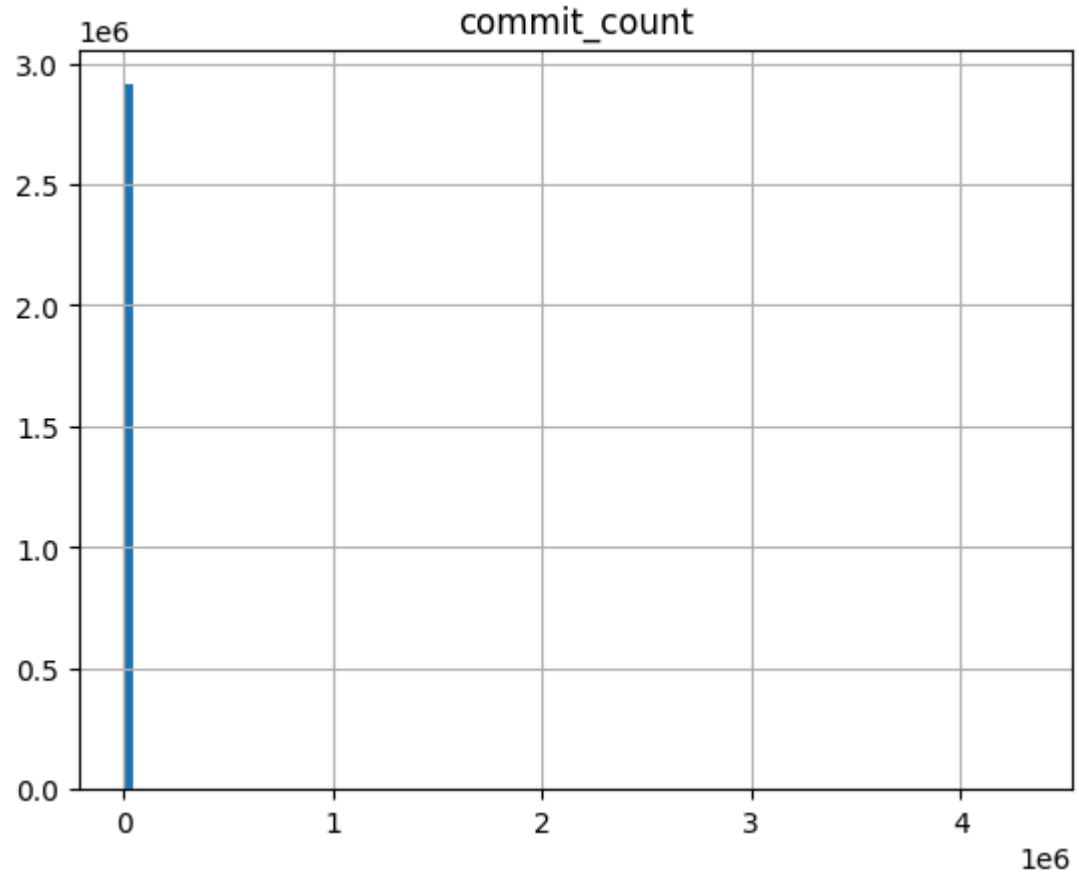
In [4]:
```
draw_histogram(df_repository_data)
```




forks_count
1e6
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
50000
100000
150000
200000
250000

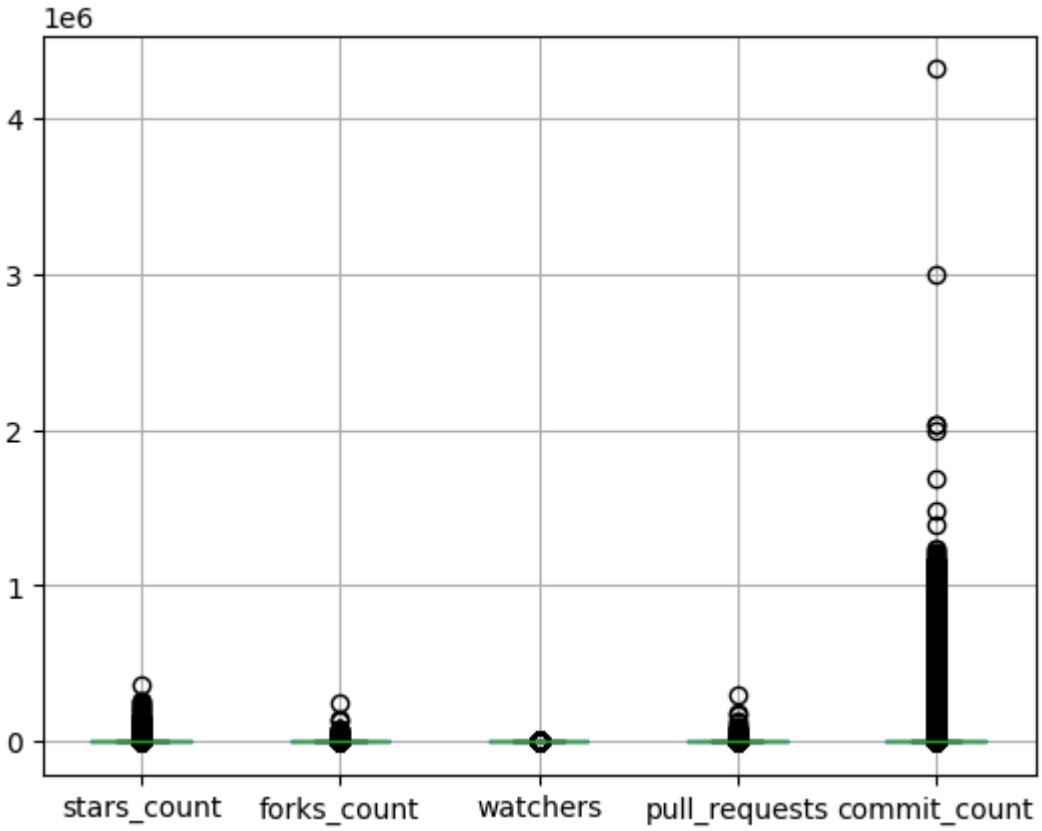

watchers
1e6
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2000
4000
6000
8000
10000





盒图

In [5]:
```
draw_boxgram(df_repository_data)
```



2. 数据缺失处理

从上面的数据分析中可以看出只有commit_count列里存在数据缺失，因此下面的实验仅在此列进行。

首先是缺失数据剔除：

In [6]:
```
print(len(df_repository_data))
```

```
2917951
```

In [7]:
```
df = df_repository_data[~df_repository_data["commit_count"].isnull()]
print(len(df))
```

```
2916030
```

该数据减少量与上面分析的结果相符，删除了1921条数据。

第二个是用最高频率值填补缺失值

In [8]:
```
null_lines = df_repository_data["commit_count"].isnull()
print(df_repository_data[null_lines]["commit_count"])
```

```
18104     NaN
31627     NaN
31774     NaN
31906     NaN
31919     NaN
          ..
2916733   NaN
2917040   NaN
2917177   NaN
2917464   NaN
2917641   NaN
Name: commit_count, Length: 1921, dtype: float64
```

In [9]:
```
freq_max = df_repository_data["commit_count"].value_counts().index[0]
print(freq_max)
```

```
2.0
```

In [10]:
```
df = df_repository_data["commit_count"].fillna(freq_max)
print(df[null_lines])
```

```
18104      2.0
31627      2.0
31774      2.0
31906      2.0
31919      2.0
          ...
2916733    2.0
2917040    2.0
2917177    2.0
2917464    2.0
2917641    2.0
Name: commit_count, Length: 1921, dtype: float64
```

可以看到缺失值均被填充为了2.0（最大频率值）。

下面使用平均数来填充缺失值。

In [11]:
```
mean = df_repository_data["commit_count"].mean()
print(mean)
```

```
614.3709265679709
```

In [12]:
```
df = df_repository_data["commit_count"].fillna(mean)
print(df[null_lines])
```

```
18104      614.370927
31627      614.370927
31774      614.370927
31906      614.370927
31919      614.370927
              ...
2916733    614.370927
2917040    614.370927
2917177    614.370927
2917464    614.370927
2917641    614.370927
Name: commit_count, Length: 1921, dtype: float64
```

空值均被填充为了平均数

下面使用前后值来填充

In [13]:
```
df = df_repository_data["commit_count"].fillna(method="pad")
print(df[null_lines])
```

```
18104      1489.0
31627       561.0
31774       367.0
31906        51.0
31919       160.0
            ...
2916733       3.0
2917040       4.0
2917177      47.0
2917464       4.0
2917641       8.0
Name: commit_count, Length: 1921, dtype: float64
```