eda

2019 年 6 月 15 日

Table of Contents


```
In [17]: from functions import *
```

```
In [157]: from config import *
          from functions import *
          import numpy as np
          import pandas as pd
          import matplotlib.pyplot as plt
          import warnings
          import json
          warnings.filterwarnings('ignore')
          pd.set_option('display.max_columns', None)
          pd.set_option('display.max_rows', None)
          pd.set_option('max_colwidth',100)
```

1 数据量

```
In [2]: ## 各个文件数据量
        str_names = ['test', 'train', 'listing_info', 'user_info', 'user_behavior_logs', 'user_tag
        for name in str_names:
            locals()['df_'+name] = pd.read_csv(path_data+locals()['file_'+name])
            print(name, locals()['df_'+name].shape)
```

```
test (130000, 5)
train (1000000, 7)
listing_info (5484891, 6)
user_info (954209, 8)
user_behavior_logs (55781271, 3)
user_taglist (615160, 3)
user_repay_logs (18001297, 7)
```

2 预处理与生成辅助文件

In [20]:
```
# 训练集预处理
df_train = df_train.sort_values(by=['user_id', 'listing_id', 'auditing_date', 'repay_date
df_train.replace({r'\N':np.nan}, inplace=True) # 缺失值处理
df_train['repay_interval'] = df_train['due_date'] + ':' + df_train['repay_date']
df_train['repay_interval'] = df_train['repay_interval'].apply(get_repay_interval) # 计算还
df_train['is_repay'] = df_train['repay_date'].apply(lambda x: 0 if x is np.nan else 1) #
```

In [35]:
```
# 生成文件: 训练集标的信息
df_listing_info_train = df_listing_info[df_listing_info.listing_id.isin(df_train.listing_
df_listing_info_train.to_csv(path_data+file_listing_info_train, index=None)

# 生成文件: 测试集标的信息
df_listing_info_test = df_listing_info[df_listing_info.listing_id.isin(df_test.listing_id
df_listing_info_test.to_csv(path_data+file_listing_info_test, index=None)
```

In [37]:
```
# 生成文件: 训练集用户日志信息
df_user_repay_logs_train = df_user_repay_logs[df_user_repay_logs.user_id.isin(df_train.us
df_user_repay_logs_train.to_csv(path_data+file_user_repay_logs_train, index=None)

# 生成文件: 测试集用户日志信息
df_user_repay_logs_test = df_user_repay_logs[df_user_repay_logs.user_id.isin(df_test.user
df_user_repay_logs_test.to_csv(path_data+file_user_repay_logs_test, index=None)
```

In [7]:
```
# 生成文件: 用户最后一次修改后的基本信息
df_user_info_last_update = df_user_info[['user_id', 'insertdate']]
df_user_info_last_update['insertdate'] = df_user_info_last_update['insertdate'].apply(get_
df_user_info_last_update = df_user_info_last_update.groupby('user_id').agg(lambda x:':'.jo
df_user_info_last_update['insertdate'] = df_user_info_last_update['insertdate'].apply(get_
df_user_info['insertdate'] = df_user_info['insertdate'].apply(get_time_string)
```

```
df_user_info_last_date = pd.merge(df_user_info_last_update, df_user_info, how='left', on=[
df_user_info_last_date.to_csv(path_data + file_user_info_last_date, index=None)
```

In [44]:
```
# 生成文件: 训练集用户信息
df_user_info_train = df_user_info_last_date[df_user_info_last_date.user_id.isin(df_train.
df_user_info_train.to_csv(path_data+file_user_info_train, index=None)

# 生成文件: 测试集用户信息
df_user_info_test = df_user_info_last_date[df_user_info_last_date.user_id.isin(df_test.us
df_user_info_test.to_csv(path_data+file_user_info_test, index=None)
```

In [137]:
```
# 生成文件: 用户最新的用户画像
df_user_taglist_last_update = df_user_taglist[['user_id', 'insertdate']]
df_user_taglist_last_update['insertdate'] = df_user_taglist_last_update['insertdate'].ap
df_user_taglist_last_update = df_user_taglist_last_update.groupby('user_id').agg(lambda
df_user_taglist_last_update['insertdate'] = df_user_taglist_last_update['insertdate'].ap
df_user_taglist['insertdate'] = df_user_taglist['insertdate'].apply(get_time_string)
df_user_taglist_last_date = pd.merge(df_user_taglist_last_update, df_user_taglist, how='
df_user_taglist_last_date.to_csv(path_data + file_user_taglist_last_date, index=None)
```

In [158]:
```
# 保存 tags
taglist = (set(x.split('|')) for x in df_user_taglist_last_date.taglist)
tags = sorted(set.union(*taglist))
with open(path_data+file_tags, 'w') as f:
    json.dump(tags, f)
```

3 训练集和测试集

In [15]:
```
# 用户的重合率
num_train_user_id = len(df_train.user_id.unique())
num_test_user_id = len(df_test.user_id.unique())
num_user_info_user_id = len(df_user_info.user_id.unique())
num_user_behavior_logs_user_id = len(df_user_behavior_logs.user_id.unique())
num_user_taglist_user_id = len(df_user_taglist.user_id.unique())
num_user_repay_logs_user_id = len(df_user_repay_logs.user_id.unique())
print('train', num_train_user_id) # 训练集有一个 user 有很多标的
print('test', num_test_user_id) # 测试集 user 都只有一个标的
print('user_info', num_user_info_user_id)
print('user_behavior_logs', num_user_behavior_logs_user_id)
print('user_taglist', num_user_taglist_user_id)
print('user_repay_logs', num_user_repay_logs_user_id)
```

```
train 823732
test 130000
user_info 928195
user_behavior_logs 920161
user_taglist 535380
user_repay_logs 874841
```

```
In [163]: num_train_test_user_id = len(set(df_train.user_id.unique()) & set(df_test.user_id.unique
          num_train_user_info_user_id = len(set(df_train.user_id.unique()) & set(df_user_info.user
          num_test_user_info_user_id = len(set(df_test.user_id.unique()) & set(df_user_info.user_i
          num_user_info_user_behavior_logs_user_id = len(set(df_user_behavior_logs.user_id.unique(
          num_user_info_user_taglist_user_id = len(set(df_user_taglist.user_id.unique()) & set(df_
          num_user_info_user_repay_logs_user_id = len(set(df_user_repay_logs.user_id.unique()) & s
          num_train_user_repay_logs_user_id = len(set(df_user_repay_logs.user_id.unique()) & set(d
          num_test_user_repay_logs_user_id = len(set(df_user_repay_logs.user_id.unique()) & set(df
          num_train_user_behavior_logs_user_id = len(set(df_user_behavior_logs.user_id.unique()) &
          num_test_user_behavior_logs_user_id = len(set(df_user_behavior_logs.user_id.unique()) &

          print('train & test', num_train_test_user_id) # 训练集和测试集有 2 万用户重合
          print('user info & train', num_train_user_info_user_id)
          print('user info & test', num_test_user_info_user_id)
          print('user info & user behavior logs', num_user_info_user_behavior_logs_user_id)
          print('user info & user taglist', num_user_info_user_taglist_user_id)
          print('user info & user repay logs', num_user_info_user_repay_logs_user_id) # 所有记录都
          print('user repay logs & train', num_train_user_repay_logs_user_id) # 训练集中大多数用户
          print('user repay logs & test', num_test_user_repay_logs_user_id) # 测试集大多数用户都在
          print('user behavior logs & train', num_train_user_behavior_logs_user_id) # 训练集中大多
          print('user behavior logs & test', num_test_user_behavior_logs_user_id) # 测试集大多数用
```

```
train & test 25537
user info & train 823732
user info & test 130000
user info & user behavior logs 920161
user info & user taglist 535380
user info & user repay logs 874841
user repay logs & train 779298
user repay logs & test 121080
user behavior logs & train 817350
user behavior logs & test 128348
```

```
In [113]: # 还款次数
          repay_time = df_train[['user_id', 'listing_id', 'auditing_date', 'due_amt', 'repay_amt']
          print('num', repay_time.shape)
          repay_time = repay_time.groupby(['user_id', 'listing_id', 'auditing_date', 'due_amt']).a
          print('agg num', repay_time.shape) # 训练集中都是一次还清
```

```
num (1000000, 5)
agg num (1000000, 5)
```

```
In [112]: # 逾期还款的记录数
          print('no repay', df_train['repay_date'].isnull().sum())
```

```
no repay 117192
```

```
In [114]: # 还款日最晚还款日期间隔的分布
          plt.bar(df_train.repay_interval.value_counts().sort_index().index, height=df_train.repay
          plt.show() # 大部分为还款日当天还
```

```
In [116]: # 训练集还款金额的分布
          cut_due_amt = pd.cut(df_train.due_amt, 10)
          print(cut_due_amt.value_counts().sort_index())
```

```
(-1.356, 1898.41]         979073
(1898.41, 3779.366]        18336
(3779.366, 5660.323]        1970
(5660.323, 7541.279]         480
(7541.279, 9422.236]         108
(9422.236, 11303.192]         26
(11303.192, 13184.149]         5
(13184.149, 15065.105]         0
(15065.105, 16946.062]         1
(16946.062, 18827.018]         1
Name: due_amt, dtype: int64
```

```
In [117]: # 测试集还款金额的分布
          cut_due_amt = pd.cut(df_test.due_amt, 10)
          print(cut_due_amt.value_counts().sort_index())
```

```
(39.606, 1550.922]        125753
(1550.922, 3047.273]        3624
```

```
(3047.273, 4543.625]         487
(4543.625, 6039.976]          95
(6039.976, 7536.328]          31
(7536.328, 9032.68]            5
(9032.68, 10529.031]           3
(10529.031, 12025.383]         1
(12025.383, 13521.735]         0
(13521.735, 15018.086]         1
Name: due_amt, dtype: int64
```

```
In [126]: # 不还款和还款的记录，它们的借款分布是否相同
          print('--repay---')
          print(df_train[df_train.is_repay == 1].due_amt.describe())
          print('---not repay---')
          print(df_train[df_train.is_repay == 0].due_amt.describe()) # 分布没有什么明显的差别
```

```
--repay---
count    882808.000000
mean        449.180055
std         511.738357
min          17.453300
25%         159.114700
50%         285.112600
75%         539.494500
max       18827.018400
Name: due_amt, dtype: float64
---not repay---
count    117192.000000
mean        473.469849
std         531.908495
min          30.958100
25%         168.272400
50%         300.341800
75%         571.932500
max       16553.338000
Name: due_amt, dtype: float64
```

4 标的数据

```
In [137]: # 标的重合率
          num_train_listing_id = len(df_train.listing_id.unique())
          num_test_listing_id = len(df_test.listing_id.unique())
          num_listing_info_listing_id = len(df_listing_info.listing_id.unique())
          num_user_repay_logs_listing_id = len(df_user_repay_logs.listing_id.unique())
          print('train', num_train_listing_id) # 训练集标的都唯一
          print('test', num_test_listing_id) # 测试集标的都唯一
          print('listing_info', num_listing_info_listing_id)
          print('user_repay_logs', num_user_repay_logs_listing_id)
```

```
train 1000000
test 130000
listing_info 5484891
user_repay_logs 4216576
```

```
In [142]: num_train_test_listing_id = len(set(df_train.listing_id.unique()) & set(df_test.listing_
          num_train_listing_info_listing_id = len(set(df_train.listing_id.unique()) & set(df_listi
          num_test_listing_info_listing_id = len(set(df_test.listing_id.unique()) & set(df_listing
          num_train_user_repay_logs_listing_id = len(set(df_train.listing_id.unique()) & set(df_us
          num_test_user_repay_logs_listing_id = len(set(df_test.listing_id.unique()) & set(df_user
          print('train & test', num_train_test_listing_id) # 训练集和测试集没有标的是相同的
          print('listing_info & train', num_train_listing_info_listing_id) # 训练集都有标的信息
          print('listing_info & test', num_test_listing_info_listing_id) # 测试集都有标的信息
          print('user_repay_logs & train', num_train_user_repay_logs_listing_id)# 训练集的标的有 17
          print('user_repay_logs & test', num_test_user_repay_logs_listing_id) # 测试集的标的没有日
```

```
train & test 0
listing_info & train 1000000
listing_info & test 130000
user_repay_logs & train 172610
user_repay_logs & test 0
```

```
In [183]: # 期限的分布
          print(df_listing_info.term.value_counts())
```

```
6     2393016
12    1372299
9     1302618
```

```
3      416958
Name: term, dtype: int64
```

```
In [188]: # 本金的分布
          cut_listing_principal= pd.cut(df_listing_info.principal, 5)
          print(cut_listing_principal.value_counts().sort_index())
```

```
(54.3, 11250.0]       5347654
(11250.0, 22390.0]     129784
(22390.0, 33530.0]       6767
(33530.0, 44670.0]        588
(44670.0, 55810.0]         98
Name: principal, dtype: int64
```

```
In [190]: # 利率的分布
          cut_listing_rate = pd.cut(df_listing_info.rate, 5)
          print(cut_listing_rate.value_counts().sort_index())
```

```
(6.497, 7.06]     301762
(7.06, 7.62]     2217877
(7.62, 8.18]      666136
(8.18, 8.74]     1743795
(8.74, 9.3]       555321
Name: rate, dtype: int64
```

5 用户基本信息数据

```
In [4]: df_user_info_last_date = pd.read_csv(path_data + file_user_info_last_date)
```

```
In [29]: # 性别分布
         print(df_user_info_last_date.gender.value_counts())
```

```
男    636349
女    291846
Name: gender, dtype: int64
```

```
In [9]: gender_repay[gender_repay.gender == '男']['count']
```

```
Out[9]: 2     80957
        3    604660
        Name: count, dtype: int64
```

```
In [11]: is_repay = df_train[['user_id', 'is_repay']]
         user_gender = df_user_info_last_date[['user_id', 'gender']]
         gender_repay = pd.merge(is_repay, user_gender, on='user_id', how='left')
         gender_repay['count'] = 1
         gender_repay = gender_repay.groupby(['gender', 'is_repay'])['count'].agg(sum).reset_index
         gender_repay.loc[gender_repay.gender == '男' ,'count'] = gender_repay['count'] / sum(gend
         gender_repay.loc[gender_repay.gender == '女' ,'count'] = gender_repay['count'] / sum(gend
```

```
In [12]: print(gender_repay)
```

```
  gender  is_repay     count
0      女         0  0.115258
1      女         1  0.884742
2      男         0  0.118079
3      男         1  0.881921
```

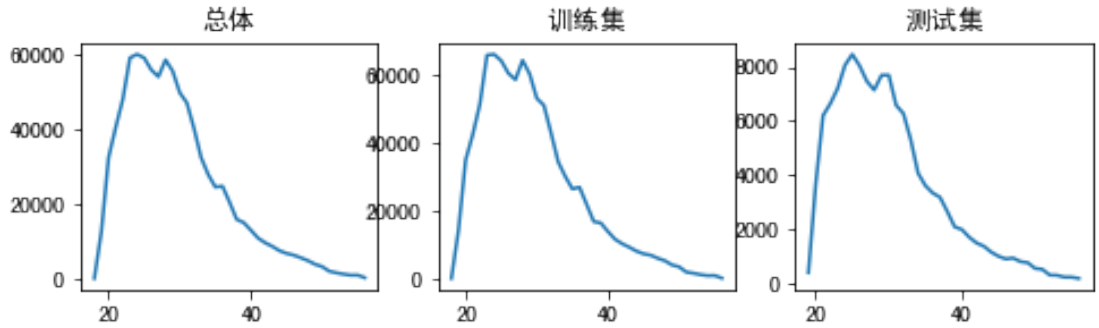
```
In [38]: # 男女在还贷时间上的差异
         is_repay = df_train[['user_id', 'repay_interval']]
         user_gender = df_user_info_last_date[['user_id', 'gender']]
         gender_repay = pd.merge(is_repay, user_gender, on='user_id', how='left')
         gender_repay.dropna(inplace=True)
         print('---男---')
         print(gender_repay[gender_repay.gender == '男'].repay_interval.describe())
         print('---女---')
         print(gender_repay[gender_repay.gender == '女'].repay_interval.describe()) # 男女在还款日其
```

```
---男---
count    604660.000000
mean          4.148163
std           7.364535
min           0.000000
25%           0.000000
50%           1.000000
75%           4.000000
max          31.000000
Name: repay_interval, dtype: float64
---女---
count    278148.000000
mean          4.139882
std           7.380120
min           0.000000
```

```
25%            0.000000
50%            1.000000
75%            4.000000
max           31.000000
Name: repay_interval, dtype: float64
```

```
In [117]: # 年龄分布
          is_repay = df_train[['user_id', 'is_repay']]
          user_age = df_user_info_last_date[['user_id', 'age']]
          age_repay_train = pd.merge(is_repay, user_age, on='user_id', how='left')
          age_repay_test = pd.merge(df_test, user_age, on='user_id', how='left')
```

```
In [118]: fig = plt.figure(figsize=(8, 2))
          ax1 = fig.add_subplot(1,3,1)
          plt.title('总体')
          plt.plot(df_user_info_last_date.age.value_counts().sort_index())
          ax2 = fig.add_subplot(1,3,2)
          plt.title('训练集')
          plt.plot(age_repay_train.age.value_counts().sort_index())
          ax3 = fig.add_subplot(1,3,3)
          plt.title('测试集')
          plt.plot(age_repay_test.age.value_counts().sort_index())
          plt.show() # 用户信息和训练集采样分布一致
```




```
In [119]: # 所有用户的年龄分布
          print(user_age.age.describe())
```

```
count    928195.000000
mean         29.473072
```

```
std           7.042113
min          18.000000
25%          24.000000
50%          28.000000
75%          33.000000
max          56.000000
Name: age, dtype: float64
```

```
In [120]: # 年龄和是否还款的关系
          age_repay_train['cut_age'] = pd.cut(age_repay_train.age, 10, labels=[str(x) for x in ran
          age_repay_train['count'] = 1
          age_repay_train = age_repay_train.groupby(['cut_age', 'is_repay'])['count'].agg(sum).res
          for i in range(1, 11):
              age_repay_train.loc[age_repay_train.cut_age == str(i) ,'count'] = age_repay_train['c
          print(age_repay_train) # 每个年龄中分布还算比较自然
```

	cut_age	is_repay	count
0	1	0	0.104095
1	1	1	0.895905
2	2	0	0.119104
3	2	1	0.880896
4	3	0	0.127291
5	3	1	0.872709
6	4	0	0.119494
7	4	1	0.880506
8	5	0	0.112089
9	5	1	0.887911
10	6	0	0.107835
11	6	1	0.892165
12	7	0	0.104896
13	7	1	0.895104
14	8	0	0.099992
15	8	1	0.900008
16	9	0	0.104335
17	9	1	0.895665
18	10	0	0.108077
19	10	1	0.891923

```
In [ ]: # 年龄和还款间隔的关系
        age_repay_train['cut_age'] = pd.cut(age_repay_train.age, 10, labels=[str(x) for x in range
```

```
        age_repay_train['count'] = 1
        age_repay_train = age_repay_train.groupby(['cut_age', 'is_repay'])['count'].agg(sum).reset
        for i in range(1, 11):
            age_repay_train.loc[age_repay_train.cut_age == str(i) ,'count'] = age_repay_train['cou
        print(age_repay_train) # 每个年龄中分布还算比较自然
```

```
In [125]: # 省份
          print(sorted(df_user_info_train.id_province.unique())) # 身份证
          print(sorted(df_user_info_train.cell_province.unique())) # 手机 (有为空的)
```

```
['c01', 'c02', 'c03', 'c04', 'c05', 'c06', 'c07', 'c08', 'c09', 'c10', 'c11', 'c12', 'c13', 'c14',
['\\N', 'c01', 'c02', 'c03', 'c04', 'c05', 'c06', 'c07', 'c08', 'c09', 'c10', 'c11', 'c12', 'c13',
```

6 用户画像

```
In [ ]: df_user_taglist_last_date = pd.read_csv(path_data + file_user_taglist_last_date)
        with open(path_data+file_tags, 'r') as f:
            tags = json.load(f)
```

```
In [141]: # 用户画像文件中，用户是否唯一
          print(df_user_taglist.user_id.is_unique)
```

```
False
```

```
In [142]: # 生成的最后一次用户画像中，用户是否唯一
          print(df_user_taglist_last_date.user_id.is_unique)
```

```
True
```

```
In [161]: # 标签的数量
          print('tags num', len(tags))
```

```
tags num 5986
```

7 用户行为日志

```
In [164]: # 每个行为的数量
          print(df_user_behavior_logs.behavior_type.value_counts().sort_index())
```

```
1    43469932
2     1007660
3    11303679
Name: behavior_type, dtype: int64
```

8 用户借款日志

略

```
In [37]: # 提交格式
```

Out[37]:

	listing_id	repay_amt	repay_date
0	5431438	4.3309	2019-03-12
1	5431438	4.3309	2019-03-13
2	5431438	4.3309	2019-03-14
3	5431438	4.3309	2019-03-15
4	5431438	4.3309	2019-03-16