导入实验所用的包

```
1  from mlxtend.preprocessing import TransactionEncoder
2  from mlxtend.frequent_patterns import apriori
3  from mlxtend.frequent_patterns import association_rules
4  from mlxtend.frequent_patterns import fpmax, fpgrowth
5  import pandas as pd
6  import numpy as np
7  from IPython.core.interactiveshell import InteractiveShell
8  InteractiveShell.ast_node_interactivity = "all"
9
```

进行数据的读取和预处理--将数据存到列表中

```
1   f = open(r"C:\Users\38061\Jupyter_Notebook\shujuwajue\TheTwo\数据集-T10I4D100K.txt")
2   line = f.readline()
3   lines = []
4   while line:
5       line_data = line.split()
6       lines.append(line_data)
7       line = f.readline()
8   f.close()
9   data = lines
10  data
```

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5708      '991',
5709      '998'],
5710     ...]
```

寻找数据频繁项集

利用Apriori算法进行寻找

```
1  te = TransactionEncoder()
2  te_ary = te.fit(data).transform(data)
3  df = pd.DataFrame(te_ary, columns=te.columns_)
4
5
6  frequent_itemsets = apriori(df, min_support=0.02, use_colnames=True)
7
8  print('以下为使用Apriori算法进行寻找频繁项集的结果')
9  frequent_itemsets
```

```
1  以下为使用Apriori算法进行寻找频繁项集的结果
```

```
1  .dataframe tbody tr th {
2      vertical-align: top;
3  }
4
5  .dataframe thead th {
6      text-align: right;
7  }
```

	support	itemsets
0	0.02680	(112)
1	0.02193	(116)
2	0.03415	(12)
3	0.04973	(120)
4	0.02641	(132)
...	...	...
150	0.03626	(956)
151	0.02732	(960)
152	0.03921	(966)
153	0.02086	(970)
154	0.02713	(998)

155 rows × 2 columns

利用FpGrowth算法寻找

```
1  te = TransactionEncoder()
2  te_ary = te.fit(data).transform(data)
3  df = pd.DataFrame(te_ary, columns=te.columns_)
4
5
6  frequent_itemsets = fpgrowth(df, min_support=0.02, use_colnames=True)
7
8  print('以下为使用FpGrowth算法进行寻找频繁项集的结果')
9  frequent_itemsets
```

```
1  以下为使用FpGrowth算法进行寻找频繁项集的结果
```

```
1  .dataframe tbody tr th {
2      vertical-align: top;
3  }
4
5  .dataframe thead th {
6      text-align: right;
7  }
```

	support	itemsets
0	0.07828	(368)
1	0.03982	(538)
2	0.03771	(775)
3	0.03085	(825)
4	0.02783	(561)
...	...	...
150	0.03281	(510)
151	0.02022	(826)
152	0.02693	(661)
153	0.02492	(634)
154	0.02082	(450)

155 rows × 2 columns

结论：两种算法进行比较，其结果相同，但是FpGrowth算法明显快于Apriori算法，因此以下均使用FpGrowth算法

计算最大频繁项集（在min_support=0.001计算）

```
1  fi2 = fpgrowth(df, min_support=0.001, use_colnames=True)
2  #frequent_itemsets = apriori(df, min_support=0.01, use_colnames=True)
3  #frequent_itemsets = fpmax(df, min_support=0.01, use_colnames=True)
4  print('以下为support大于0.001的情况下频繁项集')
5  fi2
```

```
1  以下为support>0.001的情况下频繁项集
```

```
1  .dataframe tbody tr th {
2      vertical-align: top;
3  }
4
5  .dataframe thead th {
6      text-align: right;
7  }
```

	support	itemsets
0	0.07828	(368)
1	0.03982	(538)
2	0.03771	(775)
3	0.03085	(825)
4	0.02783	(561)
...	...	...
27527	0.00182	(890, 806, 886, 259, 38, 640)
27528	0.00181	(890, 806, 886, 259, 722, 38)
27529	0.00180	(806, 886, 259, 722, 38, 640)
27530	0.00179	(890, 806, 886, 259, 722, 38, 640)
27531	0.00100	(847, 37)

27532 rows × 2 columns

```
1  fi2['length'] = fi2['itemsets'].apply(lambda x: len(x))
2  print('以下为support大于0.001的情况下频繁项集及其长度')
3  fi2
```

```
1  以下为support大于0.001的情况下频繁项集及其长度
```

```
1  .dataframe tbody tr th {
2      vertical-align: top;
3  }
4
5  .dataframe thead th {
6      text-align: right;
7  }
```

	support	itemsets	length
0	0.07828	(368)	1
1	0.03982	(538)	1
2	0.03771	(775)	1
3	0.03085	(825)	1
4	0.02783	(561)	1
...	...	...	...
27527	0.00182	(890, 806, 886, 259, 38, 640)	6
27528	0.00181	(890, 806, 886, 259, 722, 38)	6
27529	0.00180	(806, 886, 259, 722, 38, 640)	6
27530	0.00179	(890, 806, 886, 259, 722, 38, 640)	7
27531	0.00100	(847, 37)	2

27532 rows × 3 columns

```
1  fi2_max = fpmax(df, min_support=0.001, use_colnames=True)
2  print('以下为support>0.001的情况下最大频繁项集')
3  fi2_max
```

```
1  以下为support>0.001的情况下最大频繁项集
```

```
1  .dataframe tbody tr th {
2      vertical-align: top;
3  }
4
5  .dataframe thead th {
6      text-align: right;
7  }
```

	support	itemsets
0	0.00102	(729)
1	0.00102	(330)
2	0.00103	(490, 856, 906)
3	0.00109	(199)
4	0.00109	(102)
...	...	...
4049	0.00294	(722, 829)
4050	0.00328	(722, 766)
4051	0.00392	(368, 722)
4052	0.00317	(766, 529)
4053	0.00321	(829, 766)

4054 rows × 2 columns

挖掘关联规则

分别使用confidence和lift指标

```
1  rules1=association_rules(fi2, metric="confidence", min_threshold=0.997)
2  print('以下为使用confidence指标且大于0.997情况下的关联规则')
3  rules1
4
5  rules2 = association_rules(fi2, metric="lift", min_threshold=700)
6  print('以下为使用lift指标且大于700情况下的关联规则')
7  rules2
```

```
1  以下为使用confidence指标且大于0.997情况下的关联规则
```

```
1  .dataframe tbody tr th {
2      vertical-align: top;
3  }
4
5  .dataframe thead th {
6      text-align: right;
7  }
```

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction
0	(489, 145, 283)	(674)	0.00248	0.02527	0.00248	1.0	39.572616	0.002417	inf
1	(489, 39, 145, 283)	(674)	0.00245	0.02527	0.00245	1.0	39.572616	0.002388	inf
2	(422, 145, 487)	(885)	0.00138	0.03043	0.00138	1.0	32.862307	0.001338	inf
3	(354, 422, 487)	(885)	0.00133	0.03043	0.00133	1.0	32.862307	0.001290	inf
4	(354, 422, 145, 487)	(885)	0.00131	0.03043	0.00131	1.0	32.862307	0.001270	inf
...	...	...	...	...	...	...	...	...	...
882	(351, 72, 749, 841)	(268, 545)	0.00114	0.00119	0.00114	1.0	840.336134	0.001139	inf
883	(841, 606, 72, 351, 749)	(545)	0.00113	0.00119	0.00113	1.0	840.336134	0.001129	inf
884	(841, 545, 606, 72, 351, 749)	(268)	0.00113	0.00885	0.00113	1.0	112.994350	0.001120	inf
885	(841, 606, 72, 268, 351, 749)	(545)	0.00113	0.00119	0.00113	1.0	840.336134	0.001129	inf
886	(841, 606, 72, 351, 749)	(268, 545)	0.00113	0.00119	0.00113	1.0	840.336134	0.001129	inf

887 rows × 9 columns

```
1  以下为使用lift指标且大于700情况下的关联规则
```

```
1  .dataframe tbody tr th {
2      vertical-align: top;
3  }
4
5  .dataframe thead th {
6      text-align: right;
7  }
```

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction
0	(849, 809)	(447, 594)	0.00119	0.00128	0.00109	0.915966	715.598739	0.001088	11.884768
1	(447, 594)	(849, 809)	0.00128	0.00119	0.00109	0.851562	715.598739	0.001088	6.728825
2	(849, 809, 529)	(447, 594)	0.00114	0.00128	0.00107	0.938596	733.278509	0.001069	16.264869
3	(447, 809, 529)	(849, 594)	0.00122	0.00121	0.00107	0.877049	724.834033	0.001069	8.123492
4	(809, 529, 594)	(849, 447)	0.00117	0.00123	0.00107	0.914530	743.520256	0.001069	11.685609
...	...	...	...	...	...	...	...	...	...
4207	(476)	(914, 319, 145)	0.00133	0.00104	0.00102	0.766917	737.420474	0.001019	4.285861
4208	(914, 536)	(476)	0.00104	0.00133	0.00100	0.961538	722.961249	0.000999	25.965420
4209	(476)	(914, 536)	0.00133	0.00104	0.00100	0.751880	722.961249	0.000999	4.026112
4210	(319, 536)	(476)	0.00105	0.00133	0.00100	0.952381	716.075904	0.000999	20.972070
4211	(476)	(319, 536)	0.00133	0.00105	0.00100	0.751880	716.075904	0.000999	4.026071

4212 rows × 9 columns

联合使用confidence与lift指标

```
1  rules = rules1.drop(rules1[rules1.lift <700].index)
2  #设置标题索引并打印结果
3  rules.rename(columns = {'antecedents':'from','consequents':'to','support':'support','confidence':'confidence'},inplace =
   True)
4  rules = rules[['from','to','support','confidence','lift']]
5  print('以下为联合使用两种指标的关联规则')
6  rules
```

```
1  以下为联合使用两种指标的关联规则
```

```
1  .dataframe tbody tr th {
2      vertical-align: top;
3  }
4
5  .dataframe thead th {
6      text-align: right;
7  }
```

联合使用confidence与lift指标

```
1  rules = rules1.drop(rules1[rules1.lift <700].index)
   #设置标题索引并打印结果
3  rules.rename(columns = {'antecedents':'from','consequents':'to','support':'support','confidence':'confidence'},inplace =
   True)
4  rules = rules[['from','to','support','confidence','lift']]
5  print('以下为联合使用两种指标的关联规则')
6  rules
```

```
1  以下为联合使用两种指标的关联规则
```

	from	to	support	confidence	lift
698	(992, 639, 720)	(335, 331)	0.00121	1.0	781.250000
701	(639, 720, 509)	(335, 331)	0.00121	1.0	781.250000
705	(992, 639, 720, 509)	(335, 331)	0.00120	1.0	781.250000
713	(992, 720, 509)	(335, 331)	0.00122	1.0	781.250000
810	(351, 268, 841)	(545)	0.00117	1.0	840.336134
813	(268, 841, 606)	(545)	0.00117	1.0	840.336134
816	(351, 841, 606)	(545)	0.00116	1.0	840.336134
818	(351, 268, 841, 606)	(545)	0.00116	1.0	840.336134
819	(351, 841, 606)	(268, 545)	0.00116	1.0	840.336134
821	(72, 268, 606)	(545)	0.00117	1.0	840.336134
823	(72, 268, 841)	(545)	0.00117	1.0	840.336134
826	(72, 268, 841, 606)	(545)	0.00116	1.0	840.336134
828	(351, 72, 841)	(545)	0.00116	1.0	840.336134
830	(351, 72, 268, 841)	(545)	0.00116	1.0	840.336134
831	(351, 72, 841)	(268, 545)	0.00116	1.0	840.336134
833	(351, 72, 268, 606)	(545)	0.00116	1.0	840.336134
834	(351, 72, 841, 606)	(545)	0.00115	1.0	840.336134
836	(841, 606, 72, 268, 351)	(545)	0.00115	1.0	840.336134
837	(351, 72, 841, 606)	(268, 545)	0.00115	1.0	840.336134
839	(72, 749, 268)	(545)	0.00116	1.0	840.336134
841	(749, 268, 606)	(545)	0.00116	1.0	840.336134
844	(72, 749, 268, 606)	(545)	0.00115	1.0	840.336134
845	(749, 841, 268)	(545)	0.00116	1.0	840.336134
847	(749, 841, 606)	(545)	0.00115	1.0	840.336134
849	(268, 841, 749, 606)	(545)	0.00115	1.0	840.336134
850	(749, 841, 606)	(268, 545)	0.00115	1.0	840.336134
852	(72, 268, 841, 749)	(545)	0.00115	1.0	840.336134
853	(72, 749, 841, 606)	(545)	0.00114	1.0	840.336134
855	(841, 606, 72, 268, 749)	(545)	0.00114	1.0	840.336134
856	(72, 749, 841, 606)	(268, 545)	0.00114	1.0	840.336134
857	(351, 749, 268)	(545)	0.00116	1.0	840.336134
859	(351, 749, 841)	(545)	0.00115	1.0	840.336134
860	(351, 749, 606)	(545)	0.00115	1.0	840.336134
861	(351, 72, 749)	(545)	0.00115	1.0	840.336134
863	(351, 268, 841, 749)	(545)	0.00115	1.0	840.336134
864	(351, 749, 841)	(268, 545)	0.00115	1.0	840.336134
866	(351, 749, 268, 606)	(545)	0.00115	1.0	840.336134
867	(351, 749, 606)	(268, 545)	0.00115	1.0	840.336134
868	(351, 749, 841, 606)	(545)	0.00114	1.0	840.336134
870	(841, 606, 268, 351, 749)	(545)	0.00114	1.0	840.336134
871	(351, 749, 841, 606)	(268, 545)	0.00114	1.0	840.336134

	from	to	support	confidence	lift
873	(351, 72, 749, 268)	(545)	0.00115	1.0	840.336134
874	(351, 72, 749)	(268, 545)	0.00115	1.0	840.336134
875	(351, 72, 749, 606)	(545)	0.00114	1.0	840.336134
876	(351, 72, 749, 841)	(545)	0.00114	1.0	840.336134
878	(606, 72, 268, 351, 749)	(545)	0.00114	1.0	840.336134
879	(351, 72, 749, 606)	(268, 545)	0.00114	1.0	840.336134
881	(841, 72, 268, 351, 749)	(545)	0.00114	1.0	840.336134
882	(351, 72, 749, 841)	(268, 545)	0.00114	1.0	840.336134
883	(841, 606, 72, 351, 749)	(545)	0.00113	1.0	840.336134
885	(841, 606, 72, 268, 351, 749)	(545)	0.00113	1.0	840.336134
886	(841, 606, 72, 351, 749)	(268, 545)	0.00113	1.0	840.336134

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